1ST & 2nd YEAR COURSE STRUCTURE

FOR

B.TECH –MECHANICAL ENGINEERING

w.e.f.

2013-2014 ADMITTED BATCH

DEPARTMENT OF MECHANICAL ENGINEERING

COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

PULIVENDULA – 516390, Y.S.R. (DIST), ANDHRA PRADESH, INDIA

JNTUA COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA

Course structure for I B.TECH.MECHANICALENGINEERING(Regular) with effective from 2013-2014

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing/Lab	Credits
1	13AHS01	Communicative English	2		3
2	13ABS01	Engineering Physics	2		3
3	13ABS03	Engineering Chemistry	2		3
4	13ABS04	Mathematics-1	3+1		5
5	13ACS01	Programming in C and Data structure	3+1		5
6	13ACE01	Engineering Mechanics	3+1		5
7	13AME01	Engineering Drawing *	1	5	5
8	13ACS02	Programming in C and Data structure Lab	-	3	4
9	13ABS02	Engineering Physics & Engineering Chemistry Lab**	-	3	4
10	13ACS03	Engineering & IT workshop	-	3	4
11	13AHS02	English language and communications Lab	-	3	4
		Total	**19**	**17**	**45**
		Total Contact Periods/Week : 36			
		Total Credits(7 Theory +4 Labs) : 45			

II B.Tech I Semestar

S. No	Corse Code	Subject	Theory/Tutorial	Drawing/Lab	Credits
1	13ABS06	Mathematics-II	3+1	-	3
2	13AME06	Mechanics of Solids	3+1	-	3
3	13AEEE01	Electrical and Electronics Engineering	3+1	-	3
4	13AME08	Material Science and Engineering	3+1	-	3
5	13AME09	Thermodynamics	3+1	-	3
6	13AME10	Machine Drawing		6	3
7	13AHS03	Human Values and professional Ethics (Audit Course)	2	-	--
8	13AME07	Mechanics of Solids Lab & Material Science Lab	-	3	2
9	13AEEE02	Electrical and Electronics Engineering Lab	-	3	2
		Total	17	17	
		Total Contact periods/week 34			
		Total Credits (6 Theory+ 2 Labs)			**22**

***Note: The end exam timing of Machine Drawing will be 4Hrs.**

II B.Tech II Semestar

S. No	Corse Code	Subject	Theory/Tutorial	Drawing/Lab	Credits
1	13ABS10	Environmental Science	3	1	3
2	13ABS08	Probability and Statistics	3	1	3
3	13AME11	Kinematics of Machinery	3	1	3
4	13AME12	Thermal Engineering-I	3	1	3
5	13AME14	Fluid Mechanics	3	1	3
6	13AME15	Manufacturing Technology	3	1	3
7	13AME13	Thermal Engineering Lab		3	2
8	13AME16	Manufacturing Technology Lab		3	2
		Total	**18**	**12**	**22**
		Total Contact periods/week : 30			
		Total Credits (6 Theory+ 2 Labs) : 22			

III Year B. Tech -I Semester

S. No	Corse Code	Subject	Theory/Tutorial	Drawing/Lab	Credits
1	13AME17	Hydraulic Machinery	3+1	-	3
2	13AME19	Thermal Engineering –II	3+1	-	3
3	13AME20	Dynamics of Machinery	3+1	-	3
4	13AME21	Metal forming process	3+1	-	3
5	13AME22	Design of Machine Members – I	3+1	-	3
6	13AME23	Heat Transfer	3+1	-	3
7	13AME24	Heat transfer Lab		3	2
8	13AME18	Fluid mechanics & Hydraulic Machines Lab		3	2
9	13AME25	Comprehensive Online Examination			1
		Total	**24**	**6**	**23**
		Total Contact periods/week : 30			
		Total Credits : 23			

III Year B. Tech -II Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing/Lab	Credits
1	13AHS04	Managerial Economics & Financial Analysis	3+1	-	3
2	13AME26	CAD/CAM	3+1	-	3
3	13AME27	Machine Tools	3+1	-	3
4	13AME28	Refrigeration & Air conditioning	3+1	-	3
5	13AME29	Design of Machine Members – II	3+1	-	3

6	**Choice Based Credit Course(Inter department)** **ANNEXURE-I**		3+1	-	3
7	13AHS05	Advanced comm. Skills Lab (Compulsory Audit Course)		3	0
8	13AME33	Machine tolls Lab		3	2
9	13AME34	CAD Lab		3	2
10	13AME35	Comprehensive Online Examination			1
		Total	**26**	**6**	**23**
		Total contact periods/week : 32 **Total Credits : 23**			

ANNEXURE-I (Choice based credit course of inter department)

Branch	Course Code	Subjects
Physics	13ABS11	Nanomaterials And Engineering Application
Chemistry	13ABS12	Green Chemistry and Catalysis for Sustainable Environment
	13ABS13	Instrumental Methods of Chemical Analysis
	13ABS14	Chemistry of Nano Material and Application
English	13AHS07	Campus Recruitment Training & Soft Skills
	13AHS08	Competitive & Spoken English
Mathematics	13ABS15	Mathematical Modeling and Simulation
	13ABS16	Optimization Techniques
CE	13ACE27	Green Buildings
	13ACE28	Disaster Management and Mitigation
	13ACE29	Water Harvesting and Conservation
EEE	13AEE23	Renewable energy sources
	13AEE14	Power Electronics
	13AEE24	Electrical energy Management & Conservation
ME	13AME30	Robotics
	13AME31	Mechanical Manufacturing Process
	13AME32	Non Conventional Sources of Energy
ECE	13AEC29	Fundamentals of communication Systems
	13AEC30	Industrial Electronics
	13AEC31	Neural Networks & Fuzzy Logic
CSE	13ACS14	Operating Systems
	13ACS18	Database Management Systems

	13ACS27	Java Programming
BT	13ABT27	Immunology
	13ABT28	Downstream Processing
	13ABT29	Transport Phenomena in Bioprocess

IV Year B. Tech -I Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing /Lab	Credits
1	13AME36	Operation Research	3+1	-	3
2	13AME37	Automation & Robotics	3+1	-	3
3	13AME38	Finite Element Methods	3+1	-	3
4	13AME39	Metrology and Instrumentation	3+1	-	3
5	**Choice Based Credit Course-I(departmentspecific)**		3+1	-	3
	13AME40	a. Automobile Engineering			
	13AME41	b. Total Quality Management			
	13AME42	c. Entrepreneurship			
	13AME43	d. Reliability & Maintenance			
6	**Choice Based Credit Course-II(departmentspecific)**				
	13AME44	a. Computational Fluid Dynamics	3+1	-	3
	13AME45	b. Mechatronics			
	13AME46	c. Concurrent Engineering			
	13AME47	d. Production & Operations Management			
7	13AME48	Metrology & Measurements Lab		3	2
8	13AME49	Computer Aided Engineering Lab		3	2
		Total	**24**	**6**	**22**
		Total contact periods/week : 30			
		Total Credits : 22			

IV Year B. Tech -II Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing /Lab	Credits

1	13AME50	Industrial Engineering & Management	4	-	3
2	13AME51	Power plant Engineering	4	-	3
3	**MOOC-I**	**Subject -I**	4	-	3
		Subject -II			
4	**MOOC-II**	**Subject -III**	4	-	3
		Subject -IV			
5		Comprehensive Viva Voce	-	-	1
6		Seminar & Project Work	-	20	10
		Total	**16**	**20**	**23**
		Total contact periods/week : 36			
		Total Credits : 23			

MECH -I YEAR

COMMUNICATIVE ENGLISH

1. INTRODUCTION:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and technology. The prescribed books serve the purpose of preparing them for everyday communication and to face the global competitions in future.

The first text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and student-centered. They should be encouraged to participate in the classroom activities keenly.

The text for non-detailed study is meant for extensive reading/reading for pleasure by the students. They may be encouraged to read some select topics on their own, which could lead into a classroom discussion. In addition to the exercises from the texts done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

2. OBJECTIVES:

1. To enable the students to communicate in English for academic and social purpose
2. To enable the students to acquire structure and written expressions required for their profession.
3. To develop the listening skills of the students
4. To inculcate the habit of reading for pleasure
5. To enhance the study skills of the students with emphasis on LSRW skills

3. SYLLABUS:

UNIT –I

1. **Chapter titled –ASTROLOGER'S DAY (Humour) from "Using English"**
2. **Chapter titled 'HOMI JEHANGIR BHABHA' from 'New Horizons'**

L- Listening -Techniques - Importance of phonetics

L- Meet & Greet and Leave taking, Introducing Oneself and Others (Formal and Informal situations)

R- -Reading Strategies -Skimming and Scanning

W- Writing strategies- sentence structures

G-Parts of Speech –Noun-number, pronoun-personal pronoun, verb- analysis

V-Affixes-prefix and suffix, root words, derivatives

UNIT –II

1. **Chapter titled –BUILDING A NEW STATE (Inspiration) from "Using English"**
2. **Chapter titled 'MY STRUGGLE FOR AN EDUCATION' from "New Horizons"**

L- Listening to details

S- Apologizing, Interrupting, Requesting and Making polite conversations

R-note making strategies

W- Paragraph-types- topic sentences, unity, coherence, length , linking devices

G-Auxiliary verbs and question tags

V- synonyms-antonyms, homonyms , homophones, homographs, words often confused

UNIT –III

1. **Chapter titled WATER THE ELIXIR OF LIFE ('Sustainable Development) from "Using English"**
2. **Chapter titled 'THE AUTOBIOGRAPHY OF ABRAHAM LINCOLN' from "New Horizons"**

L- Listening to themes and note taking

S- Giving instructions and Directions, making suggestions, Accepting ideas, fixing a time and Advising

R- Reading for details -1

W- Resume and cover letter

G- Tenses – Present tense, Past tense and Future tense

V-Word formation and One-Word Substitutes

UNIT –IV

1. **Chapter titled THE WOODROSE ('Relationships') from "Using English"**
2. **Chapter titled 'THE HAPPY PRINCE' from "New Horizons"**

L- Listening to news

S- Narrating stories, Expressing ideas and opinions and telephone skills

R- Reading for specific details and Information

W- Technical Report writing-strategies, formats-types-technical report writing

G- Voice and Subject – Verb Agreement

V- Idioms and prepositional Phrases

UNIT –V

1. **Chapter titled PROGRESS 'Science and Humanism' from "Using English"**
2. **Chapter titled 'IF' from "New Horizons"**

L -Listening to speeches

S- Making Presentations and Group Discussions

R- Reading for Information

W- E-mail drafting

G- Conditional clauses and conjunctions

V- Collocations and Technical Vocabulary and using words appropriately

4.EXPECTED OUTCOME:

The students will get the required training in LSRW skills through the prescribed texts and develop communicative competence

Prescribed Books:

1. **Using English** published by Orient Black Swan,2013
2. **New Horizons** published by Pearson,2013

SUGGESTED READING:

1. **Raymond Murphy's English Grammar with CD,** Murphy, Cambridge University Press, 2012.
2. **English Conversation Practice –**Grant Taylor, Tata McGraw Hill,2009.
3. **Communication SKILLS, Sanjay Kumar & Pushpalatha** Oxford University Press, 2012.
4. **A Course in Communication Skills**- Kiranmai Dutt & co. Foundation Books, 2012.
5. **Living English Structures**- William Standard Allen-Pearson, 2011.
6. **Current English grammar and usage-**S M Guptha, PHI, 2013.
7. **Modern English Grammar-**Krishna SWAMI .McMillan, 2009.
8. **Powerful Vocabulary Builder**- Anjana Agarwal New Age International Publishers, 2011.

JNTUA COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA
MECH -I YEAR

ENGINEERING PHYSICS

(Common to all branches of Engineering)

PREAMBLE:

The study of Engineering Physics leads to the development of scientific temper and analytical capability through learning physical concepts and their applications in engineering and technology fields. Comprehension of some basic physical concepts will enable the students to logically solve engineering problems.

UNIT 1: **PHYSICAL OPTICS, LASERS AND FIBRE OPTICS**

Objectives: To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.

Physical Optics: Interference – Formation of Newton's Rings by reflection –Working principle of Michelson Interferometer - Fraunhofer diffraction due to single slit, double slit and diffraction grating.

Lasers: Characteristics of laser – Spontaneous and stimulated emission of radiation –- Einstein's coefficients –– Population inversion – optical resonator - He-Ne laser – CO_2 laser – Semiconductor laser - Applications of lasers - Holography

Fiber optics: Structure and working principle of optical fiber –Numerical aperture and acceptance angle – Types of optical fibers – Attenuation and losses in fibers - Optical fiber communication system – Fiber optic sensors

UNIT 2:**CRYSTALLOGRAPHY AND ULTRASONICS**

Objectives: To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and also to understand different types of defects in crystals and non-destructive evaluation using ultrasonic techniques.

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Structures of NaCl and Diamond – Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – Bragg's law - X-ray diffraction – Bragg's Spectrometer – Defects in solids: point defects.

Ultrasonics: Introduction – Production of ultrasonics by Magnetrostriction & piezoelectric methods – Properties and detection – Applications in non-destructive testing.

UNIT 3: **QUANTUM MECHANICS AND FREE ELECTRON THEORY**

Objectives: To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.

Quantum Mechanics: Introduction to matter waves – de'Broglie hypothesis - Heisenberg's uncertainty principle - Schrodinger's time independent and time dependent wave equation – Significance of wave function - Particle in one dimensional infinite potential well - Eigen values and Eigen functions.

*Free electron theory***:** Classical free electron theory – Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution –Kronig-Penny model (qualitative) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

UNIT 4: **SEMICONDUCTORS, MAGNETIC MATERIALS AND DIELECTRICS**

Objectives: To open new avenues of knowledge and understanding semiconductor based electronic devices , basic concepts and applications of semiconductors, magnetic materials and dielectrics have been introduced which find potential in the emerging micro device applications.

Semiconductors: Introduction – Intrinsic and extrinsic semiconductors – Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors – Working principle of p-n junction diode.

Magnetic materials: Introduction and basic definitions – Origin of magnetic moments – Bohr magnetron – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials (Qualitative) – Hysteresis - Soft and hard magnetic materials and applications.

Dielectrics: Dielectric Polarization – Types of Polarization – Lorentz field – Clausius-Mosotti equation.

UNIT 5: **SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS**

Objectives: To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in emerging technologies are elicited.

Superconductivity: Introduction – Meissner effect - Properties of superconductors – Type I and type II superconductors – Flux quantization – BCS theory (qualitative) – High $T_c$superconductors - Applications of superconductors.

Physics of Nanomaterials: Introduction - Significance of nanoscale - Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials: ball mill, chemical vapour deposition, and thermal evaporation – Carbon nanotubes – properties – High strength applications - Graphene- Properties – Applications.

OUTCOMES:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with defects in crystals and ultrasonic non-destructive techniques.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and the basis for the band theory are focussed.
- The properties and device applications of semiconducting, magnetic and dielectric materials are illustrated.
- The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.

Prescribed Text books:

1. Engineering Physics – Hitendra K Mallik and AK Singh
MacGraw Hill Publishers, New Delhi
2. Engineering physics – S. ManiNaidu, Pearson Education, New Delhi
3. Engineering Physics – K.Thyagarajan, MacGraw Hill Publishers, NewDelhi

Reference Books:

1. Engineering Physics – B K Pandey, S. Chaturvedi, Cengage Learning, New Delhi
2. Engineering Physics – V.Rajendran, MacGraw Hill Publishers, NewDelhi
3. Engineering Physics - Sanjay D. Jain, Girish D Sahasrabudhe
University Press, Hyderabad

3. Engineering physics – M.N. Avadhanulu and P.G. KrshiSagar,
Chand and Co, New Delhi
4. Text book of Nanoscience and Nanotechnology: B S Murthy, P.Shankar,
Baldev Raj B B Rath, James Murday, University Press
5. Carbon nanotubes and Graphene Device Physics – H.S. Philip Wong, Deji
Akinwande, Cambridge University Press

MECH -I YEAR

ENGINEERING CHEMISTRY

Preamble: Knowledge in chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering is depending on the outcome of basic sciences. Many advances in engineering either produce a new chemical demand as in the case of polymers or wait upon chemical developments for their applications as in the case of implants and alloys. Currently the electronics and computer engineers are looking forward for suitable biopolymers and nano materials for use in miniature super computers, the electrical engineers are in search of proper conducting polymers, the mechanical engineers are on lookout for micro fluids and the civil engineers are looking for materials that are environmental friendly, economical but long lasting.

COURSE OBJECTIVES (CO):

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, engineering materials and water chemistry.

UNIT.1: ELECTROCHEMISTRY

i).Review of electrochemical cells, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries), Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

ii). Voltammetry: Basic Principles and applications (Ferrous/Ferric System)

Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples : analysis of Glucose and urea

iii).Corrosion: Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating.

UNIT.2: POLYMERS

i).Introduction to polymers, Polymerisation process, mechanism: cationic, anionic, free radical and coordinate covalent, Polydispercity Index.

Elastomers (rubbers)

Natural Rubber; Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, buna-N, Polyurethene, Polysulfide (Thiokol) rubbers

Plastomers: Thermosetting and Thermoplatics, Preparation, properties and Engineering applications , PVC, Bakelite, nylons, Polyester

ii).Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline.

iii).Liquid Crystals: Introduction, classification and applications

iv).Inorganic Polymers: Introduction, Silicones, Polyphospazins (-(R)2-P=N-), applications

UNIT.3: FUEL TECHNOLOGY

Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.

i). Solid Fuels–Coal, Coke : Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.

ii).Liquid Fuels:

Petroleum: Refining of Petroleum, Gasoline: Octane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis

Power Alcohol: Manufacture, merits and demerits of Power Alcohol

iii). Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat's apparatus, Solving of problems on Combustion.

iv). Bio Fuels: Biogas, Biodiesel and their significance

UNIT.4: CHEMISTRY OF ENGINEERING MATERIALS

i).Semiconducting and Superconducting materials-Principles and some examples

ii).Magnetic materials – Principles and some examples

iii).Cement: Composition, Setting and Hardening (Hydration and Hydrolysis)

iv).Refractories: Classification , properties and applications

v).Lubricants: Classification and characteristics of lubricants, Theory of lubrication.

vi). Rocket Propellants: Classification, Characteristics of good propellant

UNIT.5: WATER TREATMENT

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching, ozonisation, U.V. treatment)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralisation of brackish water: Reverse Osmosis and Electrodialysis

EXPECTED OUTCOMES (EO): The student is expected to:

- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.
- Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.

Text Books:

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, New Delhi, Foruth Edition, 2012.

2. A Text book of Engineering Chemistry by S.S Dhara, S.S.Umare, S. Chand Publications, New Delhi, 12th Edition, 2010.

REFERENCES:

1. A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2010.
2. Engineering Chemistry, K. Sesha Maheswaramma and Mrudula Chugh, Pearson Education, First Edition, 2013.
3. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH, Publications India Pvt Limited, Chennai, 2nd Edition, 2012.
4. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi, Acme Learning Pvt Ltd, First Edition, 2013.
5. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu, BS Publications, Hyderabad, 3rd Edition, 2008.
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapath Rai Publications, New Delhi, 4th Edition, 2011

MECH-I YEAR

MATHEMATICS-I

Objectives

- To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications in electrical circuits, deflection of beams, whirling of shafts.
- To prepare students for lifelong learning and successful careers using mathematical concepts of differential, Integral and vector calculus, ordinary differential equations and Laplace transforms.
- To develop the skill pertinent to the practice of the mathematical concepts including the students abilities to formulate the problems, to think creatively and to synthesize information.

UNIT – I

Exact, linear and Bernoulli equations. Applications to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type eax, Sin ax, cos ax, polynomials in x, eax V(x), xV(x), method of variation of parameters. Applications to oscillatory electrical circuits, Deflection of Beams, whirling of shafts.

UNIT – II

Taylor's and Maclaurin's Series - Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrange's method of undetermined Multipliers with three variables only. Radius of curvature, center of curvature, Involutes evolutes, envelopes.

UNIT – III

Curve tracing – Cartesian, polar and parametric curves. Length of curves.

Multiple integral – Double and triple integrals – Change of Variables – Change of order of integration. Applications to areas and volumes, surface area of solid of revolution in Cartesian and polar coordinates using double integral.

UNIT – IV

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – Application of Laplace transforms to ordinary differential equations of first and second order.

UNIT – V

Vector Calculus: Gradient – Divergence – Curl and their properties; Vector integration – Line integral - Potential function – Area – Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss's Divergence Theorem (Without proof). Application of Green's – Stoke's and Gauss's Theorems.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers-42 Edition(2012)
2. Engineering Mathematics, Volume - I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher 1st Edition (2010)

REFERENCES:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, S.Chand publication-12th Edition(2013)
2. Engineering Mathematics, Volume - I, by G.S.S.Raju, CENGAGE publisher.(2013)
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India-10thEdition(2012)
4. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers(2008)
5. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier-1st Edition(2001)

Outcomes:

- The students become familiar with the application of differential, integral and vector calculus, ordinary differential equations and Laplace transforms to engineering problems.
- The students attain the abilities to use mathematical knowledge to analyze and solve problems in engineering applications.

MECH -I YEAR

PROGRAMMING IN C AND DATA STRUCTURES

Course Objectives:

- To make the student understand problem solving techniques
- Students will be able to understand the syntax and semantics of C programming language and other features of the language
- Get acquaintance with data structures, searching and sorting techniques

Course Outcomes:

- Student can effectively apply problem solving techniques in designing the solutions for a wide-range of problems
- Student can choose appropriate data structure and control structure depending on the problem to be solved
- Student can effectively use existing data structures and design new data structures appropriate to the problem to be solved
- Student can modularize the problem and also solution
- Student can use appropriate searching and sorting technique to suit the application

Unit-I

Introductory Concepts: Introduction to computers, What is a Computer, Block diagram of Computer, Computer Characteristics, Hardware Vs Software, How to develop a program, Software development life cycle, Structured programming, Modes of operation, Types of programming languages, Introduction to C, Desirable program characteristics.

Introduction to Computer problem solving: Introduction, The problem solving aspect, Top down design, Implementation of algorithms.

Introduction to C programming: The C character set, Writing first program of C, Identifiers and key words, A more useful C program, Entering the program into the computer, Compiling and executing the program, Data types, Constants, Variables and arrays, Declarations, Expressions, Statements, Symbolic Constants.

Operators and Expressions: Arithmetic operators, Unary operators, Relational and Logical operators, Assignment operators, Conditional operator, Library functions.

Fundamental algorithms: Exchanging the values of two variables, Factorial computation, Sine function computation, Reversing the digits of an integer, Generating prime numbers.

Unit-II

Data Input and Output: Preliminaries, Single character input-getchar function, Single character output-putchar function, Entering input data-the scanf function, More about the scanf function, Writing output data-The printf function, More about the printf function, The gets and puts functions, Interactive(conversational) programming.

Preparing and running a complete C program: Planning a C program, Writing a C program, Error diagnostics, Debugging techniques.

Control statements: Preliminaries, Branching: if-else statement, Looping: The while statement, More looping: The do-while statement, Still more looping: The for statement, Nested control structures, The switch statement, Break statement, Continue statement, The comma operator, The goto statement.

Functions: A brief overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Recursion

Unit-III

Program Structure: Storage classes, Automatic variables, External (global) variables, Static variables, Multi file programs, More about library functions.

Arrays: Defining an array, Processing an array, Passing arrays to functions, Multi dimensional arrays.

Array Techniques: Array order reversal, Removal of duplicates from an ordered array, Finding the K^{th} smallest element.

Merging, Sorting and Searching: The two way merge, Sorting by selection, Sorting by exchange, Sorting by insertion, Sorting by partitioning, Recursive Quick sort, Binary Search.

Strings: Defining a string, NULL character, Initialization of strings, Reading and Writing a string, Processing the strings, Character arithmetic, Searching and Sorting of strings, Some more Library functions for strings

Unit-IV

Pointers: Fundamentals, Pointer Declarations, Passing pointer to a function, Pointers and one dimensional array, Dynamic memory allocation, Operations on pointers, Pointers and multi dimensional arrays, Arrays of pointers, Passing functions to other functions, More about pointer declarations.

Structures and Unions: Defining a structure, Processing a structure, User defined data type (typedef), Structures and Pointers, Passing structures to functions, Unions.

File Handling: Why files, Opening and closing a data file, Reading and Writing a data file, Processing a data file, Unformatted data files, Concept of binary files, Accessing the file randomly (using fseek).

Additional Features: Register variables, Bitwise operations, Bit Fields, Enumerations, Command line parameters, More about Library functions, Macros, The C Preprocessor

Unit-V

Introduction to Data Structures: Data abstraction

Stacks and Queues: Stacks, Stacks using dynamic arrays, Queues, Circular Queues using dynamic arrays

Evaluations of expressions: Expressions, Evaluating postfix expressions, Infix to Postfix, Multiple Stacks and Queues.

Linked Lists: Singly Linked lists and chains, Representing chains in C, Linked Stacks and Queues.

Text Books:

1. “Programming with C”, Byron Gottfried, Third Edition, Schaum’s Outlines, 3rd edition, 2010, Mc Graw Hill.
2. “Fundamentals of Data Structures in C”, Horowitz, Sahni, Anderson-freed, 2nd Edition, 2011, Universities Press.
3. “How to Solve it by Computer”, R.G. Dromey, 14th impression, 2013, Pearson. (*Pascal implementations may be considered without loss of generality or Instructors may replace them with C language programs*)

References:

1. “Programming in C”, Pradip Dey, Manas Ghosh, Oxford Higher Education
2. “Programming in C and Data Structures”, Hanly, Koffman, Kamthane, Ananda Rao, Pearson.
3. “Programming in C”, Reema Thareja, Oxford Higher Education.
4. “Computer Fundamentals and C Programming”, First Edition, Dr.P.Chenna Reddy, Available at: www.pothi.com.
5. “Data Structure and Program Design in C”, Second Edition, Kruse, Tondo, Leung, Mogalla, Pearson.
6. “Programming with C”, R.S. Bichkar, University Press.
7. “Computer Science A Structured Programming Approach Using C”, Third Edition, Fourouzan & Gilberg, Cengage Learning.

MECH -I YEAR

ENGINEERING MECHANICS

OBJECTIVE:

Through this course students will advance their development of the following specific capabilities:

1. *Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.*
2. *Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.*
3. *This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.*

UNIT – I

INTRODUCTION OF ENGINEERING MECHANICS – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT – II

FRICTION : Types of friction– Laws of Friction – Limiting friction- Cone of limiting friction– Static and Dynamic Frictions – Motion of bodies – Wedge, Screw jack and Differential Screw Jack.

UNIT – III

CENTROID AND CENTER OF GRAVITY: Centroids of Simple Figures – Centroids of Composite Figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and Perpendicular axis theorems - Moments of Inertia of Composite Figures.

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids – Moment of Inertia of Composite Masses.(Simple problems only)

UNIT – IV

KINEMATICS: Rectilinear and Curvilinear Motion – Velocity and Acceleration – Motion of a Rigid Body – Types and their Analysis in Planar Motion.

KINETICS : Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work-Energy Method – Equation for Translation – Work-Energy application to Particle Motion, Connection System – Fixed Axis Rotation and Plane Motion.

UNIT – V

ANALYSIS OF PERFECT FRAMES: Types of Frames – Cantilever Frames and Simply Supported Frames – Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

MECHANICAL VIBRATIONS: Definitions, Concepts-Simple Harmonic Motion-Free Vibrations-Simple Compound and Torsional pendulums- Numerical problems.

TEXT BOOKS:

1.Singer's Engineering Mechanics Statics and Dynamics , K. Vijaya Kumar Reddy, J.Suresh Kumar, BS Publications, 3rd Edition(SI Units)Fifth impression 2013
2.Engg. Mechanics / Timoshenko & Young – Mc Graw Hill International Edition
3.Engineering Mechanics by Shames & Rao – Pearson Education.
4.Engineering Mechanics by Dr.R.k.Bansal -- Lakshmi Publications.
5.Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.
6.Engineering Mechanics by S.S Bhavikatti and Rajasekharappa

REFERENCES:

(1) Engineering Mechanics by Fedrinand L.Singer – Harper Collings Publishers.
(2) Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
(3) Engineering Mechanics by Rajsekharan, Vikas Publications.
(4) Engineering Mechanics (Statics and Dynamics) by Hibller and Gupta; Pearson Education
(5) Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company
(6) Engineering Mechanics by Chandramouli, PHI publications.
(7) Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning

Course outcomes:

After learning this course, Students will be able to

- *Solve for the resultants of any force systems*
- *Determine equivalent force systems*
- *Determine the internal forces in plane frames, simple span trusses and beams*
- *Solve the mechanics problems associated with friction forces*
- *Obtain the centroid, first moment and second moment of an area*
- *Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference*
- *Analyze the forces causing the motion of a particle*

MECH-I YEAR

PROGRAMMING IN C AND DATA STRUCTURES LAB

Course Objectives:

- To make the student learn C Programming language
- To make the student solve problems, implement them using C language.
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem

Course Outcomes:

- Apply problem solving techniques to find solutions to problems
- Able to use C language features effectively and implement solutions using C language.
- Be capable to identity the appropriate data structure for a given problem or application.
- Improve logical skills

List of Experiments/Tasks

1. Practice DOS and LINUX Commands necessary for design of C Programs.
2. Study of the Editors, Integrated development environments, and Compilers in chosen platform.
3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.
4. Practice programs: Finding the sum of three numbers, exchange of two numbers, maximum of two numbers, to read and print variable values of all data types of C language, to find the size of all data types, to understand the priority and associativity of operators using expressions, to use different library functions of C language.
5. Write a program to find the roots of a quadratic equation.
6. Write a program to compute the factorial of a given number.
7. Write a program to check whether the number is prime or not.
8. Write a program to find the series of prime numbers in the given range.
9. Write a program to generate Fibonacci numbers in the given range.
10. Write a program to find the maximum of a set of numbers.
11. Write a program to reverse the digits of a number.
12. Write a program to find the sum of the digits of a number.
13. Write a program to find the sum of positive and negative numbers in a given set of numbers.
14. Write a program to check for number palindrome.
15. Write a program to evaluate the sum of the following series up to ‘n’ terms $e^x=1+x+x^2/2!+x^3/3!+x^4/4!+$--------
16. Write a program to generate Pascal Triangle.
17. Write a program to read two matrices and print their sum and product in the matrix form.
18. Write a program to read matrix and perform the following operations.
    i. Find the sum of Diagonal Elements of a matrix.
    ii. Print Transpose of a matrix.
    iii. Print sum of even and odd numbers in a given matrix.
19. Write a program to accept a line of characters and print the count of the number of Vowels, Consonants, blank spaces, digits and special characters.
20. Write a program to insert a substring in to a given string and delete few characters from the string. Don’t use library functions related to strings.

21. Write a program to perform the operations addition, subtraction, multiplication of complex numbers.
22. Write a program to split a 'file' in to two files, say file1 and file2. Read lines into the 'file' from standard input. File1 should consist of odd numbered lines and file2 should consist of even numbered lines.
23. Write a program to merge two files.
24. Write a program to implement numerical methods Lagrange's interpolation, Trapezoidal rule.
25. Write a program to read a set of strings and sort them in alphabetical order.
26. Write a program to sort the elements of an array using sorting by exchange.
27. Write a program to sort the elements of an array using Selection Sort.
28. Write a program to perform Linear Search on the elements of a given array.
29. Write a program to perform Binary Search on the elements of a given array.
30. Write a program to find the number of occurrences of each number in a given array of numbers.
31. Write a program to read two strings and perform the following operations without using built-in string Library functions and by using your own implementations of functions.
    i. String length determination ii .Compare Two Strings
    iii. Concatenate them, if they are not equal iv. String reversing
32. Write programs using recursion for Factorial of a number, GCD, LCM, Towers of Hanoi.
33. Write a program to convert infix expression to postfix expression and evaluate postfix expression.
34. Write a program to exchange two numbers using pointers.
35. Write a program to implement stack, queue, circular queue using array and linked lists.
36. Write a program to perform the operations creation, insertion, deletion, and traversing a singly linked list
37. Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
38. A file consists of information about employee salary with fields employeeid, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employeeid, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions is user specified. Compute the Gross and Net salary of the employee and update the file.
39. Write a program to perform Base (decimal, octal, hexadecimal, etc) conversion.
40. Write a program to find the square root of a number without using built-in library function.
41. Write a program to convert from string to number.
42. Write a program to generate pseudo random generator.
43. Write a program to remove duplicates from ordered and unordered arrays.
44. Write a program to sort numbers using insertion sort.
45. Write a program to implement quick sort using non-recursive and recursive approaches. Use randomized element as partitioning element.
46. Write a program to search a word in a given file and display all its positions.
47. Write a program to generate multiplication tables from 11 to 20.
48. Write a program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six.

49. Write a program to generate a telephone bill. The contents of it and the rate calculation etc should be as per BSNL rules. Student is expected to gather the required information through the BSNL website.
50. Write a program for tic-tac-toe game.
51. Write a program to find the execution time of a program.
52. Design a file format to store a person's name, address, and other information. Write a program to read this file and produce a set of mailing labels

Note: The above list consists of only sample programs. Instructors may choose other programs to illustrate certain concepts, wherever is necessary. Programs should be there on all the concepts studied in the Theory on C programming and Data structures. Instructors are advised to change atleast 25% of the programs every year until the next syllabus revision.

References:

4. “Programming with C”, Byron Gottfried, Third Edition, Schaum’s Outlines, Mc Graw Hill.
5. “Fundamentals of Data Structures in C”, Horowitz, Sahni, Anderson-freed, Second Edition, Universities Press.
6. “How to Solve it by Computer”, R.G. Dromey, Pearson.
7. “The C Programming Language”, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
8. “Classic Data Structures”, Samantha, PHI
9. “Let us C”, Yeswant Kanetkar, BPB publications
10. “Pointers in C”, Yeswant Kanetkar, BPB publications

MECH-I YEAR

ENGINEERING PHYSICS LABORATORY

PREAMBLE:

By performing the experiments engineering students acquire the knowledge about the importance of the studied theoretical physical concepts.

LAB OBJECTIVE:

- Will understand the role of optical fiber parameters and signal losses in communication.
- Will recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor
- Will understand the applications of B H curve.
- Will acquire a practical knowledge of studying the crystal structure in terms of lattice constant.
- Will recognize the significance of laser by studying its characteristics and its application in finding the particle size.
- Will learn to synthesis of the nanomaterials and recognize its importance by knowing its nano particle size and its impact on its properties.

Any 10 of the following experiments has to be performed during the academic year

1. Determination of radius of curvature of a lens by forming Newton's rings.
2. Determination of wavelength of various colours of mercury spectrum using diffraction grating in normal incidence method.
3. Determination of Numerical aperture, acceptance angle and losses of an optical fiber.
4. Energy gap of a material using p-n junction diode.
5. Hall effect – Determination of mobility of charge carriers.
6. B-H curve – Determination of hysteresis loss.
7. Determination of lattice constant using X-ray spectrum.
8. Determination of particle size by using laser source.
9. Determination of dielectric constant.
10. Study of Laser characteristics.
11. Synthesis of nanomaterial by sol-gel method.
12. Particle size analysis of the synthesized nanomaterials.

LAB OUTCOMES:

- Would have acquired the practical application knowledge of optical fiber, semiconductor, dieclectric and magnetic materials, crystal structure and lasers by the study of their relative parameters.
- Would recognize the significant importance of nanomaterials in various engineering fields.

Preamble: The experiments are designed in a manner that the students can validate their own theory understanding in chemistry by self involvement and practical execution. Thus the execution of these experiments by the student will reinforce his/her understanding of the subject and also provide opportunity to refine their understanding of conceptual aspects. As a result, the student gets an opportunity to have felt good factor at the laboratory bench about the chemical principles that he/she learned in the classroom.

Programme Objective:

- Will learn practical understanding of the redox reaction
- Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention

- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology

LIST OF EXPERIMENTS

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Manganese by colorimetry.
5. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Alkalinity of Water
7. Determination of acidity of Water
8. Preparation of Phenol-Formaldehyde (Bakelite)
9. Determination of Viscosity of oils using Redwood Viscometer I
10. Determination of Viscosity of oils using Redwood Viscometer II
11. Conductometric titration of strong acid Vs strong base (Neutralization titration).
12. Conductometric titration of Barium Chloride vs Sodium Sulphate (Precipitation Titration)
13. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
14. Estimation of Chloride ion using potassium Chromate indicator (Mohrs method)
15. Acid-Base neutralisation by pH method.

(Any 10 experiments from the above list)

Course Outcomes

- **Would be confident in handling energy storage systems and would be able combat chemical corrosion**
- **Would have acquired the practical skill to handle the analytical methods with confidence.**
- **Would feel comfortable to think of design materials with the requisite properties**
- **Would be in a position to technically address the water related problems.**

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.

2. Chemistry Practical – Lab Manual by K.B.Chandra Sekhar, G.V. Subba Reddy and K.N.Jayaveera, SM Publications, Hyderabad, 3rd Edition, 2012.

MECH -I YEAR

ENGINEERING CHEMISTRY LAB

Preamble: The experiments are designed in a manner that the students can validate their own theory understanding in chemistry by self involvement and practical execution. Thus the execution of these experiments by the student will reinforce his/her understanding of the subject and also provide opportunity to refine their understanding of conceptual aspects. As a result, the student gets an opportunity to have felt good factor at the laboratory bench about the chemical principles that he/she learned in the classroom.

Programme Objective:

- Will learn practical understanding of the redox reaction
- Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention
- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology

LIST OF EXPERIMENTS

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Manganese by colorimetry.
5. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Alkalinity of Water
7. Determination of acidity of Water
8. Preparation of Phenol-Formaldehyde (Bakelite)
9. Determination of Viscosity of oils using Redwood Viscometer I
10. Determination of Viscosity of oils using Redwood Viscometer II
11. Conductometric titration of strong acid Vs strong base (Neutralization titration).
12. Conductometric titration of Barium Chloride vs Sodium Sulphate (Precipitation Titration)
13. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
14. Estimation of Chloride ion using potassium Chromate indicator (Mohrs method)
15. Acid-Base neutralisation by pH method.

(Any 10 experiments from the above list)

Course Outcomes

- **Would be confident in handling energy storage systems and would be able combat chemical corrosion**
- **Would have acquired the practical skill to handle the analytical methods with confidence.**
- **Would feel comfortable to think of design materials with the requisite properties**
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TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.

2. Chemistry Practical – Lab Manual by K.B.Chandra Sekhar, G.V. Subba Reddy and K.N.Jayaveera, SM Publications, Hyderabad, 3rd Edition, 2012.

MECH-I YEAR

Engineering &IT Workshop(13ACS03)

ENGINEERING WORKSHOP

(*common for all branches)*

Course Objective:

- *The objective of this Lab is to provide the basic concepts about different manufacturing processes, use of various workshops tools and exposer to the power tools.*
- *Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.*

TRADES FOR EXERCISES:

At least 2 exercise in each:

1. Carpentry
2. Fitting
3. House-wiring
4. Foundry
5. Tin smithy
6. Power Tools Demonstration.

TEXT BOOK:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/Scitech Publishers.
2. Workshop practice manual by K.Venkata Reddy B.S Publications

Codes / Tables : will be provided

Question Paper pattern: Test in any two trades out of 6 trades.

Course outcomes

- *Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops.*
- *This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing.*
- *Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems.*
- *Workshop curricula build the hands on experiences which would help to learn manufacturing processes and production technology courses in successive semesters.*
- *Workshop practice is also important since only practice can make the man perfect.*

IT Workshop

Course Objectives:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Course Outcomes:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

Preparing your Computer (5 weeks)

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet (4 weeks)

Task 5:Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

Task 6:Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc.

If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users

(LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools (6 weeks)

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 9: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement.Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 10: Presentations :creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Optional Tasks:

Task 11: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material
- Air conditioner
- UPS and Inverter

- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

Task 12: Software: Students may submit a report on specifications of various software that may be used by them for the laboratories in their curriculum starting from I B.tech to IV. B.Tech. The software may be proprietary software or Free and Open source software. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop operating system
- Server operating system
- Antivirus software
- MATLAB
- CAD/CAM software
- AUTOCAD

References:

1. “Introduction to Computers”, Peter Norton, Mc Graw Hill
2. “LaTeX Companion” – Leslie Lamport, PHI/Pearson.
3. “MOS study guide for word, Excel, Powerpoint & Outlook Exams”, Joan Lambert, Joyce Cox, PHI.
4. “Introduction to Information Technology”, ITL Education Solutions limited, Pearson Education.
5. “Networking your computers and devices”, Rusen, PHI
6. “Trouble shooting, Maintaining& Repairing PCs”, Bigelows, TMH.

MECH-I YEAR

English Language & Communication Skills Lab

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

OBJECTIVES:

- To train students to use language effectively in everyday conversations, to participate in group discussions, to help them face interviews, and sharpen public speaking skills
- To expose the students to a varied blend of self-instructional learner-friendly modes of language learning through computer-aided multi-media instruction.
- To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

SYLLABUS:

Unit-1

1. Phonetics -importance
2. Introduction to Sounds of Speech
3. Vowels sounds
4. Consonants sounds
5. Phonetic Transcription

Unit-2

6. Word Stress
7. Syllabification
8. Rules of word stress
9. Intonation
10. Falling
11. Rising Tone
12. Fall rise tones

Unit-3

Situational Dialogues

13. Role Plays
14. JAM
15. Describing people/object/place
16. Stage dynamics
17. Body language

Unit-4

18. Debates
19. Group Discussions
20. Interview skills
21. Telephone skills
22. Public Speaking
23. Preparation of resume

Unit-5

24. Basics of Communication Skills
25. Objectives & Characteristics of Communication
26. LSRW Skills –
27. Presentation Skills

EXPECTED OUTCOMES:

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students
- Speaking with clarity and confidence thereby enhancing employability skills of the students

MINIMUM REQUIREMENT FOR ELCS LAB:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab:
   The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

ii) Headphones of High quality

SUGGESTED SOFTWARE:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. *DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.*
6. Lingua TOEFL CBT Insider, by Dreamtech
7. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
8. Cambridge Advanced Learners' English Dictionary with CD.
9. Oxford Advanced Learner's Compass, 8th Edition
10. Sanjay Kumar & Pushp Lata. 2011. Communication Skills, OUP

REFERENCE BOOKS:

1. **A Textbook of English Phonetics for Indian Students** 2nd Ed T. Balasubramanian. (Macmillian),2012.
2. **A Course in Phonetics and Spoken English**, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd
3. **Strengthen Your Steps,** Maruthi Publicaions, 2012.
4. **Speaking English Effectively**, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
5. **Listening in the Language Classroom**, John Field (Cambridge Language Teaching Library),2011
6. **A Hand book for English Laboratories**, E.Suresh kumar, P.Sreehari, Foundation Books,2011
7. **English Pronunciation in Use. Intermediate &Advanced** ,Hancock, M. 2009. CUP
8. **Basics of Communication in English** ,Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
9. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.

English Pronouncing Dictionary, Daniel Jones Current Edition with CD.Cambridge,17th edition, 2011.

II Year B.Tech - I Semester

MATHAMATICS-II

Objectives:

 This course aims at providing the student with the concepts of Matrices, Fourier series, Fourier and Z-transforms and partial differential equations which find the applications in engineering.
 Our emphasis will be more on logical and problem solving development in Numerical methods and their applications.

UNIT – I

Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonolization of matrix. Calculation of powers of matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

UNIT – II

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method.

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's Interpolation formula.

Curve fitting: Fitting of a straight line – Second degree curve – Exponentional curve-Power curve by method of least squares. Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT – III

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods – Predictor-Corrector Method – Milne's Method. Numerical solution of Laplace equation using finite difference approximation.
Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation –Half-range Fourier sine and cosine expansions.

UNIT – IV

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms. z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by ztransforms.

UNIT – V

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace's equation under initial and boundary conditions.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers- 42 Edition(2012)
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher 5th Edition(2012)

REFERENCES:

1. Engineering Mathematics, Volume - II, E. Rukmangadachari & E. Keshava Reddy,Pearson Publisher-1st Edition (2010)
2. Engineering Mathematics, Volume - II, by G.S.S.Raju, CENGAGE publisher – 1stEdition(2013)
3. Mathematical Methods by T.K.V. Iyengar, S. Chand publication-8th Edition(2013)
4. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers(2008)
5. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India 10thEdition(2013)

Outcomes:

 The student becomes familiar with the application of Mathematical techniques like Fourier series, Fourier and z-transforms.
 The student gains the knowledge to tackle the engineering problems using the concepts of Partial differential equations and Numerical methods.

II Year B.Tech - I Semester

MECHANICS OF SOLIDS

OBJECTIVE: *The subject provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems.*

UNIT – I

SIMPLE STRESSES AND STRAINS : – Deformable bodies **-** Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.

Strain energy **–** Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections.

UNIT – IV

TORSION OF CIRCULAR SHAFTS – Theory of pure torsion – Derivation of Torsion equations : – Assumptions made in the theory Theory of pure torsion – Torsional moment of resistance – Polar section modulus.

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods.

Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load-Mohr's theorems.

UNIT – V

THIN CYLINDERS & THICK CYLINDERS : Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – Changes in dia, and volume of thin cylinders – Thin spherical shells.

Introduction Lame's theory for thick cylinders – Derivation of lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

TEXT BOOKS :

1. Strength of Materials by B.S.Basavarajaiah, Universities Press, Hyderabad
2. Strength of Materials by Dr.R.K.Bansal, Lakshmi Publications.
3. Strength of Materials by R.S.Khurmi, S.Chand publications.
4. Strength of Materials by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.

REFERENCES:

1. Mechanics of Materials – Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
2. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.
3. Strength of Materials by Jindal , Pearson publications
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by Schaum's out line series – Mc.Graw hill International Editions.
7. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

II Year B.Tech - I Semester

ELECTRICAL & ELECTRONICS ENGINEERING
Part A

Objectives: This course aims at providing fundamental concepts of electrical circuits, DC, AC Machines and Electrical instruments, which help to increase knowledge and to apply principles in their applications

UNIT I: Fundamentals of Electrical Circuits & Instruments

Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, Series, Parallel circuits and Star-Delta and Delta-Star transformations.

Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT II: DC Machines

Principle of operation of DC Generator – EMF equation – types - DC motor types torque equation applications – Three point starter

UNIT III: AC Machines

Principle of Operation of alternators – regulation by synchronous impedance method principle of operation of induction motor – slip – torque characteristics – applications Principle of Operation of single phase transformers –EMF equation – losses –efficiency and regulation

TEXT BOOKS

1. Network Analysis – A Sudhakar,Shyammohan S.Palli, 3 ed., 2009. TMH Publications.
2. Priciples of Electrical and electronics engineering by V.K.Mehta, S.Chand&Co.

REFERENCES

1. Network analysis and Synthesis – CL Wadhwa, 3 ed., 2007, New Age International Publishers.
2. Introduction to Electrical Engineering – M.S Naidu and S.Kamakshaiah, THM Publications.
3. Basic Electrical Engineering by Kothari and Nagarath, THM Publications, 2nd Edition

COURSE OUTCOME: Students able to apply fundamental concepts, principle of electrical engineering for their applications.

II Year B.Tech - I Semester

ELECTRICAL & ELECTRONICS ENGINEERING
PART-B

Objective:

- The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering.

UNIT – IV

Semiconductor Devices: Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction - Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

UNIT – V

BJT and FETs: Bipolar Junction Transistor (BJT) **–** Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between $I_{C,}$ I_B and I_E.Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. Junction Field Effect Transistor (JFET)- Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET,MOSFET-The Enhancement and Depletion MOSFET, Static Characteristics of MOSFET, Applications of MOSFET

UNIT – VI

Oscillators and Op-Amps: Sinusoidal Oscillators, Barkhausen Criteria for Oscillator Operation, Components of an Oscillator-Transistor Amplifier Circuits, Feedback Circuits and Oscillator Circuits, Classification of Oscillators, LC Tuned, RC Phase Shift Oscillator circuits.

Operational Amplifiers(Op-Amps)-Symbol of an Op-Amp, single Input and Dual Input Op-Amps(Differential Amplifier), Characteristics of an Ideal Op-Amp, Basic Forms of Op-Amps-Inverting & Non-Inverting Amplifiers, Applications of Op-Amps, summing, Differential, Integrator, differentiator Amplifier.

Text Books:

1. Basic Electrical Engineering by D P KOTHARI &I J NAGRATH, Tata McGraw Hill, Second Edition, 2007.
2. Electrical Circuit Theory and Technology by JOHN BIRD, Routledge publisher, 4^Th Edition, 2011.
3. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.
4. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

Reference Books :

1. Electrical & Electronic Technology by Edward Hughes, 10th Edition, Pearson, 2008
2. “Basic Electrical Engineering”, Uma Rao, Sanguine-Pearson.

II Year B.Tech - I Semester

MATERIAL SCIENCE AND ENGINEERING

UNIT – I

Structure of Metals : Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

Constitution of Alloys : Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT -II

Equilibrium of Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

UNIT –III

Cast Irons and Steels : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys :

Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT –IV

Heat treatment of Alloys:

Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – V

Ceramic materials:

Crystalline ceramics, glasses, cermets, abrasive materials, nonmaterial's-definition, properties and application of the above.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

TEXT BOOKS :

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.
3. Materials Science and Engineering / William and collister.

REFERENCES:

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Elements of Material science / V. Rahghavan
4. An introduction to materialscience / W.g.vinas & HL Mancini
5. Material science & material / C.D.Yesudian & harris Samuel
6. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
7. Engineering materials and metallurgy/R. K. Rajput/ S.Chand.

II Year B.Tech - I Semester

THERMODYNAMICS

UNIT- I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, Surrounding, boundary, universe, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,.

WORK & HEAT TRANSFER: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

UNIT- II

FIRST LAW OF THERMODYNAMICS: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I. Limitations of first law, thermal reservoir, heat pump, heat engine.

FLOW SYSTEMS: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

UNIT- III

SECOND LAW OF THERMODYNAMICS: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II, Kelvin Flank statement.

ENTROPY AND AVAILABILITY: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability, Gibbs & Helmholtz functions.

UNIT- IV

PURE SUBSTANCES: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties, Rankine cycle.

THERMODYNAMIC RELATIONS: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius- Clapeyron equation.

UNIT-V

PROPERTIES OF GASES AND GAS MIXTURES: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

GAS POWER CYCLES: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles, P-V & T.S diagrams, Thermal Efficiency, mean effective pressure.

Note: Steam tables Mollier Diagrams Shall be supplied.

TEXT BOOKS :

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.
3. Advanced thermodynamics – by R.Yadav
4. Thermal Engineering – by R.K. Raj put

REFERENCES :

1. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd.
2. Thermodynamics by Chattopadhyay, oxford
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH
4. Thermodynamics – J.P.Holman, McGrawHill
5. An introduction to Thermodynamics, YVC Rao, New Age
6. Engineering Thermodynamics – Jones & Dugan

II Year B.Tech - I Semester

MACHINE DRAWING

Course Objectives:

To make the students understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.

To make the students understand and draw assemblies of machine parts and to draw their sectional views

UNIT- I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions

a) Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.

b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

c) Title boxes, their size, location and details-common abbreviations & their liberal usage

Learning Outcomes & Suggested Student Activities

This unit is useful to prepare the students for representing their ideas at International standards and will be able to convey in without much effort globally with ease. Students will acquire skills to draft on a drawing sheet without much effect.Studentsare advised to visit machine shop.

UNIT-II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws,

b) Keys, cottered joints and knuckle joint,

c) Rivetted joints for plates, welding joints.

d) Shaft coupling, spigot and socket pipe joint.

e) Journal and foot step bearings.

Learning Outcomes & Suggested Student Activities

Students can represent various details of an object quickly without much time and ambiguity. These drawings can be easily prepared and understood by both the people in a manufacturing industry and the consumers too. Students are advised to visit machine shop.

UNIT- III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.

a) Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.

b) Other machine parts- Screw jack, Machine Vice, single tool post, swivel joint.

c) Valves: Steam stop valve, feed check valve. Non return value.

Learning Outcomes &Suggested Student Activities

Students can understand the working principles of an assembly or subassembly so that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still produce any useful product serving effectively. It is not necessary that all the components to be made locally only. Students are advised to visit body building and assembly unit.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text Books:

1. Machine Drawing- K.L. Narayana, P.Kannaiah&K.Venkata Reddy, New Age Publishers
2. Machine Drawing- Dhawan, S.Chand Publications

References:

1. Machine Drawing- P.S. Gill.
2. Machine Drawing- Luzzader
3. Machine Drawing – Rajput
4. Textbook of Machine Drawing-K.C.John,2009, PHI learning

Suggestions:

1. Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.
2. Student should visit an automobile shop while the unit is being disassembled / assembled.
3. Student should go through the exercises given under assembly drawings refereeing to various books in the library to improve his assimilation capacity.

II Year B.Tech - I Semester

HUMAN VALUES AND PROFESSIONAL ETHICS

OBJECTIVE

• To create an awareness on Engineering Ethics and Human Values.
• To instill Moral and Social Values and Loyalty
• To appreciate the rights of Others

Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy – Self Confidence Character – Spirituality.

Unit II: ENGINEERING ETHICS

Senses of 'Engineering Ethics- Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg's theory- Gilligan's theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV: ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V: GLOBAL ISSUES

Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics and Research – Analyzing Ethical Problems in research – Intellectual property Rights(IPR).

BOOKS FOR REFERENCE

1. **Engineering Ethics includes Human Values** by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. **Engineering Ethics** by Harris, Pritchard and Rabins, Cengage Learning, India Edition, 2009.
3. **Ethics in Engineering** by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
4. **Professional Ethics and Morals** by Prof.A.R.Aryasri, Dharanikota Suyodhana, Maruthi Publications.
5. **Professional Ethics and Human Values** by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
6. **Professional Ethics and Human Values** by Prof.D.R.Kiran-
7. **Indian Culture, Values and Professional Ethics** by PSR Murthy-BS Publication

MECHANICS OF SOLIDS & MATERIAL SCIENCE ENGINEERING LAB
MECHANICS OF SOLIDS - PART – A

OBJECTIVE: *The object of the course to make the student to understand the behaviour of materials under different types of loading for different type of structures.*

SYLLABUS:

1. Tension test.
2. Torsion test.
3. Hardness test.
4. Shear test.
5. Spring test (compression & Expansion).
6. Izod test.
7. Charpy test

MATERIAL SCIENCE LAB – PART B

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – Carbon steels.
3. Study of Micro Structures of Cast Irons.
4. Study of Micro Structures of Non-Ferrous alloys.
5. Study of Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out hardness of various treated and untreated steels.

II Year B.Tech - I Semester

ELECTRICAL AND ELECTRONICS LAB

(PART – A)ELECTRICAL LAB

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Open Circuit Characteristics of DC Shunt Generator.
4. Swinburne's Test on DC Shunt Machine(Predetermination of efficiency of a given DC shunt Machine Working as Motor and Generator).
5. Brake test on DC Shunt Motor. Determination of Performance Characteristics
6. OC &SC Tests on Single phase transformer (Predetermination of efficiency and regulation at given Power factors)

PART – B (ELECTRONICS LAB)

OBJECTIVES:

- This Lab provides the students to get an electrical model for various semiconductor devices. Students can find and plot V-I characteristics of all semiconductor devices. Student learns the practical applications of the devices. They can learn and implement the concept of the feedback and frequency response of the small signal amplifier

OUTCOMES:

- Students able to learn electrical model for various semiconductor devices and learns the practical applications of the semiconductor devices

LIST OF EXPERIMENTS:

(For Laboratory Examination-Minimum of Six Experiments)

1. Identification, specifications and testing of R, L and C components (color codes), Potentiometers, Bread board, Identification and specification of active devices, Diodes, BJTs, low power JFETs, MOSFETs, UJTs, Linear and Digital ICs
2. P-N Junction Diode Characteristics
   a. Germanium Diode (Forward bias& Reverse bias)
   b. Silicon Diode (Forward bias only)
3. Zener Diode Characteristics
   a. V-I Characteristics
   b. Zener Diode act as a Voltage Regulator
4. Rectifiers (without and with c-filter)
   a. Half-wave Rectifier
   b. Full-wave Rectifier
5. BJT Characteristics (CE Configuration)
   a. Input Characteristics
   b. Output Characteristics
6. FET Characteristics(CS Configuration)
   a. Drain (Output) Characteristics
   b. Transfer Characteristics

II Year B.Tech - II Semester

II Year B.Tech - II Semester

ENVIRONMENTAL SCIENCE

UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, Scope and Importance – Need for Public Awareness.

Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II : ECOSYSTEMS & BIODIVERSITY AND ITS CONSERVATION

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-soports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III: ENVIRONMENTAL POLLUTION, SOLID WASTE MANAGEMENT & SOCIAL ISSUES AND THE ENVIRONMENT

Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Causes**,** effects and control measures of urban and industrial waste – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Social issues and the environment From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT IV: HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations.Population explosion–Family Welfare programme. Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

UNIT V: FIELD WORK

Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds – river, hill slopes, etc..

TEXT BOOKS :

1. Text book of Environmental Studies for Undergraduate Courses, Erach Bharucha for University Grants Commission, Univ. Press, 2001.
2. Environmental Studies by R.Rajagopalan, Oxford Univ.Press,2008.
3. Environmental Studies by Benny Joseph, Mc.Graw Hill Publications, 2007.

REFERENCES:

1. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication, 2008.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications, 2008.
3. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited, 2004.
4. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited, 1992.
5. Environmental Studies by Anindita Basak – Pearson education, 2009.

II Year B.Tech - II Semester

PROBABILITY AND STATISTICS

(Common to Civil & Mech.)

Objectives:

- To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, ANOVA, Statistical Quality Control and Queuing theory

UNIT – I

Conditional probability – Baye's theorem. Random variables – Discrete and continuous Distributions – Distribution functions. Binomial and poison distributions Normal distribution – Related properties.

UNIT – II

Test of Hypothesis: Population and Sample - Confidence interval of mean from Normal distribution - Statistical hypothesis - Null and Alternative hypothesis - Level of significance - Test of significance - Test based on normal distribution - Z test for means and proportions; Small samples - t- test for one sample and two sample problem and paired t-test, F-test and Chi-square test (testing of goodness of fit and independence).

UNIT – III

Analysis of variance one way classification-CRD and two way classification (RBD and Latin square Design)

UNIT – IV

Statistical Quality Control: Concept of quality of a manufactured product -Defects and Defectives - Causes of variations - Random and assignable - The principle of Shewhart Control Chart-Charts for attribute and variable quality characteristics- Constructions and operation of X- bar Chart, R-Chart, P-Chart and C-Chart.

UNIT – V

Queuing Theory: Pure Birth and Death process, M/M/1 & M/M/S & their related simple problems.

TEXT BOOKS:

1. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers(2010)
2. Probability & Statistics by T.K.V. Iyengar, S.Chand publications-4th Edition(2013)

REFERENCES:

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher-1st Edition(2010)
2. Statistical methods by S.P. Gupta, S.Chand publications-41th Edition(2011)
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press-1st Edition(2011)
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE-8th Edition,(2011).
5. Probability and Statistics by R.A. Jhonson and Gupta C.B, Pearson Education- 7th Edition(2007).

Outcomes:

- The student will be able to analyze the problems of engineering & industry using the techniques of testing of hypothesis, ANOVA, Statistical Quality Control and Queuing theory and draw appropriate inferences.

II Year B.Tech - II Semester

KINEMATICS OF MACHINERY

UNIT – I

MECHANISMS AND MACHINES: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain.Mobility of mechanisms.

UNIT-II

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types –Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms.Pantograph.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) **-**Single and double Hooke's joint — applications – Simple problems.

UNIT – III

KINEMATICS

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

GEARS: Higher pairs, toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference.Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.Introduction to Helical, Bevel and Worm gearing.

GEAR TRAINS: Introduction –Types of gears – Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains.Differential gear of an automobile.

UNIT – V

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion **-** Uniform velocity, Simple harmonic motion, Cycloidal and uniform acceleration–and retardation Maximum velocity and maximum acceleration during outward and return strokes.Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

TEXT BOOKS :

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers.
2. The Theory of Machines, J.E. Shiegley, McGraw Hill .
3. Theory of Machines, Thomas Bevan, CBS.

REFERENCES :

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
3. Theory of machines, P.L. Ballaney, Khanna Publishers.
4. Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers

Suggestions:

Students may visit nearby machine tool shops and automobile workshops to know about different mechanisms, gears, gear trains, flexible drives and cams. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

WEB REFERENCES :

http://nptel.iitk.ac.in
http://ptumech.loremate.com/tom1/node/1
http://www.youtube.com/watch?v=6coD3oOuhr8

THERMAL ENGINEERING - I

UNIT-I

I.C. ENGINES : Definition of Engine and Heat Engine, I.C Engine Classification – Parts of I.C. Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C. Engines SI & CI Engines, Valve and Port Timing Diagrams.

UNIT-II

S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems.

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System, Lubrication Systems-Flash, Pressurized and Mist Lubrication.

Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

UNIT-III

COMBUSTION OF I.C ENGINES

S I engine : Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

UNIT – IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

UNIT-V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

- **Students are advised to refer the text book of “Internal Combustion Engine Fundamentals” by John B. Heywood.**

TEXT BOOKS:

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.

REFERENCES:

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons.
2. Internal Combustion Engines by K.K. Ramalingam, Scitech Publications.
3. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI
4. Thermal Engineering, Rudramoorthy - TMH
5. Thermodynamics & Heat Engines, B. Yadav, Central Book Depot., Allahabad
6. I.C. Engines, Heywood, McGrawHIll.
7. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
8. Thermal engineering data book-B.Srinivasulu Reddy, JK International Pub.
9. I.C Engines by S.S Thipse – Jaico

WEB RESOURCES

http://autoclub.rso.siuc.edu/frange.html

http://www.howstuffworks.com/engine1.htm

http://inventors.about.com/library/inventors/blinternalcombustion.htm
http://www.animatedengines.com/

II Year B.Tech - II Semester

FLUID MECHANICS

UNIT - I

FLUID STATICS : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

FLUID KINEMATICS : stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

FLUID DYNAMICS: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.

UNIT – II

CONDUIT FLOW: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine current meter.

UNIT – III

VISCOUS FLOWS: flow of viscous through a circular pipe, Ratio of maximum velocity to Average velocity, Drop of pressure for given length of pipe, flow between parallel two plates ratio of maximum velocity to average velocity, Drop of pressure head for a given length, shear stress distribution.

UNIT- IV

LOSSES OF ENERGY DUE TO FRICTION MAJOR LOSSES: Darcy-Weisbach formula, Chezy's formula, minor losses, Losses of head due to sudden enlargement, sudden contraction at entrance of pipe, at exit of a pipe, obstruction in a pipe, bend in a pipe.

UNIT-V

BOUNDARY LAYER FLOW: Introduction to boundary layer theory, laminar flow, displacement thickness, momentum thickness, Energy thickness, drag force on a plate due to boundary layer, local coefficient of drag, Average coefficient of drag, simple problems.

TEXT BOOKS :

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.

REFERENCE BOOKS :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & sons.
2. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age Internat.
3. hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004

II Year B.Tech - II Semester

MANUFATURING TECHNOLOGY

UNIT – I

CASTING: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Principles of Gating, Gating ratio and design of Gating systems, Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment.

Methods of Melting: Crucible melting and cupola operation, steel making processes.

UNIT – II

Welding: Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

Cutting of Metals: Oxy – Acetylene Gas cutting, Plasma Cutting , Inert Gas welding, TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive non-destructive testing of welds.

UNIT – III

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, plastic blow and injection moulding, Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.

UNIT- IV

EXTRUSION OF METALS: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

Forging processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

UNIT - V

Plastic –types, properties and their applications; processing of plastic – different methods – blow and injection molding, process capabilities and equipment details. Ceramic – Processing of different types of ceramics- compaction of metal powders, sintering, finishing operations, process capabilities.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao/TMH
2. Manufacturing Technology/ kalpakjian, Pearson education

REFERENCES:

1. Production Technology / R.K. Jain
2. Process and materials of manufacturing –Lindberg/PE
3. Principles of Metal Castings / Rosenthal.
4. Welding Process / Paramar
5. Manufacturing Technology / R.K. Rajput, Laxhimi Pub
6. Workshop Technology Vol-, by Raghuvamsi

II Year B.Tech - II Semester

THERMAL ENGINEERING LAB

1. Valve Timing Diagram of 4 Stroke Diesel Engine
2. Port Timing Diagram of Single Cylinder 2 **-** Stroke Petrol Engine
3. Assembly and Disassembly of Diesel and Petrol Engines
4. Performance Test on 2 **-** Stage Reciprocating Air Compressor
5. Performance Test on 2 – Stroke Single Cylinder Petrol Engine Coupled to D.C Generator Loaded Resistance Rheostat with Motoring Test Rig
6. Performance Test on 4 – Stroke 4 Cylinder Petrol Engine Coupled to D.C Generator Loaded Resistance Rheostat with Motoring Test Rig
7. Performance Test on Refrigeration Test Rig
8. Performance Test on Air Conditioning Test Rig
9. Study of Boilers
10. Demonstration of Diesel and Petrol engines by cut models.

II Year B.Tech - II Semester

MANUFACTURING TECHNOLOGY LAB

Minimum of 10 Exercises need to be performed

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. WELDING LAB :

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

III B.Tech I Semester

HYDRAULIC MACHINERY

L	T	P	C
3	1	0	3

Course Objective:

The aim of this course is to make the students familiar with the different components of a hydroelectric power plant and understand the basic concepts of power production using energy of water along with estimation of potential of power generation. And also to make the students to study the working of hydraulic machines, their features of design and working proportions.

UNIT I

Hydroelectric Power Stations: Elements of hydro electric power station - types - concept of pumped storage plants - storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

Learning Outcome:

At the end of this unit the student shall have an overview of different aspects of hydro power generation. The student gets an idea about the different types of power plant and estimation of power that can be generated from these plants besides the study of different heads and efficiencies

UNIT II

Basics Of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Learning Outcome:

At the end of this unit the student shall learn about the different cases of impact and the work done in all these cases. The student shall be able to draw the velocity triangles and analyse the same to arrive at the required quantities. Different cases of flow are made known to the student.

UNIT III

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine - working proportions, work done, efficiencies, hydraulic design - draft tube theory - functions and efficiency.

Learning Outcome

At the end of this unit the student shall be able to understand the features and working of different hydraulic turbines and their use. The student is also exposed to the aspects of hydraulic design of the turbines along with the calculation of various quantities like work done and efficiency.

UNIT IV

Performance Of Hydraulic Turbines: Geometric similarity - unit quantities - performance under specific conditions - specific speed - characteristic curves - Governing of turbines - Selection of type of turbine - model testing of turbines - cavitation - surge tank - water hammer.

Learning Outcome:

At the end of this unit the student shall know about the evaluation of the performance of the various hydraulic turbines. The student shall also have idea about the calculation of different quantities used for predicting the behavior and performance of turbines besides knowing the importance of different effects of cavitation and water hammer.

UNIT V

Pumps: Centrifugal pumps - Classification, working, work done - manometric head - losses and efficiencies specific speed - pumps in series and parallel - performance - characteristic curves, NPSH. Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Learning Outcome:

At the end of this unit the student shall have an opportunity to understand the various types and purposes of hydraulic machines (pumps). The student is exposed to different types of pumps, their working and applications. This makes the student capable of selecting the suitable pump according to the requirement

TEXT BOOKS:

1. Hydraulics, fluid mechanics and hydraulic machinery by Modi and Seth, Standard Publishers, 19th Edition,2013.
2. Fluid Mechanics and Hydraulic Machines by R.K Rajput. 5th Edition,2013.

REFERENCES:

1. Fluid Mechanics and Hydraulic Machinery by R.K. Bansal, Laxmi Publicaitons (P) Ltd. 9th Edition,2012.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International. 1st Edition.
3. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
4. JagadishLal, Hydraulic Machines, Metropolitan Book Company Pvt. Ltd.

SUGGESTED LINKS:

- http://nptel.iitm.ac.in/courses/105101082/
- http://ga.water.usgs.gov/edu/hyhowworks.html
- http://www.youtube.com/watch?v=wvxUZF4lvGw&feature=player_detailpage

http://www.mech.uq.edu.au/courses/mech7350/lecture-notes-in-pdf/mech7350-10-hydraulic-turbines.pdf

III B.Tech I Semester

THERMAL ENGINEERING – II

L	T	P	C
3	1	0	3

Course Objective:

This subject is designed to provide a sound knowledge in various aspects of thermal equipments. This subject has an increasingly dominant role to play in the vital areas of power generation, Automobiles, R&AC and energy sector. The course contents aims at developing the necessary analytical and technical contents among engineers in these areas. The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.

UNIT I

Basic Concepts: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance - Regeneration - Reheating- Combined- Cycles.

Learning Outcome & Suggested Student Activities:

Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation.

Students are advised to be acquainted with the terms related to steam, steam tables and mollierchart. Also, students are advised to visit the thermal power station to get real expose.

UNIT II

Boilers: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers - Mountings and Accessories.

Draught: Classification - Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney - Artificial Draught, Induced and Forced Draught.

Learning Outcome & Suggested Student Activities:

Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator. Students are advised to visit the Boilers in the power generation units to get better expose.

UNIT III

Steam Nozzles: Function of Nozzle - Applications - Types, Flow through Nozzles, Thermodynamic Analysis - Assumptions - Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line -Shock at the Exit.

Learning Outcome & Suggested Student Activities:

Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations. Student can able to understand the effect of metastable flow/ super saturation flow through nozzle.

UNIT IV

Impulse Turbine: Mechanical Details - Velocity Diagram - Effect of Friction - Power Developed Axial Thrust Blade or Diagram Efficiency - Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow - Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

Reaction Turbine: Mechanical Details - Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction -Velocity Diagram - Parson's Reaction Turbine - Condition for Maximum Efficiency.

Learning Outcome & Suggested Student Activities:

At the end of unit, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce. Students are advised to visit thermal power stations for better understanding the working of turbines. Students are suggested to participate in science exhibitions based on the concept of thermal power plants.

UNIT V

Gas Turbines: Simple Gas Turbine Plant - Ideal Cycle, Essential Components - Parameters of Performance - Actual Cycle - Regeneration, Inter Cooling and Reheating - Closed And Semi-Closed Cycles - Merits and Demerits.

Jet Propulsion: Principle of Operation - Classification of Jet Propulsive Engines - Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency - Turbo Jet, Turbo Prop, Pulse Jet Engines - Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Learning Outcome & Suggested Student Activities:

After the study of the unit, Student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices. Student can aware of using thrust equations in solving problems. Students advised to visit Gas power generation plants.

TEXT BOOKS

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publicatndons, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2 Edition,2012.

REFERENCE BOOKS

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Gas Turbines and Propulsive Systems, P.Khajuria & S.P.Dubey, Dhanpatrai
4. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.
5. Thermal Engineering-M.L.Mathur & F.S.Mehta, Jain bros, 2006.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B.Umamaheswar Gowd and A. Nagraju, Siri Publ.

NOTE: Steam tables and Mollier charts to be supplied for exam.

SUGGESTED LINKS:

- http://www.iscid.org/encyclopedia/Tthermodynamics
- https://www.youtube.com/watch?v=Ota2_LUuar0
- https://www.youtube.com/watch?v=8GSUgwombdE
- http://www.youtube.com/watch?v=cdUNmzcu2rA
- http://www.youtube.com/watch?v=y2dOmpZgYW8&list=PLBD7B1EEF7CCB7D9D
- https://www.youtube.com/watch?v=1bl1Q3V_79I
- http://www.youtube.com/watch?v=hnVWpOV5chs,
- http://www.youtube.com/watch?v=p1TqwAKwMuM
- http://www.youtube.com/watch?v=MUxP3PCDRTE

III B.Tech I Semester

DYNAMICS OF MACHINERY

L	T	P	C
3	1	0	3

Course objective:

To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

UNIT I

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Brakes and Dynamometers: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers - absorption and transmission types, General description and methods of operation.

Learning outcome & suggested Student Activities:

After completion of this unit, students are able to solve the numerical problems on brakes, students can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. Students may go through text books given for more number of problems on brakes and dynamometers.

UNIT II

Turning Moment Diagrams And Fly Wheels: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed - Fly wheels and their design, Fly wheels for Punching machines.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to design a flywheel for IC engine. Students may go through text books given for more number of problems on flywheels.

UNIT III

Governors: Watt, Porter and Proell governors. Spring loaded governors - Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting.Effort and power of a governor.

Learning outcome & suggested Student Activities:

The outcome of this unit is to study the basics and definitions related to governors and forces acting on various governors. After completion of this unit students are able to solve numerical problems on different governors. Students may go through text books given for more number of problems on governors.

UNIT IV

Balancing: Balancing of rotating masses - single and multiple - single and different planes.

Balancing Of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples,V-engine, multi cylinder in- line and radial engines for primary and secondary balancing.

Learning outcome & Suggested Student Activities:

After completion of this unit students can solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines. Students may go through text books given for more number of problems on balancing of rotating masses and balancing of reciprocating masses in locomotives and IC engines.

UNIT V

Vibration: Free and forced vibration of single degree of freedom system- undamped and damped , Simple problems on free, forced and damped vibrations. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, whirling of shafts and critical speeds.Vibration Isolation & Transmissibility.Raleigh's method.

Torsional Vibrations – undamped - two and three rotor systems.

Learning outcome & Suggested Student Activities:

Upon completion of this unit, the student will perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. Students may go through text books given for more number of problems on single degree of freedom system, transverse and torsional vibrations.

TEXT BOOKS:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.
2. Theory of Machines by P.L Ballaney – Lakshmi Publications.
3. Theory of Machines by R.S.Khurmi and Guptha.

REFERENCE BOOKS:

1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.
2. The theory of Machines, J.E. Shiegley, McGraw Hill .
3. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill

NOTE: End Exam Should be conducted in Drawing Hall

SUGGESTED LINKS:

- http://nptel.iitm.ac.in/video.php?subjectId=112104114
- http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html
- http://nptel.iitm.ac.in/video.php?subjectId=112104121,
- http://www.youtube.com/watch?v=FA04XFpJgwE
- http://www.youtube.com/watch?v=FydJu1A1oeM&list=PL46AAEDA6ABAFCA78&index=7
- http://www.youtube.com/watch?v=swgvKwyOnYk&list=PL46AAEDA6ABAFCA78&index=16
- http://www.youtube.com/watch?v=OG1AiaNTT6s
- http://www.youtube.com/watch?v=aRulDXMuNDc&list=PL46AAEDA6ABAFCA78&index=8
  http://www.youtube.com/watch?v=irudCaBrij0&list=PL46AAEDA6ABAFCA78&index=30

III B.Tech I Semester

METAL FORMING PROCESSES

L	T	P	C
3	1	0	3

Course Objective:

Metal forming processes are highly non linear because they involve geometric, material and contact non linearity. And so this subject introduce the concepts of one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students also will get the awareness on various types of rolling mills, forgings, extrusions, wire drawing processes, sheet metal operations, concepts on plastic manufacturing processes and rapid manufacturing process and its applications.

UNIT I

Classication of forming process, Mechanism of metal forming, Temperatures of metal working, Stress, strain, Two dimensional stress analysis and three dimensional stress analysis, relation between engineering stress and true stress, relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts

Learning Outcome & Suggested Student Activities:

Students can understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process.

UNIT II

Rolling: Deformation processes - Economics of bulk forming, principles and theory of rolling, types of Rolling and products. Forces in rolling and power requirements, applications and, limitations, defects in rolled products - machinery and Equipment.

Forging Processes: Principles of forging -Types Forging - Smith forging, Drop Forging - Roll forging - Forging hammers: Rotary forging - forging defects, Forces in forging of strip, disc and power requirements, applications, Equipment and their selection.

Learning Outcome & Suggested Student Activities:

Students can understand the principles of rolling and forging processes, their applications and defects.

UNIT III

Extrusion Processes: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion - Impact extrusion Hydrostatic extrusion, forces in extrusion of cylindrical and non cylindrical components - characteristics and defects in extruded parts. Wire Drawing: Process Mechanics and its characteristics, determination of degree of drawing, drawing force, power, and number of stages-defects in products.

Learning Outcome & Suggested Student Activities:

Students can understand the fundamentals of extrusion process and wire drawing processes and their industrial applications.

UNIT IV

Sheet Metal Working - Economical Considerations - Stamping, forming and other cold working processes: Blanking and piercing - Bending and forming - Drawing and its types - Cup drawing and Tube drawing - coining - Hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products - Equipment, tooling and their characteristics.

Learning Outcome &Suggested Student Activities:

Students can understand the various press working processes, their advantages and disadvantages. Students are advised to visit nearby sheet metal works industries.

UNIT V

Processing Of Plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction - concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

Learning Outcome &Suggested Student Activities:

Students can understand the concept of plastic manufacturing process, rapid manufacturing process and its applications.

TEXT BOOKS:

1. Manufacturing Technology, Schmid and kalpakjin, Pearson Education.
2. Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH

REFERENCE BOOKS:

1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012
2. Process and materials of manufacturing -Lindberg, PE
3. Principles of Metal Castings, Rosenthal.
4. Welding Process, Parmar
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub
6. Rapid Prototyping Principles and Applications, RafiqNoorani, Wiely Pub.

SUGGESTED LINKS:

- www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt
- www.rose-hulman.edu/~stienstr/ME470/DFA.ppt
- www.design4manufacturability.com/DFM_article.htm
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm

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III B.Tech I Semester

DESIGN OF MACHINE ELEMENTS – I

L	T	P	C
3	1	0	3

Course Objective:

The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied. This subject will help to the students to learn to analyze and design basic machine elements in mechanical systems. By this subject students will become familiar on design principles, materials selection, stresses developed in machine elements under different loads. The students will also get knowledge on design of the permanent and temporary joints.

UNIT I

Introduction: General considerations of design, design process. Selection of Engineering Materials - properties -Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

Stresses In Machine Members: Simple stresses - Combined stresses - Torsional and bending Stresses - impact stresses - stress -strain relation - Various theories of failure - factor of safety.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are capable to apply design procedures using theories of failure for different elements.

UNIT II

Design For Fluctuating Loads: Stress concentration -notch sensitivity - Design for fluctuating stresses - Endurance limit - Estimation of Endurance strength - Goodman's line - Soderberg's line. Design of components for finite and infinite life.

Learning Outcome & Suggested Student Activities:

After completion of this chapter students are able to design simple components under cyclic loading using Goodman‟s and Soderberg‟s criterions.

UNIT III :

Bolted Joints: Forms of screw threads, stresses in screw fasteners, Design of bolts with pre stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength

Welded Joints: Weld Symbols, Strength of fillet welded joints, stresses in welded joints, Eccentric loading in welded joints.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design bolted joints with different configuration, eccentric loading design of bolted joints. Further students are able to design welded joints with direct loading and eccentric loading.

UNIT IV

Design of Cotters and Knuckle Joints: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

Design of Shafts: Design of solid and hollow shafts for strength and rigidity - Design of shafts for combined bending and axial loads - Standard shaft sizes.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design cotter joint, knuckle joint and shafts

UNIT V

Design Of Mechanical Springs: Stress and deflections of helical Springs-Springs for fatigue loading - Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs-Design of leaf springs.

Learning Outcome & Suggested Student Activities:

After completion of this unit, students are able to design helical sprigs for two wheel vehicle and laminated springs for trucks.

TEXT BOOKS:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers
2. MachineDesign,Schaum‟sseries,TMHPublishers, NewDelhi
3. MachineDesign,R.K.Jain,KhannaPublishers,NewDelhi.

REFERENCE BOOKS:

1. MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi
2. MachineDesign,R.S. Kurmi and J.K. Gupta ,S.ChandPublishers, NewDelhi
3. Mechanical Engineering Design, JosephE.Shigely, TMH Publishers, NewDelhi
4. DesignofMachineElements, M.F.Spotts, PHIPublishers, NewDelhi.
5. MachineDesign,PandyaandShah,CharotarPublishers,Anand,
6. Machine Design, R.L. Norton, Tata McGrawHillPublishers
7. Machine Design by Groover - CBS Publications,

NOTE: Design data books are not permitted in the examinations.

SUGGESTED LINKS:

http://machinedesign.com/
http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6
http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8
http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19

III B.Tech I Semester

HEAT TRANSFER

L	T	P	C
3	1	0	3

Course Objective:

The students will gain the ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques , tools and skills required to solve typical thermal related problems, the analysis of energy flows in complicated systems and the design of efficient heat transfer equipments. Enables the student to utilize analogies to solve heat transfer problems. Further students gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

UNIT I

Introduction: Modes and Mechanisms of Heat Transfer - Basic Laws of Heat Transfer - General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation - General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates. Simplification and Forms of the Field Equation - Steady, Unsteady and Periodic Heat Transfer - Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres - Overall Heat Transfer Coefficient - Electrical Analogy - Critical Radius/Thickness of Insulation

Learning Outcome & Suggested Student Activities:

After the completion of the unit, student can able to grasp the concept of steady state conduction. Student can learn representing conduction equation in various forms. Student can imply concept successfully to problems encounter in day to day life

UNIT II

Heat Transfer in Extended Surface (Fins) - efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance - Significance of Biot and Fourier Numbers - Chart Solutions of Transient Conduction Systems - Problems on Semi-infinite Body.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student is expected understand the concept of extended surfaces and its applications. Also, student can aware transient heat conduction and how it vary w.r.t time. Student is expected to develop the ability to formulate practical conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution technique and evaluating the significance of results.

UNIT III

Convective Heat Transfer: Dimensional Analysis - Buckingham Π Theorem and Its Application for Developing Semi - Empirical Non-Dimensional Correlations for Convective Heat Transfer - Significance of Non-Dimensional Numbers - Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over - Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths - Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical

Plate - Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Learning outcome & Suggested Student Activities:

At the end of the chapter, Student will have the ability to formulate practical forced and natural convection heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance.

UNIT IV

Heat Transfer With Phase Change: Boiling, Pool Boiling - Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation - Nusselt's Theory of Condensation on a Vertical Plate - Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers - Overall Heat Transfer Coefficient and Fouling Factor - Concepts of LMTD and NTU Methods - Problems using LMTD and NTU Methods.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student will be able to calculate heat transfer in condensation and boiling systems, turbulent and laminar film condensation. Student can understand the concepts of critical heat flux and different models of critical heat flux. Student can able to grasp the fundamentals of heat exchangers and its analysis.

UNIT V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation - Irradiation - Total and Monochromatic Quantities- Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann - Heat Exchange Between Two Black Bodies - Concepts of Shape Factor - Emissivity - Heat Exchange Between Gray Bodies - Radiation Shields - Electrical Analogy for Radiation Networks.

Learning outcome & Suggested Student Activitie:

At the end of the unit, student can have knowledge on fundamental laws of radiative heat transfer. Also, student can understand the concept of radiative heat transfer between black bodies and grey bodies. Student can know radiation shields and their applications. Student can determine shape factor for different geometries and can know its importance in determining radiative heat transfer.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International

REFERENCE BOOKS:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011
2. Heat Transfer, Ghoshdastidar, Oxford Univ. Press, 1st edition, 2004
3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012
4. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001
5. Fundamentals of Heat and Mass Transfer, Kodandaraman, C.P., 3/e, New Age Publ.
6. Fundamentals of Heat and Mass Transfer, Incropera, 5/e, Wiley India.
7. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007

NOTE: Heat transfer Data books are permitted for Exam.

Web References:

- http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304
- http://web.cecs.pdx.edu/~gerry/heatAnimations/sphereTransient/#TOC
- http://www.youtube.com/watch?v=9WwSaIP5pbs
- http://www.youtube.com/watch?v=HIYCR7gXXFo;
- http://www.youtube.com/watch?v=S57nIs503fA
- http://energy.concord.org/ir/experiments-page3.html
- http://www.youtube.com/watch?v=cMmREKOhIV8
- http://www.youtube.com/watch?v=HiX7DKUlAOM
- http://www.youtube.com/watch?v=Gu1ApKpcxQc
- http://energy.concord.org/ir/experiments-page5.html

III B.Tech I Semester

HEAT TRANSFER LABORATORY

L	T	P	C
0	0	3	2

Course objectives:-

Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems. The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the course, Heat and Mass Transfer. The laboratory consists of experiments on various conductive, convective, radiative, boiling and condensing mechanisms of heat transfer.

NOTE: Thermal Engineering data books are permitted in the examinations

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus Thermal Conductivity of metal (conductor).
4. Heat transfer in pin-fin
5. Experiment on Transient Heat Conduction
6. Heat transfer coefficient in forced convection.
7. Heat transfer coefficient in natural convection
8. Experiment on Parallel and counter flow heat exchanger.
9. Emissivity of a gray body through Emissivity apparatus.
10. Experiment on Stefan Boltzman Apparatus.
11. Heat transfer in drop and film wise condensation.
12. Experiment on Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two - Phase flow.

Note: Any 10 of the above 15 experiments are to be conducted.

Course outcomes:-

After completion of this course the student can be able to:

- Apply the techniques in the lab are having wide applications in various industries such as sugar industries, petroleum industries, process industries, fertilizer industries etc.
- Design new equipment related to heat transfer

III B.Tech I Semester

FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY

L	T	P	C
0	0	3	2

Course objectives:-

The students will gain the ability

- To compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows;
- To discuss and practice standard measurement techniques of fluid mechanics and their applications;
- To learn and practice writing technical reports; and
- To work on small design projects.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Discharge measurement through Venturimeter.
9. Discharge measurement through Orifice meter.
10. Estimation of friction factor for a given pipe line.
11. Estimation of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

NOTE: Any 10 of the above 12 experiments are to be conducted

Course outcomes:-

Students who successfully complete this course will have demonstrated an ability to:

- Identify, name, and characterize flow patterns and regimes.
- Understand basic units of measurement, convert units, and appreciate their magnitudes.
- Utilize basic measurement techniques of fluid mechanics.
- Discuss the differences among measurement techniques,

III B.Tech II Semester

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (MEFA)

L	T	P	C
3	1	0	3

Course Objectives:

Prepare engineering students to analyze cost/revenue data and carry out make economic analysis in the decision making process to justify or reject alternatives/projects on economic basis.

Unit I

Introduction to Managerial Economics & Demand Analysis: Definition of Managerial Economics, Characteristics and Scope – Managerial Economics and its relation with other subjects- Basic economic tools in Managerial Economics.

Demand Analysis: Meaning- Demand distinctions- Demand determinants- Law of Demand and its exceptions.

Elasticity of Demand & Theory of Production and Cost Analysis: Definition -Types of Elasticity of demand - Measurement of price elasticity of demand: Total outlay method, Point method and Arc method- Significance of Elasticity of Demand.

Unit-II

Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting - Forecasting demand for new products- Criteria of a good forecasting method.

Theory of Production and Cost Analysis: Production Function- Isoquants and Isocosts, MRTS, Cobb-Douglas Production function.

Cost Analysis: Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break even analysis -Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP.

Unit-III

Introduction to Markets & Pricing Policies: Market structures**:** Types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition.

Pricing Policies: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Bundling Pricing, and Peak Load Pricing.Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model, Smart market mechanism model.

UNIT-IV

Types of Industrial Organization & Introduction to business cycles: Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types.

Introduction to business cycles: Meaning - Features of business cycles.

Capital and Capital Budgeting: Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples of capital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems).

Unit V

Introduction to Financial Accounting: Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts (with simple adjustments)- Limitations of Financial Statements.

Interpretation and analysis of Financial Statement: Ratio Analysis – Liquidity ratios, Profitability ratios and solvency ratios – Preparation of changes in working capital statement and fund flow statement.

Text Books:

1. **J.V.PrabhakarRao**: Managerial Economics and Financial Analysis, MaruthiPublications, 2011
2. **N. AppaRao. & P. Vijaya Kumar**: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi, 2011

References:

1. **A R Aryasri -** Managerial Economics and Financial Analysis, TMH 2011
2. **Suma damodaran**- Managerial Economics, **Oxford** 2011
3. **S.A. Siddiqui& A.S. Siddiqui**, Managerial Economics and Financial Analysis, New Age International Publishers, 2011.

Course outcomes:-

1. Be able to perform and evaluate present worth, future worth and annual worth analysis on one of more economic alternatives.
2. Be able to perform and evaluate payback period and capitalized cost on one of more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analysis on one or more economic alternatives.

III B.Tech II Semester

CAD/CAM

L	T	P	C
3	1	0	3

Course objective:

The objective of the this subject is to enable the students to understand and handle design problems in symmetric manner, gain practical experience in handling 2-D drafting and 3-D modeling software systems, apply CAD in real life applications, understand the concepts G and M codes and manual part programming and know the applications of CNC machines. Further the students will become familiar on principles of computer graphics, geometric modeling, NC and CNC machines, group technology and FMS.

UNIT I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design.

UNIT II

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

Learning outcome & suggested Student Activities:

After completion of this unit students are able to understand the geometric model of the component in CAD technology of computer graphics. The techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.

UNIT III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

Learning outcomes & suggested Student Activities:

Geometric Modeling constitutes the most important and complex part in most of CDA software Packages. Hence the students should focus on various requirements of information that are generated during geometric modeling stage, various types and its applications. Mathematical representations of curves used in geometric construction.

UNIT IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM

Learning outcome & Suggested Student Activities:

CNC has revolutionized the manufacturing automation. The flexibility of manufacturing achvied with the use of CNC and associated Technology. The students should aimed to understand the principle of NC, CNC, Machining Centre and various methods of part programming. The student is advised to visit manufacturing industry where the CNC machines are using and also interact with CNC programmer in industry.

UNIT V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer Integrated Production Planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits.

Trends In Manufacturing Systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Learning outcomes &Suggested Student Activities:

Understanding the need of GT as a means of bringing the benefits of mass production to relatively smaller production.Understanding the need of computers in process planning and QC .Understanding the definition and concept of FMS, and its elements etc.

TEXT BOOKS:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

REFERENCE BOOKS:

1. Automation, Production systems & Computer integrated Manufacturing,Groover, P.E
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008
3. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH
5. Computer Aided Design and Manufacturing, K.LalitNarayan , PHI, 2008.
6. Computer Aided Manufacturing, T.C. Chang, Pearson, 3rd edition, 2008

SUGGESTED LINKS:

http://www.cadcamfunda.com/cam_computer_aided_manufacturing
http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf

III B.Tech II Semester

MACHINE TOOLS

L	T	P	C
3	1	0	3

Course Objective:

The objectives of this course are to introduce to demonstrate the fundamentals of machining processes and machine tools. To develop knowledge and importance of metal cutting parameters, tool materials, cutting fluids and tool wear mechanisms. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes. The students will have the knowledge and hands-on experience that will enable them to work in a typical machine shop.

UNIT I

Elementary treatment of metal cutting theory - Elements of cutting process - Geometry of single point tool and angles, chip formation and types of chips - built up edge and its effects, chip breakers. Mechanics of orthogonal cutting -Merchant's Force diagram, cutting forces - cutting speeds, feed, depth of cut, heat generation, tool life, machinability.cutting Tool materials and cutting fluids -types and characteristics .

Learning outcome & suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the interface in the machining zone between the tool and the work piece and how the physical and mechanical parameters dictate the cutting performance.

UNIT II

Engine lathe - Principle of working- specification of lathe - types of lathes - work holders and tool holders -Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes - collet chucks - other work holders - tool holding devices - box. Principal features of automatic lathes - classification - Single spindle and multi-spindle automatic lathes.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of turning. Student shall be made familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation.

UNIT III

Drilling and Boring Machines - Principles of working, specifications, types, operations performed - tool holding devices - twist drill - Boring tools - machining time calculation. Shaping, Slotting and Planning machines -Principles of working - Principal parts - specification, classification, Operations performed. Machining time calculations

Learning outcome & suggested Student Activities:

After completion of this unit students are able to understand the basic principle of drilling, shaping and planning operation, parts of the drilling, shaping and planning machines and tool holding devices, operations performed on drilling, shaping and planning and machining calculations.

UNIT IV

Milling Machine - Principles of working - specifications - classifications of milling machines - Principal features - machining operations, Types and geometry of milling cutters- methods of indexing - Accessories to milling machines.

Grinding Machine -Theory of grinding - classification- cylindrical and surface grinding machine - Tool and cutter grinding machine - special types of grinding machines - Grinding wheel: Different types of abrasives - bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels.Lapping, Honing and Broaching machines.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation, parts of the milling machine and types of milling and grinding machines.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures - Principles of location and clamping - Types of clamping & work holding devices, Typical examples of jigs and Fixtures.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures - Principles of location and clamping. Some examples of jigs and fixtures.

TEXT BOOKS:

1. Manufacturing Technology by P.N.Rao
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012

REFERENCE BOOKS:

1. Manufacturing Technology-Kalpakzian- Pearson
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2ndeditstion, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1 edition, 2001
4. Production Technology by K.L.Narayana, IK International Pub.
5. Unconventional Machining process by V.K.Jain, Allied Pub
6. manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013
7. Machining and machine tools by AB. Chattopadyay, WileyEdn,2013
8. Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Taylor and Francies

SUGGESTED LINKS:

www.hgfarley.com
www.kennametal.com/ - United States
www.mini-lathe.com/links.htm;machinedesign.com/.../designer-s-guide-tometalcutting-machinery-0608 - www.metalwebnews.com/wc.html
www.britannica.com/EBchecked/topic/463000/planer www.americanmachinist.com
www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm

III B.Tech II Semester

REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	1	0	3

Course Objective:

This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.

The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

Learning Outcome & Suggested Student Activities:

At the end of the chapter, student can able to understand the terminologies associated with refrigeration and also understand the basic principles of Refrigeration and applications. Student can also know the aspects of various natural refrigeration methods; understand the components of Air refrigeration system and the necessity of air craft refrigeration.

UNIT II

Vapour Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of The Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the components in the domestic refrigerator, analyzing the concepts of sub-cooling and super heating to improve the COP and also necessity of replacements for CFCs and HCFCs with new refrigerants.

UNIT III

Vapor Absorption Refrigeration (VAR) System- Description and Working of NH_3 - Water System and Li Br -Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the basic components of the absorption refrigeration system. Student can have knowledge on latest developments of Electrolux, thermo electric vortex tube methods.

UNIT IV

Introduction To Air Conditioning: Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads -- Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcome & Suggested Student Activities:

After the end of the chapter, student can have knowledge on the use of psychrometric terms in Air conditioning. Student can learn the use of psychrometric chart to know psychrometric properties of air. Student can able to understand the terms sensible heat load and latent heat load. This technical information is fundamental to all types of domestic, commercial and industrial systems for the calculations of heat loads. Student is advised to conduct experiment on A.C tutor in the laboratory.

UNIT V

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.**Human Comfort:** Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can understand the components of A/C system and describe the cooling equipment combinations. Student can describe the concept of human comfort chart and the processes by which the body produces and rejects heat. Student can be familiar with the Heat pumpcircuit analysis.

TEXT BOOKS:

1. Refrigeration and Air Conditioning ,CPArora,TMH, 15th edition, 2013.
2. A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai

REFERENCE BOOKS:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4th edition, 2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containing refregerent and Psychrometricproperty Tables and charts are permitted in Exam

SUGGESTED LINKS:

- http://www.refrigerationbasics.com/index.htm http://www.howstuffworks.com/ac.htm
- http://www.ashrae.org
- http://www.taftan.com/thermodynamics/AIRCOND.HTM
- http://www.wisegeek.com/how-does-air-conditioning-work.htm
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20%20 Lecture%201.pdf
- http://www.ignou.ac.in/upload/Unit%201-32.pdf ,
- http:/nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20 Cond/pdf/RAC%20 Lecture%209.pdf
- http://www.nptel.iitm.ac.in/courses/IITMADRAS/Applied_Thermodynamics/Module_6/6_Simple_Vapor_ Compression_RS.pdf
- http://www.mcquay.com/mcquaybiz/literature/lit_ch_wc/AppGuide/AG31-007.pdf
- http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20Lecture%2014.pdf
- http://en.wikipedia.org/wiki/Thermoelectric_cooling
- http://server.fst.uga.edu/kerr/FDST%204060/pdf%20files/7%20Psychrometrics.pdf
- http://people.eng.unimelb.edu.au/mjbrear/436-432/chapter%208%20-%20psychrometry.pdf
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2031.pdf
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2029.pdf
- http://courses.washington.edu/me333afe/Comfort_Health.pdf
- http://web.me.unr.edu/me372/Spring2001/Heat%20Pumps.pdf

III B.Tech II Semester

DESIGN OF MACHINE ELEMENTS – II

L	T	P	C
3	1	0	3

Course Objective:

To aware the student about basic concepts design of power transmission elements, understand the design concepts of various types of keys and couplings and various types of bearings and gears. To know the students how to apply design concepts in designing of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

UNIT I

Design of Keys and Couplings: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design various rigid and flexible shaft couplings.

UNIT II

Design of Power Transmissions Systems: Design of Flat belt drives, V-belt drives drives, Selection of wire ropes.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design various belts and rope drives.

UNIT III

Design Of Sliding Bearings: Types of Journal bearings - Lubrication - Bearing Modulus-bearing materials - journal bearing design

Design Of Roller Bearings: Ball and roller bearings types - Static loading of ball & roller bearings, bearing life -Failure of bearings.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings.

UNIT IV

Design of Spur & Helical Gears: Spur gears- Helical gears, Nomenclature, Lewis equation, Load concentration factor - Dynamic load factor. Surface compressive strength - Bending strength - Design analysis of spur and Helical gears - Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design spur and helical gears for different input conditions.

UNIT V

Design Of Ic Engine Parts: Pistons- Construction, Design of piston. Cylinder, Cylinder block, Connecting Rod. Cranks and Crank shafts- Center and over hung cranks.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to know various forces acting on I C engine parts and failure criteria to be adopted for various parts.

TEXT BOOKS:

1. MechanicalEngineeringDesign,JosephE.Shigely,TMHPublishers,NewDelhi, 9th edition
2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

REFERENCE BOOKS:

1. MachineDesign,Schaum"sseries,TMHPublishers, NewDelhi, 1st edition, 2011 nd
2. Design ofMachine Elements, V.B.Bhandari , TMH Publishers,NewDelhi, 2 edition, 2013.
3. MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi
4. DesignofMachineElements,M.F.Spotts,PHIPublishers, NewDelhi.
5. MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2012.

NOTE: Design data books are permitted in the examinations.

SUGGESTED LINKS:

- http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf
- http://www.uni.edu/~rao/Md-15%20Keys%20and%20Couplings.pdf
- http://machinedesign.com/
- http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21
- http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
- http://www.youtube.com/watch?v=nMsB6Soz4Hc&list=PL3D4EECEFAA99D9BE&index=30
- http://www.mae.ncsu.edu/klang/courses/mae442/Tranmission/Journal%20Bearing.ppt
- http://nhbb.com/files/catalog_pages/HiTech_Catalog.pdf
- http://nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_9.pdf
- http://www.youtube.com/watch?v=8bml2pK6Ra0
- http://umpir.ump.edu.my/1778/1/Design_Of_Cooecting_Rod_Of_Internal_Combustion_Engine_A_Topology_Optimization_Approach.pdf
- http://www.d-p.com.gr/pistons/piston-designs.html

B.Tech. III –II Semester

NANOMATERIALS AND ENGINEERING APPLICATIONS
(Choice Based Credit Course Inter Department)
(Common to all branches)

L	T	P	C
3	1	0	3

Objectives:

i) to be able to critically evaluate nanotechnology concepts and therefore be equipped to develop deeper into research.

ii) Acquire knowledge of basic significance of TEM, Nanosemiconductors, nanopolymers and nanocomposites towards Engineering applications.

iii) Understand and describe the use of unique properties of nanoscale structures for various applications.

iv) Understand the physical and chemical properties of carbon based nanostructures.

UNIT -1: Nano Structures: Zero, one –two and three dimensional structures , size control of metal nano particles and their properties- optical, electronic, magnetic properties- surface Plasmon resonance- change of band gap-applications, catalysis, electronic devices

UNIT-II: Carbon Nanostructures: DLCs, fullerences, C-60, C-80, single walled nanotube (SWNT) and Multi Walled nanotuebs (MWNT) properties-mechanical, optical and electrical properties.

UNIT-III: Thermo electric materials (TEM): concept of phonon, thermal conductivity, specific heat, exothermic and endothermic processes. Bulk TEM properties, different types of TEM; one dimensional TEM; composite TEM; applications.

UNIT-IV: Nano semiconductors: Nanoscale electronic devices including CMOS, potentiometric sensors etc., MRAM devices, spintronic devices including spin values.

UNIT-V: Nanopolymers; preparation of and characterization of diblock Copolymer based nanocomposites, nanoparticles polymer ensembles; applications of nanopolymers in catalysis. Nano Composites: metal-metal nano composites, polymer-metal nanocomposites, ceramic nanocomposites: Dielectric and CMR based nanocomposites.(one example for each type)

TEXT BOOKS

1. Physics of Magnetism – S. Chikazumi and S. H. Charap., John Wiley and Sons, 1964.
2. Physical Properties of Carbon nanotube - R. Satio, 5th Edition, Imperial College Press,2004. ISBN-13: 978-1860942235
3. Nanoscale materials – Liz Marzan and Kamat, Springer, 2003, ISBN 978-0-306-48108-6.

REFERENCES:

1. Novel nanocrystalline Alloys and Magnetic nanomaterials – Brain Cantor, 1st Edition, CRC Press, 2004, ISBN-13: 978-0750310024
2. Polymer nanocomposites: Edited by Yiu-Wing Mai and Zhong, Znen Yu, 1st edition, Woodhead Publishing Limited and CRC Press LLC, USA.2006,
3. Physics of Magnetism – S. Chikazumi and S. H. Charap., John Wiley and Sons, 1964.
4. Magnetostriction and Magnetomechanical Effects – E. W. Lee, IOP Science, Rep. Prog. Phys. 18 184 doi:10.1088/0034-4885/18/1/305 1955.
5. Carbon Nanotubes: Properties and Applications – Michael J. O'Connel, 1st Edition, Taylor & Francis, 2006.
6. Carbon nanotechnology – Liming Dai, Science Direct. ISBN: 978-0-444-51855-2
7. Nanotubes and Nanowires – CNR Rao and A Govindaraj, 2nd Edition, RSC Publishing, 2011.
8. CRC Handbook of thermoelectric, Ed. Cr Rowe., 1st Edition, CRC Press, 2001.

Outcomes:

- Students will have a sound knowledge in multidisciplinary areas of nanotechnology.
- The necessary foundation for future nanomaterials engineering.
- Recognize the role of carbon based nanomaterials, TEM, Nanosemiconductors, nanopolymers and nanocomposites towards Engineering applications.
- Techniques to characterize, design and validate nano devices

B.Tech. III –II Semester

GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objectives:

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

UNIT 1: Principles and Concepts Of Green Chemistry

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT 2: Catalysis and Green Chemistry

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

UNIT 3: Organic Solvents: Environmentally Benign Solutions

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent

.

UNIT 4: Emerging Greener Technologies and Alternative Energy Sources

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

UNIT 5: Green Processes for Green Nanoscience

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

TEXT BOOKS :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

REFERENCES :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

Course Outcomes:

Upon completion of this course the students should recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

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B.Tech. III –II Semester

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objectives:

- To understand the principles of different instruments
- To apply the instruments for analysis of various species in different matrices
- To apply instrumental methods for framing project works

UNIT – I: Molecular Spectrophotometry
Absorption spectra, Lamberts Law, Beer's Law - Combined law equation; Derivations from Beer's Law. Block diagram of a uv- visible spectrophotometer – quantitative analysis ; Direct method for the determination of metal ions; Chromium, Manganese, Iron etc in alloys.

UNIT – II: Infrared Spectroscopy
Interaction of infra-red radiation with molecules, Sources of IR Radiation ; Spectral regions; Block diagram of IR Spectrometer , Function of each component; Sampling Techniques; Application of IR Spectroscopy to functional group analysis (-OH, -NH_2, -CHO, -CO-R, -CONH).

UNIT III: Chromatography
Gas Chromatography: Principles of Gas Chromatography, block diagram of gas chromatograph, Function of each component, Detectors (FID, ECD), stationary phase for column, mobile phase, chromatogram, qualitative analysis, quantitative analysis, retention time, retention volume, capacity factor, area., normalization method. Analysis of gaseous and volatile impurities.
HPLC: Principles of high performance liquid chromatography, Block diagram of HPCL, Systems, functions of each component, stationary phases, eluting solvents, pumps, detectors, quantitative applications of HPLC for environmental analysis.

UNIT IV: Atomic Spectrophotometry
Principle of atomization, atomic absorption spectrometer, applications for metal ions, Atomic emission, application and principle of ICP-OES, X-ray fluorescence spectrometry- Applications

UNIT V: Thermal methods of analysis
TGA- Thermo Gavimetry – Principle, instrumentation and applications
DTA- Differential Thermal Analysis- Principle, instrumentation and applications
DSC- Differential Scanning Coulometry- Principle, instrumentation and applications

TEXT BOOK:

1.Principles of Instrumental Analysis, 6th Edition, Douglas A. Skoog, James Holler. J, Stanley R. Crouch, Cengage Learning, New Delhi, 2014.
2.Instrumentaiotn methods of analysis, Chatwal & Anand, Himalaya Publ;ications, 2003

REFERENCES:

1.Instrumental methods of analysis, Willand merrit and dean, caps publications & Distribution, 1999.
2.Vogels Text book of Quantitative chemical analysis, 6^{th}edition ,Mendham J, Denny R.C,Barnes J.D, Thomas M.J.K, pearson education, 2002.
3.Modern Analytical Chemistry, 1^{St} edition, David Harvey, McGraw-Hill Higher Education, 2010.

Course Outcomes: Upon successful completion of this course, the students will be able to:

1. Differentiate between classical and instrumental methods of Chemical analysis.
2. Apply different types of Instrumental methods for analysis of various samples in water and other environmental samples

B.Tech. III –II Semester

CHEMISTRY OF NANOMATERIALS AND APPLICATIONS
(Choice Based Credit Course Inter Department)

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- And also characterisae the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

UNIT I:

Introduction**:**Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods**:** Bottom-Up approach**:-** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-II

Top-Down approach**:-** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

UNIT-III

Techniques for characterization**:** Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterilas, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV

Studies of Nano-structured Materials**:** Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

UNIT.V

Engineering Applications of Nanomaterials

TEXT BOOKS:

1. **NANO: The Essentials :**T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.
3. **Nanomaterials Chemistry**, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

Course Out Come

At the end of the course, the student will be able to:

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

B.Tech. III –II Semester

MATHEMATICAL MODELING AND SIMULATION
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objectives:

- This course aims at providing the basic knowledge to understand a Mathematical model and formulate a Mathematical model related to a real word problems of engineering, biological science etc.

Prerequisite: Instructor's permission

UNIT – I

Mathematical Model, types of Mathematical models and properties, Procedure of modeling,

UNIT – II

Graphical method: Barterning model, Basic optimization, Basic probability: Monte-Carlo simulation,

UNIT – III

Approaches to differential equation: Heun method, Local stability theory: Bernoulli Trials, Classical and continuous models, Case studies in problems of engineering and biological sciences.

UNIT – IV

General techniques for simulating continuous random variables, simulation from Normal and Gamma distributions, simulation from discrete probability distributions

UNIT – V

simulating a non – homogeneous Poisson Process and queuing system.

TEXT BOOKS:

1. Edward A. Bender.. An Introduction to Mathematical Modeling.
2. J. N. Kapoor.. Mathematical Modeling, Wiley eastern Limited.

REFERENCES:

1. A. C. Fowler.. Mathematical Models in Applied Sciences, Cambridge University Press.
2. S.M. Ross ..Simulation, India Elsevier Publication.
1. A.M.Law and W.D.Kelton.. Simulation Modeling and Analysis, T.M.H. Edition.

Outcomes: The student will be able to analyze the real word problem through the technique of modeling of that problem to have better insight of the real word problem.

B.Tech. III –II Semester

OPTIMIZATION TECHNIQUES
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objectives:

- This course aims at providing the student with the basic concepts and several methods of optimization .

Prerequisite: Instructor's permission

UNIT – I

Convex sets and functions, constrained optimization methods: Introduction, Kuhn-Tucker conditions, convex optimization, Lagrange multipliers.

UNIT – II

Non-linear programming: One-dimensional minimization method, seach method, unconstrained and constrained optimization theory and practices.

UNIT – III

Reliability: Basic concepts, conditional failure rate function, Failure time distributions, Certain life models, Reliability of a system in terms of the reliability of it's components, series system, Parallel system.

UNIT – IV

Dynamic Programming: Multistage decision problems, computation procedure and case studies.

UNIT – V

Fundamentals of queuing system, Poisson process, the birth and death process, special queuing methods.

TEXT BOOKS:

1. S.S Rao.. Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. Chong, E.K.P.and Zak, S. H.. An Introduction to Optimization, John Wiley & Sons, N.Y.
3. Peressimi A.L., Sullivan F.E., Vhl, J.J..Mathematics of Non-linear Programming, Springer – Verlag.

Outcomes: The student will be able to analyze optimization problems in engineering and technology using various elegant optimization technique.

CAMPUS RECRUITMENT TRAINING & SOFT SKILLS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objectives:
1. To develop awareness in students of the relevance and importance of soft skills.
2. To provide students with interactive practice sessions to make them internalize soft skills.
3. To prepare the students for placements.
4. To train students to use language appropriately for interviews, group discussion and public speaking
5. To help the students to understand interpersonal skills.
6. To support them in building interpersonal skills.
7. To better the ability to work with others

Outcome:

After completing this course,
- The students would have Understood of what Soft Skills is,
- Understood the significance of soft skills in the working environment
- Turning out engineering students with a clear concept of soft skills and equipping them with readiness to implement them at work place.

SYLLABUS:

UNIT I: Interview Dynamics-Preparation-Power Selling- Cracking the top Questions- Stress Control.

UNIT II: Intra Personal Skills: Knowing Strengths & Weaknesses – Goal Setting-Quotient Skills- Positive thinking- Problem Solving-analytical Skills.

UNIT III: Intra Personal Skills: Managerial Skills, Group dynamics- Negotiation Skills- Time Management.

UNIT IV: Verbal Skills: Dynamics of listening, Speaking, Reading & Writing skills- Email writing.

UNIT V: Non Verbal Skills: Body Language-Body Posture, Gestures, Eye Contact, Facial Expressions,Appearance, Space Distance /Proxemics , Touch/Haptics,. Para Language-Tone, Pace, Pause, Volume , Quality**.**

Reference books:

1. M. Ashraf Rizvi: Effective Technical Communication, Tata McGraw Hill, New Delhi, 2014.
2. Alex.k, soft skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
3. Technical Communication, Principle and Practice, Meenakshi Raman and Sangita Sharma, OUP, 2009.
4. Sherfield, M. Robert at al Cornerstone Developing Soft Skills, 4th ed. Pearson Publication,

New Delhi, 2014.

5. Shalini Varma, Body Language for your success mantra, 4th ed, S. Chand Publication, New Delhi, 2014.

COMPETITIVE & SPOKEN ENGLISH.
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objectives:

- To train students to use language effectively in everyday conversations, to participate in group discussions, to help them face interviews, and sharpen public speaking skills
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence.
- To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To train students to use language appropriately for interviews, group discussion and public speaking
- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

Expected Outcomes:

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students.
- Speaking with clarity and confidence thereby enhancing employability skills of the students.
- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities.

SYLLABUS:

UNIT I: Creating the unknowing passage-Reading Comprehension- Listening Comprehension.

UNIT II: Correction of the Sentences Nouns – Pronouns – Verbs- Tenses- Articles-Prepositions- Sentences.

UNIT III: Competitive Vocabulary – Word Building – Memory techniques

UNIT IV: Functional English – Sentences – Construction – Neutralization of accent – Intonation.

UNIT V: Dynamics of Speaking – Communication Skills – Speech Preparation – Speaking Practices.

Reference books:

1. M. Ashraf Rizvi: **Effective Technical Communication**, Tata McGraw Hill, New Delhi, 2014.
2. Wren and Martin, **High School English Grammar and Composition,**S. Chand Publication, New Delhi, 2014.
3. Hari Mohan Prasad, **Objective English for Competitive Examination,**Tata McGraw Hill, New Delhi, 2014.
4. R.S. Aggarwal , **Objective General English**, S. Chand Publication, New Delhi.
5. R.K Bansal, **Spoken English : Manual of Speech and Phonetics**,4th Edition, Orient Black swan Pvt Ltd.-New Delhi, 2013.

B.Tech III – II Semester

GREEN BUILDINGS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:
To enable the students learn to reduce the overall impact of the built environment on human health and natural environment. Student will able to learn how to reduce waste, pollution and environmental degradation and also to understand how to use effectively energy, water and other resources.

Unit I Introduction :Concept of Green Building, Need for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

Unit-II Green Building Concepts and Practices Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

Unit-III Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

Unit IV Air Conditioning Introduction,CII Godrej Green business centre,Design philosophy,Design interventions,Energy modeling, HVAC System design,Chiller selection,pump selection,Selection of cooling towers,Selection of air handing units,Precooling of fresh air,Interior lighting system,Key feature of the building. Eco-friendly captive power generation for factory,Building requirement.

Unit-V Material Conservation Handling of non process waste, waste reduction during construction,materials with recycled content,local materials,material reuse,certified wood ,Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books:
1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference Books:
1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

B.Tech III – II Semester

DISASTER MANAGEMENT AND MITIGATION
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:

To know the various types of disaster caused by the nature and disaster prone areas in India. To have knowledge about the response of the structure for various disasters.To obtain a brief knowledge about the planning and preparedness for a disaster.To have knowledge about the various modern materials and tools in disaster reduction.

UNIT I - Introduction To Disaster :Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster- Dimensions & Scope of Disaster Management - India's Key Hazards – Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II - Natural Disaster : Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT III - Anthropogenic Disaster :Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV - Approaches In Disaster Management :Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan - Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

UNIT V - Disaster Mitigation : Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management - Emergency Management Systems (EMS) in the Disaster Management Cycle - Remote Sensing and Geographic Information Systems(GIS) in Disaster Management. 2

Text book:

Sharma.S.R, "Disaster management", A P H Publishers, 2011.

REFERENCES

1. VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.
2. Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.
3. Gupta.H.K, "Disaster Management", University Press, India, 2003.
4. Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management,IIPA, New Delhi, 2001.

B.Tech III-II Semester

RENEWABLE ENERGY SOURCES
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course objectives:

1. To understand processing and limitations of fossil fuels (coal, petroleum and natural gas)
2. To know the necessity of harnessing alternate energy resources such as solar, wind, nuclear, geothermal, tidal and biomass.
3. To understand and practice various characterization techniques for different renewable fuels.
4. To do the design and analysis practice for solar, wind systems.

UNIT-I:

Photo voltaic power generation ,spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT-II:

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology.

Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT-III:

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

UNIT-IV:

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.

Global energy position and environmental effects: energy units, global energy position.

UNIT-V:

Types of fuel cells, H_2-O_2 Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures steam stations and pollution, pollution free energy systems.

TEXT BOOKS:

1. "Energy conversion systems" by Rakosh das Begamudre, New age International publishers, New Delhi - 2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd Edition, Fspon & Co

B.Tech III-II Semester

POWER ELECTRONICS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objective:

With the advent of semiconductor devices, revolution is taking place in the power transmission distribution and utilization. This course introduces the basic concepts of power semiconductor devices, converters and choppers and their analysis.

UNIT – I Power Semi Conductor Devices

Semiconductor Power Diodes, Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power Transistor - Power Mosfet – Power IGBT - TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors – Basic Theory of Operation of SCR – Static Characteristics – Turn On and Turn Off Methods- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits—— Series and Parallel Connections of SCR's – Snubber Circuits – Specifications and Ratings of SCR's, BJT, IGBT - Numerical Problems –Commutation Circuits.

UNIT – II Phase Controlled Converters

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Line Commutated Inverters -Active and Reactive Power Inputs to the Converters without and with Free Wheeling Diode, Effect of Source Inductance – Numerical Problems.

Three Phase Line Commutated Converters – Three Pulse and Six Pulse Converters – Mid Point and Bridge Connections - Average Load Voltage with R and RL Loads – Effect of Source Inductance–Dual Converters (Both Single Phase and Three Phase) - Waveforms –Numerical Problems.

UNIT – III Dc – Dc Converters

Buck converters, boost converters and buck boost converters. Steady state analysis, voltage and current ripple, design of inductor and capacitor values.

UNIT – IV Inverters

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms –sine-triangle PWM, Three Phase VSI in 120^0 And 180^0 Modes of Conduction. unipolar, bipolar inverter PWM techniques selective harmonic elimination - Voltage Control Techniques for Inverters Pulse Width Modulation Techniques – Numerical Problems,

UNIT – V AC Voltage Controllers & Cyclo Converters

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of Triac – Triac with R And RL Loads – Derivation of RMS Load Voltage, Current and Power Factor Wave Forms –Firing Circuits -Numerical Problems - Thyristor Controlled Reactors; Switched Capacitor Networks.

Cyclo Converters – Single Phase Mid Point Cyclo Converters With Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration Of Single Phase Cyclo Converter (Principle of Operation only) – Waveforms

Text Books:

1. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing company, 1998.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998

Reference Books:

1. Power Electronics – by P.S.Bimbra, Khanna Publications.
2. Power electronics, Essentials and applications – L.Umanand Wiley Publications
3. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
4. Power Electronics - by V.R.Murthy , 1st edition -2005, OXFORD University Press
5. Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.
6. The power electronics (hand book) : Timothy L.Skgarnina

B.Tech III-II Semester

ELECTRICAL ENERGY MANAGEMENT AND CONSERVATION
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course objectives:

1. To Understanding, analysis and application of electrical energy systems
2. To acquire the knowledge regarding energy conservation methods and its management.
3. Able to calculate Energy Efficiency, Energy accounting, monitoring and control.
4. To do Specific Energy Consumption; ECO assessment and Evaluation methods, Case study.

UNIT-I

Induction Motors – Three Phase - Cage motors - Equivalent circuit - Speed - torque characteristics - Performance characteristics - voltage unbalance - over motoring - slip ring induction motor characteristics multi speed motors - Single Phase Induction Motors - Starting & running performance - Split phase - Capacitor type motors - Characteristics - Reluctance motors – Universal motors – Stepper motor – Servo motor – Characteristics - Applications

UNIT-II

Energy Efficient Motors - Constructional details - Factors affecting efficiency - Losses distribution - Characteristics - Calculation of R.M.S rating - Power Factor – Causes and disadvantages of low power factor – Methods to improve p.f – Economics of power factor improvement - Simple pay back method - Return on investment - Life cycle analysis.

UNIT-III

Energy efficient lighting - Terminology - Cosine law of luminance - Types of lamps - Characteristics - Design of illumination systems - Good lighting practice - Lighting control - Steps for lighting energy conservation.

UNIT-IV

Economics of Electrical Energy Generation, Audit and Distribution: Definitions - Connected load, Maximum demand - Demand factor – Diversity factor – Significance - Load curve – Load sharing between base load and peak loads - Electrical Energy Audit: Check List – Data Collection – Data Analysis – Case Studies - Electrical Distribution: Electrical load analysis - types of consumers & tariffs - line losses - corona losses - types of distribution system - Kelvin's law - loss load factor.

UNIT-V

Economics Of Electrical Drives - Selection of motors - types of loads - Energy Consumption during starting of a.c and d.c motors - Braking of d.c and a.c motors - Plugging - Regenerative braking – Applications of different electric drives.

TEXT BOOKS:

1. Energy Efficient Electrical motors / John C.Andreas / Marcel Dekker Inc.
2. Generation,Distribution&Utilization of Electrical Energy /CLWadhwa /Wiley Eastern ltd

REFERENCE BOOKS:

1. Electrical Machines /Bimbra / Khanna Publishers
2. Electrical Machinery / Fitzgerland, Kingsley, Kusko / Mc Graw Hill Ltd
3. Electrical Machines/ S.K.Bhattacharya
4. Electrical Machines /I.J.Nagarath and D.P.Kothari / TMH
5. Electrical Technology/ Edward Hughes / ELBS.

Energy Management and good lighting practice: Fuel Efficiency Booklet 12 / EEO

III B.Tech II Semester

ROBOTICS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course objectives

- To design, develop and complete robotic activities and challenges
- This course aims at providing the students the fundamental knowledge of the various subscriptions such as kinematics, Dynamics, controls, sensors, actuators, etc.
- It is aimed to provide adequate background in both analysis and design of robots.

UNIT – I

Fundamentals of Robots: Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

UNIT – II

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, The inverse kinematic of robots, Degeneracy and Dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT – III

Control of Manipulators: Open- and Close-Loop Control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID Control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

UNIT – IV

Robot Vision: Industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision system, Image acquisition, description of other components of vision system, image representation, image processing.

UNIT – V

Robot Cell Design and Programming: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.

Methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

TEXT BOOKS

1. Industrial Robotics – Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey – Mc Graw Hill, 1986.
2. Robotics and control – R K Mittal and I J Nagrath, - Tata Mc Graw Hill

REFERENCES

1. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI Publications
2. Robot Analysis and Control - H. Asada and J.J.E. Slotine John Willey & Sons.
3. Fundamentals of Robotics: Analysis and control, Robert J. Schilling, Prentice Hall, 1990.
4. A robot Engineering text book – Mohsen shahinpoor, Harper & Row Publishers,1987
5. Introduction to Robotics: Mechanics and Control, John.J.Craig, Addison- Wesley, 1999
6. Robotics: Control, sensing, vision, and intelligence – K.S. FU, R.C. Gonzalez and C.S.G Lee. Mc Graw Hill, 1987.
7. Robotic Engineering an integrated approach- Richard D. Klafter Thomas – PHI publications

Course outcomes

By studying this course, students will be

- Familiar with the history, concept development and key components of robotics technologies.
- Understand basic mathematic manipulation of spatial coordinate representation and transformation.
- Understand and able to solve basic robot forward and inverse kinematic problems.
- Understand and able to solve robotic dynamics, path planning and control problems.
- Able to undertake practical robotics experiments that demonstrate the above skills.

III B.Tech II Semester

MECHANICAL MANUFACTURING PROCESSES
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Objectives:

The objectives of this course are to introduce to demonstrate the various manufacturing processes. To develop knowledge and importance of surface treatment, processing of powder metals, glass, ceramics plastics.To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes.

Unit – I

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

Unit – II

Processing of Powder metals, Glass and Superconductors: Introduction, production of metal powders, compaction of metal powders, sintering, secondary and finishing operations, design considerations for powder metallurgy, Process capabilities, economics of powder metallurgy, forming and shaping of Glass, techniques for strengthening and treating Glass, design considerations for Glass, processing of superconductors.

Processing of ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying , sintering, Hot compaction, Area of application , finishing of ceramics.

Unit – III

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, and micromachining, High speed Machining

Unit – IV

Processing Of Plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction - concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

Unit – V

Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

TEXT BOOKS:

3. Manufacturing Engineering and Technology, Schmid and kalpakjin, Pearson Education.
4. Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH
5. Rapid Prototyping Principles and Applications, RafiqNoorani, Wiely Pub

REFERENCE BOOKS:

7. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012
8. Process and materials of manufacturing -Lindberg, PE
9. Principles of Metal Castings, Rosenthal.
10. Welding Process, Parmar, Khanna publication.
11. Manufacturing Technology, R.K. Rajput, Laxmi Pub

Course Outcomes:

After completion of this course student will be able to

- Understand the principles of processing of various powder metals, glass, ceramics and semiconductors.
- Understand the applications of rapid prototyping and processing of plastics

SUGGESTED LINKS:

- www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt
- www.rose-hulman.edu/~stienstr/ME470/DFA.ppt
- www.design4manufacturability.com/DFM_article.htm
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm

III B.Tech II Semester

NON-CONVENTIONAL SOURCES OF ENERGY
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analyse the environmental and cost economics of using renewable energy sources compared to fossil fuels.

UNIT - I

Principles Of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications :

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

Wind Energy : Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

BIO-MASS : Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engineoperation and economic aspects.

UNIT-IV

Geothermal Energy : Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC.

Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects.Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS

1. Renewable energy resources, Tiwari and Ghosal, Narosa.
2. Non-Conventional Energy Sources ,G.D. Rai

REFERENCES

1. Renewable Energy Sources, Twidell& Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering,B.S.Magal Frank Kreith&J.F.Kreith.
4. Principles of Solar Energy, Frank Krieth& John F Kreider.
5. Non-Conventional Energy, Ashok V Desai, Wiley Eastern 6. Non-Conventional Energy Systems, K Mittal , Wheeler.

Course Outcome:

At the end of the course the student will

1. Have knowledge about various renewable energy sources
2. Be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

III B.Tech II Semester

FUNDEMENTALS OF COMMUNICATION SYSTEMS
(Choice Based Credit Course Inter Department)
(QUALITATIVE TREATMENT ONLY)

L	T	P	C
3	1	0	3

Course Objectives:

1. To study the fundamental concept of the analog communication systems.
2. To analyze various analog modulation and demodulation techniques.
3. To know the working of various transmitters and receivers.
4. To understand the influence of noise on the performance of analog communication systems, and to acquire the knowledge about information and capacity.

Learning Outcomes:
This course provides the foundational education in Analog Communication systems, and applications. The students are provided the learning experience through class room teaching and solving assignment & tutorial problems. At the end of course, students should be able to:

a. Acquire knowledge on the basic concepts of Analog Communication Systems.
b. Analyze the analog modulated and demodulated systems.
c. Verify the effect of noise on the performance of communication systems.
d. Know the fundamental concepts of information and capacity.

UNIT- I
Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication, Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

UNIT- II
Angle Modulation &Demodulation: Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis, & De-emphasis, Illustrative Problems.

UNIT -III
Pulse Analog Modulation Techniques
Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation.
Multiple Access Techniques
Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications.

UNIT IV
Digital Communication (Qualitative Approach only)
Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M- PSK techniques

UNIT -V

Modern Communication Trends (Qualitative Approach only)

Basics of Spectrum utilizations, Comparison of 2G, 3G, Types of Ethernet, Modems – Types of Modems, 100Mbps, 1Gbps modems, Role of IPV6 in Present trends.

TEXT BOOKS:

1. B. P. Lathi, "Modern Digital and Analog Communication Systems," Oxford Univ. press, 3rd Edition, 2006.
2. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.
3. Electronic Communications System: Fundamentals Through Advancedby 2nd editions By Wayne Tomasi
4. Simon Hakin, "Communication Systems," Wiley India Edition, 4th Edition, 2011.

REFERENCES:

1. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010.
2. Simon Haykin, "Communication Systems", Wiley-India edition, 3rd edition, 2010.
3. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.

III B.Tech II Semester

FUZZY LOGIC & NEURAL NETWORKS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

UNIT-I

Neural Networks Characteristics: History of Development in neural networks, Artificial neural net terminology, model of a neuron, Topology, Types of learning. Supervised, Unsupervised learning. Basic Learning laws, Hebb's rule, Delta rule, widrow and Hoff LMS learning rule, correlation learning rule instar and ouster learning rules.

UNIT-II

Unsupervised Learning: Competitive learning, K-means clustering algorithm, Kohonen's feature maps. Radial Basis function neural networks- recurrent networks, Real time recurrent and learning algorithm. Introduction to Counter propagation Networks- CMAC Network, ART networks, Application of NN in pattern recognition, optimization, Control, Speech and decision making.

UNIT-III

Neural Network models: neural network models, layers in neural network and their connections. Instar, outstar, weights on connections, threshold function, application- Adaline and madaline. Back propagation: feed forward back propagation network- mapping, layout, training, BPN applications

UNIT-IV

Fuzzy Logic: Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, membership functions, operations of Fuzzy sets, Fuzzy if-then rules, Variables inference techniques, defuzzification techniques, basic Fuzzy interference algorithm, application of fuzzy logic , Fuzzy system design implementation , useful tools supporting design.

UNIT-V

Bidirectional Associative Memory (BAM), inputs and outputs, weights and training. FAM-fuzzy associative memory, association, FAM neural networks, encoding Adaptive Resource theory-network for ART, processing in ART

Text Books:

1. Berkin Riza C and Trubatch, " Fuzzy System design principles- Building Fuzzy IF-THEN rule bases", IEEE Press.
2. Yegna Narayanan, "Artificial Neural Networks". 8th Printing. PHI(2003)
3. Patterson Dan W, "Introduction to artificial Intelligence and Expert systems", 3rd Ed., PHI
4. Simon Haykin, "Neural Networks" Pearson Education.
5. Yen and Langari, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education.
6. Jacek M Zaurada, "Introduction to artificial neural Networks Jaico Publishing Home, Fourth Impression.

III B.Tech II Semester

INDUSTRIAL ELECTRONICS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:

1. To get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
2. To study the characteristics of AC to DC converters.
3. To know about the practical applications Electronics in industries.

Learning Outcome:

After completion of the course the students will be able to

a. Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
b. Understand the characteristics of AC to DC converters.
c. Understand about the practical applications Electronics in industries.

UNIT – I :

Semiconductor Devices: Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open-circuited p-n junction, Diode resistance, Zener diode, Photoconductors and junction photo diodes, Photo voltaic effect, Light emitting diodes (LED)

UNIT – II:

Junction Transistors: Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

UNIT – III :

AC To DC Convertors: AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

UNIT – IV: Industrial Applications – I

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding.

Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating

Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

UNIT – V: Industrial Applications - II

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasoni8c waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physico-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

TEXT BOOKS:

1. G. K. Mithal, “Industrial Electronics”, Khanna Publishers, Delhi, 2000.
2. J.Gnanavadivel, R.Dhanasekaran, P.Maruthupandi, “Industrial Electronics”, Anuradha Publications, 2011.

REFERENCE BOOKS:

1. F. D. Petruzulla, “Industrial Electronics”, McGraw Hill, Singapore, 1996.
2. M. H. Rashid, “power Electronics Circuits, Devices and Application”, PHI, 3rd edition, 2004.
3. G. M. Chute and R. D. Chute, “Electronics in Industry”, McGraw Hill Ltd, Tokyo, 1995.

III B.Tech II Semester

OPERATING SYSTEMS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective

- To make the students understand the basic operating system concepts such as processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection.
- To get acquaintance with the class of abstractions afford by general purpose operating systems that aid the development of user applications

Course Outcomes

- Understand what makes a computer system function and the primary PC components.
- Understand past and current trends in computer technology.
- Use basic software applications.
- Add functionality to the exiting operating systems
- Design new operating systems

UNIT I

Operating Systems Overview: Operating system functions, Operating system structure, operating systems Operations, protection and security, Kernel data Structures, Computing Environments, Open- Source Operating Systems

Operating System Structure: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

Processes: Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.

UNIT II

Threads: overview, Multicore Programming, Multithreading Models, Thread Libraries, Implicit threading, Threading Issues.

Process Synchronization: The critical-section problem, Peterson‘s Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches.

CPU Scheduling: Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.

UNIT III

Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

Virtual memory: demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory

Deadlocks: System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

UNIT IV

Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

File system Interface: The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection.

File system Implementation: File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.

UNIT V

I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

Protection: Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability-Based systems, Language – Based Protection

Security: The Security problem, Program threats, System and Network threats, Cryptography as a security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications.

TEXT BOOKS:

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition, 2009, Pearson Education.

REFERENCE BOOKS:

1. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.
4. Operating Systems, A.S.Godbole, Second Edition, TMH.
5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
6. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
7. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.

III B.Tech II Semester

DATABASE MANAGEMENT SYSTEMS
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:

- To create database and query it using SQL queries, design forms and generate reports.
- Learn to use integrity constraints, referential integrity constraints, triggers, assertions

Course Outcomes

- Design databases
- Retrieve information from data bases
- Use procedures to program the data access and manipulation
- Create user interfaces and generate reports

UNIT I

The Worlds of Database Systems -The Evolution of Database Systems - Overview of a Database Management System - Outline of Database System Studies.

The Entity-Relationship Model – Elements of E/R Model – Design Principles – The Modeling of Constraints – Weak Entity Sets.

The Relational Data Model – Basics of the Relational Model – From E/R Diagrams to Relational Designs – Converting Subclass Structures to Relations.

UNIT II

Relational Algebra and Calculus – Preliminaries, Relational algebra: Selection and Projection , Set Operations, Renaming, Joins, Division - Relational Calculus – Expressive power of Algebra and Calculus.

The Database Language SQL – Simple Queries in SQL – Queries Involving More than One Relation – Subqueries – Full Relation Operations – Database Modifications – Defining a Relation Schema in SQL – View Definitions

UNIT III

Constraints and Triggers – Keys and Foreign keys – Constraints on Attributes and Tuples, Schemalevel

Constraints and Triggers.

Functional Dependencies– Rules about Functional Dependencies -- Design of Relational Database Schemas, Normal Forms based on FDs – Multivalued Dependencies, 4NF, 5NF

UNIT IV

Transaction Management : Transactions, ACID properties, Serializability, Other isolation levels.

Concurrency Control – Serial and Serializable Schedules – Conflict Serializability – Enforcing Serializability by Locks – Locking Systems with Several Lock Modes - Concurrency Control by Timestamps – Concurrency Control by Validation.

UNIT V

Index Structures – Indexes on Sequential Files – Secondary Indexes – B-Trees, B+ Trees – Hashing.

Introduction to Query Optimization.

Failures and Recovery: System Failures – Issues and Models for Resilient Operation – Undo Logging – Redo Logging – Undo/Redo Logging – Protecting Against Media Failures.

TEXT BOOKS:

1. **“Database Systems, The Complete Book”,** Hector Garcia-Molina, Jeffrey D. Ullman and Jennifer Widom, 6th impression, 2011, Pearson.

2. **“Data base Management Systems”,** Raghu Rama Krishnan, Johannes Gehrke, 3rd Edition, 2003, McGraw Hill.

REFERENCE BOOKS:

1. “Fundamentals of Database Systems”, Elmasri Navrate, 6th edition, 2013, Pearson.

2. “Data base Systems design”, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.

3. “Introduction to Database Systems”, C.J.Date, Pearson Education.

4. “Data base System Concepts”, Silberschatz, Korth, McGraw Hill, V edition.

(refer Raghu Rama Krishnan text book latest version and frame new syllabus)

III B.Tech II Semester

JAVA PROGRAMMING
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objectives:
- Study the syntax, semantics and features of Java Programming Language
- Study the Object Oriented Programming Concepts of Java Programming language
- Learn the method of creating Multi-threaded programs and handle exceptions
- Learn Java features to create GUI applications & perform event handling

Course Outcomes:
- Solve problems using object oriented approach and implement them
- Ability to write Efficient programs that handle exceptions
- Create user friendly interface

UNIT I
The History and Evolution of Java: Java's Lineage, The Creation of Java, How Java Changed the Internet, Java's Magic: The Bytecode, Servlets: Java on the Server Side, The Java Buzzwords, The Evolution of Java, Java SE 8, A Culture of Innovation.

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries.

UNIT II
Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings, A Note to C/C++ Programmers About Pointers.

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

UNIT III
Introducing Classes: Class Fundamentals,Declaring Objects, Assigning Object Reference Variables ,Introducing Methods,Constructors,The this Keyword, The finalize( ) Method, A Stack Class.

A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Introducing Nested and Inner Classes, Exploring the String Class, Using Command-Line Arguments, Varargs: Variable-Length Arguments.

UNIT IV
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch,Using Abstract Classes, Using final with Inheritance, The Object Class.

Packages and interfaces: Packages, Access Protection, Importing Packages, Interfaces,Default Interface Methods,Use static Methods in an Interface, Final Thoughts on Packages and Interfaces.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch,Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions,

Creating Your Own Exception Subclasses, Chained Exceptions, Three Recently Added Exception Features, Using Exceptions.

UNIT V

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive( ) and join( ), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads. Obtaining A Thread's State, Using Multithreading.

Enumerations, Autoboxing, and Annotations (Metadata): Enumerations, Type Wrappers, Autoboxing, Annotations (Metadata), Type Annotations, Repeating Annotations.

Text Book:

JAVA the Complete Reference 9^{th} edition, Herbe

III B.Tech II Semester

IMMUNOLOGY
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:

This course aims to familiarize the students to mechanisms associated with immune system, any abnormalities which could lead to disease development.

Course Outcome:

Students will be able to distinguish between innate & acquired immunity, they should also be able to demonstrate and identify immune cells specific functions. They can correlate between immune/disease developments.

UNIT I: Basics of immunology

Immunity: Types of immunity, Innate & Adaptive; Cells of immune system, Organs of the immune system, Primary lymphoid organs (bone marrow, Thymus), Secondary lymphoid organs (Spleen, Lymphnode, MALT, CALT), Immunogen, Antigen and their chemical nature, Factors that influence immunogenicity, epitopes, properties of "B" cell epitopes & "T" cell epitopes, haptens & adjuvants.

UNIT II: Immunoglobulin's: structure & function

Basic & fine structure of Immunoglobulin classes & their functions, isotopes, allotypes & idiotypes, Monoclonal antibodies: production of Monoclonal antibodies and their uses.

UNIT III: Complement system & its path ways, antigen- antibody interactions & immune assays.

UNIT IV: Humoral immunity & cell mediated immunity

MHC, Antigen processing and, Antigen presentation cells, structure & functions of TCR, T-cell maturation, activation & differentiation of T cell.T cell subclasses & linkage. Activation of B cells, proliferation by thymus dependent & thymus independent antigens. B cell differentiation, class switching & generation of plasma & memory cells.Primary immune response & secondary immune responses.

UNIT V: Hyper sensitivity & Auto immune disease & tumor immunology

Hypersensitivity & its types, autoimmunity, autoimmune disorders, transplantation, tumor Transplantation, mechanism of graft rejection, immuno suppressive drugs.

TEXT BOOKS:

1. E. Roitt Essential Immunology, Vaccines conventional, subunit and recombinant, antidiotypic vaccine, Blackwell Scientific publications, Oxford,1991.
2. Kuby Immunology, 5th Edition. Richard A Goldsby, Thomas J Kindt Barbara A Osborne. W H Freeman and Company, 2006.

REFERENCES:

1. Benjamin E and Leskowitz S, immunology A short Course. Wiley LISS NY, 1991.

ELISA Immunological Techniques.DNA vaccines Immunotechnology.

2. Cellular Molecular Immunology. Abul Abbas and Litchman, 2003.

III B.Tech II Semester

DOWNSTREAM PROCESSING
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:
This course aims to introduce the students to different steps of downstream processing including cell disruption, separations, extractions, fractionations & Concentrations.

Course Outcome:
At the end of the course the students will be able to differentiate between different separation techniques and design a combination of downstream techniques for a given process. They will be able to analyze scientific results from real examples and calculate operating parameters for a particular operation.

UNIT I: Role of Downstream Processing In Biotechnology
Role and importance of downstream processing in biotechnological processes.Problems and requirements of bio product purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bio products (high volume, low value products and low volume, high Value products)

UNIT II: Primary Separation And Recover Process
Cell disruption methods for intracellular products, removal of insoluble, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT III: Membrane Separations
Introduction, Principles & theory, Requirements of membranes, Structure of membranes, Membrane types and their preparation, Membrane modules, flow patterns in membrane modules, Membrane fouling, Membrane separation process: Types Principles, driving forces and applications

UNIT IV: Enrichment Operations
Precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), in situ product removal, integrated bioprocessing.

UNIT V: Electrophoresis & Product Resolution / Fractionation
Introduction, Principles and theory, Electrophoresis equipment, Gel electrophoresis, SDS Page, Isoelectric focusing, 2D Gel Electrophoresis, Pulse field Electrophoresis
Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration, affinity chromatographic separation processes, GC, HPLC, FPLC, Chromatofocusing electrophoretic separations.

TEXT BOOKS:
1. Wankat PC. Rate controlled separations, Elsevier, 1990.
2. Ajay Kumar and Abhisek Awasthi " Bioseparation Engineering" I.K. International publicationsm, 2007.

REFERENCES:
1. Product Recovery in Bioprocess Technology, BIOTOL.'Series, VCH, 1990.
2. Asenjo J.M. Separation processes in Biotechnology, 1993, Marcel Dekkere Inc.
3. M.R.Ladisch, Bioseparation engineering: Principles, Practice and Economics, Wiley Interscience, 2001.
4. Belter PA and Cussler E. Bioseparations, Wiley, 1985.

III B.Tech II Semester

TRANSPORT PHENOMENA IN BIOPROCESSES
(Choice Based Credit Course Inter Department)

L	T	P	C
3	1	0	3

Course Objective:
This course will provide the fundamentals to solve real life problems involving transports of momentum, energy and mass in biological, mechanical and chemical systems using a unified approach.

Course Outcomes:
• Understanding of transport processes.
• Ability to do heat, mass and momentum transfer analysis.
• Ability to analyze industrial problems along with appropriate boundary conditions.
• Ability to develop steady and time dependent solutions along with their limitations

UNIT I: Momentum Transport
Mechanism of Momentum Transport: Newton's Law of Viscosity, Non- Newtonian fluids, theory of viscosity of liquids, time dependant viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscosity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Velocity distribution in laminar flow and turbulent flow

UNIT II: Shell Momentum balances and Mixing of Fluids
Flow of Falling Film, Flow through circular tube, Flow through the annulus, Flow of two adjacent immiscible fluids
Introduction to turbulent flow, time smoothening, mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, operating conditions for turbulent shear damage.

UNIT III: Energy Transport
Thermal conductivity and the mechanisms of energy transport- measurement of thermal conductivity, Fourier's law, steady state conduction, analogy between heat and momentum transfer

UNIT IV: Mass Transport & Shell Mass Balances
Theory of Diffusion and estimation of Diffusion coefficient for gases, liquids, in colloidal a polymers suspensions in polymers. shell mass balances: Diffusion through a stagnant gas film, diffusion with in a heterogeneous and homogeneous chemical reaction. Diffusion and chemical reaction inside a porous catalyst.

UNIT V: Oxygen Transport
Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer in fermentors- bubbles, factors affecting oxygen transport- sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurements of kLa - oxygen balance method, dynamic method.

Note: In all units relevant basic numerical problems should be practiced

TEXT BOOKS:
1. R.B.Bird, W.E.Stewart, E.N.Lightfoot, Transport Phenomena, John wiley and sons, Singapore , 1994.
2. P.M.Doran, Bioprocess Principles, Academic Press, 1995.
3.Harvey W. Blanch, Douglas S. Clark Biochemical Engineering, Marcecel, Dekker, 2007.

REFERENCES:1. M.L.Shuler and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd edition, Prentice Hall of India, 2003.

III B.Tech II Semester

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS (AELCS) LAB

L	T	P	C
0	0	3	0

Introduction:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

UNIT-I: Communicative Competency

1. Reading Comprehension – Techniques-Book Review
2. Listening comprehension – Video Talks-Eminent speeches
3. Verbal Competency - Vocabulary - Spotting Errors- Aptitude Tests

UNIT-II: Technical Writing

1. Essentials of writing -Technical Paper/ Report writing-Concise writing
2. Administrative / Business Documentation – Circular Writing -Meeting – Agenda – Minutes-Resolutions
3. Project Writing – Framing Outline – Finding Problem- Documentation-Citation

UNIT-III: Presentational Skills

1. Oral presentations – Public Speaking –Paper & Seminar Presentation
2. Digital Presentations -Power point - Video Presentation -Poster presentation
3. Stage Dynamics – Body Language – Para Language

UNIT-IV: Corporate Skills

1. Etiquettes -Dress - Dining – Net Etiquettes
2. Telephonic skills –Mobile Etiquettes
3. Soft Skills – Intra – Inter Personal Skills

UNIT-V: Getting Ready For Job

1. Before Interview -Curriculum vitae/ Resume-Covering letter-E-mail writing
2. During Interview – G.D-Mock Interviews– Psychometric Tests – Follow up
3. After interview - Excelling in Profession– Team spirit– Work culture

Learning Outcomes:

- Acquiring extensive range of vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects / Employability skills /developing organizational abilities in tune with corporate requirement
- Effective Speaking Abilities

Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids /LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

1. **K-VAN SOLUTIONS-Advanced communication lab**
2. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
3. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
4. **Train2success.com**

Books Recommended:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011.
3. **Technical Communication**, Meenakshi Raman & Sangeeta Sharma, O U Press 2009.
4. Books on **TOEFL/GRE/GMAT/CAT/IELTS**, Barron's/DELTA/Cambridge University Press.2012.
5. **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.
6. **Ultimate Psychometric Tests**: Mike Bryon,Vinod Vasishtha for Kogan Page India Pvt. Ltd, New Delhi.
7. **Soft Skills-** Know Yourself And Know The World, Dr.K.Alex, Chand Publications ,Third revised edition 2014.
8. **Management Shapers Series** , Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
9. **Word Power Made Handy,** Shalini Verma, S Chand Publications, 2011.

III B.Tech II Semester

CAD LABORATORY

COMPUTER AIDED DRAFTING (CAD)

L	T	P	C
0	0	3	2

Course objective:-

Student should be able to:

- apply all basics commands in CAD software
- create produce 2D drawing and 3D drawings using CAD software
- create the assembly modeling using CAD software

LIST OF EXPERIMENTS:

I. Introduction to CAD software

II. 2D drafting using Auto CAD / Iron CAD (Two exercises)

III. 3D modeling using Pro-E or CATIA or Solid Works or Iron CAD or Auto CAD (Any four exercises from the following)

a. Modeling of Component in 3D - V block
b. Modeling of Component in 3D - Open Bearing
c. Modeling of Component in 3D - Angular block
d. Modeling of Component in 3D - Dovetail Guide
e. Modeling of Component in 3D - Dovetail Bracket
f. Modeling of Component in 3D - Dovetail stop

IV. Assembly Modeling: Student must do at least two exercises by using Pro-E or CATIA or Solid Works or Iron CAD or Auto CAD

a. Assembly of a screw jack parts
b. Assembly of a knuckle joint
c. Assembly of a Oldham's coupling
d. Assembly of a footstep bearing
e. Assembly of a stuffing box
f. Assembly of a square tool post

Courser outcomes:-

After completing this course, students will be able to:

- Navigate the interface comfortably
- Use the fundamental features and precision drafting tools in CAD software to develop accurate technical drawings.
- Present drawings in a detailed assembly and visually impressive manner

III B.Tech II Semester

MACHINE TOOLS LABORATORY

L	T	P	C
0	0	3	2

Course objectives

This Lab focuses on using mechanical machines to meet the following targets:

- To improve the students' in practical knowledge on various machines Further, they would be required to do the projects relevantly and coherently in industries.
- To provide hands on training on various machine tools (Like Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine)

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

Course outcomes

After completion of this course the student may be able

- To explain the concept of machining with various machine tools
- To get hands on experience on various machine tools

IV B.Tech I Semester

OPERATIONS RESEARCH

L	T	P	C
3	1	0	3

Course Objective:

The subject should enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications, To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

UNIT I

Introduction To Or And Linear Programming – 1:OR definition- Classification of Models - Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two-Phase Simplex Method, Big-M Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

Learning Outcome & Suggested Student Activities:

At the end of the Unit, the student will be able to create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method.
(The student must refer to any of the text books and practice solving several problems as it is very common to make mistakes while solving due to lack of practice). The student should take up a real life problem and formulate it as a mathematical programming problem.

UNIT II

Linear Programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method, Transportation Problem - Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases -Unbalanced Transportation Problem, Degenerate Problem;Assignment Problem - Formulation; Optimal Solution -Traveling Salesman problem.

Learning Outcome &Suggested Student Activities:

At the end of this Unit, the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems. A large number of problems are to be solved by the student in order to gain much required capability of handling the problems without mistakes.

UNIT III

Game Theory: Introduction - Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy -Games with Mixed Strategies - 2 X 2 Games – Dominance, Principle- Solution by Graphical Method of m X 2 & 2 X n games

Queuing Theory: Introduction -Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.

UNIT IV
Sequencing:Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models.
PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float
CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration
PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Varianceof the Activities and Projects, and Probability of Completing the Project within scheduled time

Learning Outcome & Suggested Student Activities:
At the end of this Unit, student will be able to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability.

UNIT V
Dynamic Programming : Introduction - Bellman's Principle of Optimality - Applications of Dynamic Programming- Capital Budgeting Problem - Shortest Path Problem - Solution of Linear Programming Problem by DP
Replacement And Maintenance Analysis: Introduction - Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will be aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.
TEXT BOOKS:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.
2. Introduction to OperationsResearch Frederick K. Hiller,Bodhibrata Nag, PreetamBasu, Gerialld J. Lieberman, TMH, 9th edition, 2011.

REFERENCE BOOKS:

1. Operations Research by R Panneerselvam, PHI, 2ndndition, 2012. ed
2. Operations Research, Wagner, PHI Publications , 2 edition.
3. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
4. Linear Programming, SusyPhillippose, PHI
5. Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.
6. Operations Research: Methods & Problems , Maurice Saseini, ArhurYaspan& LawrenceFriedman
7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers

Web References:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/
- http://nptel.iitm.ac.in/video.php?subjectId=112106134
- http://www.youtube.com/watch?feature=player_detailpage&v=ug7O1lSZyg0
- http://www2.ensc.sfu.ca/undergrad/courses/ENSC201/Unit09/lecture9.html
- http://pakaccountants.com/what-is-depreciated-replacement-cost/
- http://www.youtube.com/watch?feature=player_detailpage&v=H58TPQNr2kM
- http://www.youtube.com/watch?feature=player_detailpage&v=h0bdo06qNVw
- http://www.youtube.com/watch?feature=player_detailpage&v=xGkpXk-AnWU#t=104s
- http://nptel.iitm.ac.in/video.php?subjectId=112106134,
- http://www. Math.harvard.edu/archive/20_spring_05/handouts

IV B.Tech I Semester

AUTOMATION AND ROBOTICS

L	T	P	C
3	1	0	3

Course Objective:

The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types. To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

UNIT I

Introduction To Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation. Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation.

UNIT II

Automated Flow Lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

Assembly Line Balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines.

UNIT III

Introduction To Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot Actuators And Feedback Components: Actuators, Pneumatic, Hydraulic actuators, Electric &Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning outcome & Suggested Student Activities:

Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure.

UNIT IV

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot.

UNIT V

Robot Programming: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application In Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand robot programming languages which may adopt in different applications of robot. Student also knows the control motion mechanism in all devices of robot and application of robots in manufacturing sector.

TEXT BOOKS:

Automation , Production systems and CIM,M.P. Groover/Pearson Edu. 2. Industrial Robotics - M.P. Groover, TMH.

REFERENCE BOOKS:

- Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
- An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
- Robotic Engineering , Richard D. Klafter, Prentice Hall
- Robotics, Fundamental Concepts and analysis –AshitaveGhosal,Oxford Press
- Introduction to Robotics - John J. Craig,PearsonEdu.

Suggested Links:

- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm
- http://www.cadcamfunda.com/cam_computer_aided_manufacturing
- http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf
- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo
- http://nptel.iitm.ac.in/video.php?courseId=1052
- http://www.nptel.iitm.ac.in/and iitb.ac.in , http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm

IV B.Tech I Semester

FINITE ELEMENT METHODS

L	T	P	C
3	1	0	3

Course objective:

The subject should enable the students to learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements, find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions. To learn the application of FEM to various structural problems incorporating temperature.and boundary conditions and heat transfer problems.

UNIT I

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions.

Approximate Methods For Solving The Differential Equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems.Solution methods for solving simultaneous equations.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to know introductory basic principles and approaches for solving FEM problems in different fields

UNIT II

Problems With One-Dimensional Geometry:

Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations.

Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to formulate FEM model for simple problems.

UNIT III

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.

Higher Order And Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions - linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

Learning Outcome &Suggested Student Activities:

After completion of this unit students are able to write interpolation functions to higher order isoparametric elements.

UNIT IV

Finite Element Application In Solid Mechanics:

Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Axi-symmetric triangular elements: formulation of stiffness and load vectors. Introduction to 3D stress analysis.

Learning Outcome &Suggested Student Activities:

After completion of this unit students are able to derive element matrices for applying the principles to find stresses in beams and trusses and temperature distribution in composite walls and fins.

UNIT V

Heat Transfer And Fluid Mechanics Problems:

Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces.

Two Dimensional Potential Flow Problems: Potential function formulation and stream functionformulation.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to solve bars, trusses, beams and heat transfer problems using FEM and also to apply boundary conditions in realistic problems.

TEXT BOOKS:

1. Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu ,Pearson Education, New Delhi.
2. Finite Element Methods, S. S. Rao , Pergamom Press, New York

REFERENCE BOOKS:

1. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.
2. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.
3. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.
4. Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.
5. Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers.
6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

SUGGESTED LINKS:

- http://nptel.iitm.ac.in/video.php?subjectId=112104115
- http://nptel.iitm.ac.in/video.php?subjectId=112106135
- http://www.youtube.com/watch?v=UeatU9OpDNA&list=PLA4CBD0C55B9C3878
- http://uqu.edu.sa/files2/tiny_mce/plugins/filemanager/files/4041296/ComputerApplicationsInStructures/LeturesTutorialsDowloadedFromWeb/Lecture%202%20Truss%20and%20Beam%20FEM.pdf
- http://www.engineering.uiowa.edu/~sxiao/class/058-153/lecture-24.pdf
- www.rpi.edu/~des/CST.ppt
- http://www.kochmann.caltech.edu/ae108a/IsoparametricElements.pdf
- http://www.me.mtu.edu/~bettig/MEEM4405/Lecture08.pdf http://site.iugaza.edu.ps/marafa/files/FEM-Chapter-10.pdf
- http://web.iitd.ac.in/~achawla/public_html/429/fem/overview.pdf
- http://www.cmmacs.ernet.in/cmmacs/Lect_notes/sangeeta1.pdf
- http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter4.pdf
- http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter6.pdf
- http://www.colorado.edu/engineering/cas/courses.d/IFEM.d/IFEM.Ch22.d/IFEM.Ch22.pdf

IV B.Tech I Semester

METROLOGY AND MEASUREMENTS

L	T	P	C
3	1	0	3

Course objective:

Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods, Alignment tests on machine tools. Students will be able to understand various transducers to measure displacement like Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers and also learn about Calibration procedure, temperature and pressure calibration methods, measurement of flow stress, strain measurements acceleration and vibration.

UNIT I

LIMITS, FITS And TOLERNCES : Introduction, Definitions, fits and their types - unilateral and bilateral tolerance system, hole and shaft basis systems - interchangeability and selective assembly. Indian standard system - International Standard organization system for plain work.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle.Design of Go and No Go gauges.

Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the Limits, Fits and Tolerance. Indian standard system - International Standard organization system. He will know the principles of working of the most commonly used instruments for measuring linear and angular distances.

UNIT II

Linear Measurement: Length standard, line and end & wavelength standards, slip gauges - calibration of the slip gauges, Dial indicator, micrometers, vernier height gauges.

Measurement Of Angles And Tapers: Different methods - Bevel protractor - angle gauges - spirit levels - sine bar - Sine plate, rollers and spheres used to determine the tapers.

Flatness Measurement: Measurement of flatness of surfaces - straight edges- surface plates - optical flat and auto collimators, interferometer and their uses.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to study the different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness.

UNIT III

Surface Roughness Measurement: Differences between surface roughness and surfacewaviness- Numerical assessment of surface finish - CLA, R.M.S Values - R_a , R_z values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

Screw Thread Measurement: Elements of measurement - errors in screw threads - measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand, Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools.

UNIT IV

Measurement Of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement Of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

Measurement Of Acceleration And Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand working of various instruments used for measuring for displacement, temperature and pressure.

UNIT V

Measurment Of Temperature: Standards and calibration, thermal expansion methods, thermo electric sensors(thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.

Measurement Of Pressure And Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.

Measurement Of Force, Torque,Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power measurement(dynamometers), Vibrating wire force transducers.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand working of various instruments used for measuring for flow, speed,stress,strain and Vibration.

TEXT BOOKS:

1. Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI
2. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.
3. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.

REFERENCE BOOKS:

1. Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.
2. BIS standards on Limits & Fits
3. Fundamentals of Dimensional Metrology,Connie Dotson ,4e, Thomson
4. Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, McGrawHill, 2013.
5. Instrumentation, measurement &analysis ,B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.

Web References:

- http://emtool box.nist.gov
- CambridgeViscosity.com/Viscometer
- www.e.FlukeCal.com/Calibration
- www.inscotemperature.com/
- www.solartronmetrology.com/
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

IV B.Tech I Semester

AUTOMOBILE ENGINEERING

(CBCC-I)

L	T	P	C
3	1	0	3

Course Objective:

The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods. The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT I

Introduction: Components of a Four Wheeler Automobile - Chassis and Body - Power Unit - Power Transmission - Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive - Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging - Oil Filters, Oil Pumps - Crank Case Ventilation.

Learning outcome & Suggested Student Activities:

Student can understand the function of each and every component of an automobile. Student can understand the use of turbo charging and super charging.

UNIT II

Emissions From Automobiles - Pollution Standards National and International - Pollution Control- Techniques - Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources- Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Electrical System: Charging Circuit, Generator, Current - Voltage Regulator - Starting System, BendixDrive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge - Oil Pressure Gauge, Engine Température Indicator.

Learning outcome & Suggested Activities:

Student can be able to grasp the knowledge on emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future.

UNIT III

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel - Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.Propeller Shaft - Hotch - Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

Learning outcome &Suggested Student Activities:

At the end of the unit, student can have broad knowledge on each and every component of transmission system of a automobile.

UNIT IV

Steering System: Steering Geometry - Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism - Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears - Types, Steering Linkages.

Learning outcome & Suggested Student Activities:
After the completion of the chapter, student can able to understand purpose and methods of steering systems and their applications. Students may refer the following website.

UNIT V

Suspension System: Objects of Suspension Systems - Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.
Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Learning outcome & Suggested Student Activities:
At the end of the unit. Student can have ample knowledge on suspension system and braking system of an automobile

TEXT BOOKS:

1. Automotive Mechanics - Vol. 1 & Vol. 2, Kirpal Singh, Standard PublishersDistributors.
2. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

REFERENCE BOOKS:

1. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.
2. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.
3. Automotive engines , Newton, Steeds & Garret.

IV B.Tech I Semester

TOTAL QUALITY MANAGEMENT

(CBCC-I)

L	T	P	C
3	1	0	3

Course Objective:

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees into improvement of processes and products. It helps to reduce costs and to meet and exceed needs and expectations of customers and other stakeholders of an organization. TQM encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership.The objectives of this course is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

UNIT - I

TQM - overview , concepts, elements - History-Quality management philosophies-Juran, Deming, Crosby , Feigenbaum, Ishikawa- Stages of Evolution- continuous improvement - objectives - internal and external customers.

UNIT - II

Quality standards - Need of standardization - Institutions – bodies of standardization, ISO 9000 series - ISO 14000 series - other contemporary standards - ISO certification process-Third party audit.

Process management- Quality measurement systems (QMS) - developing and implementing QMS - nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools.

UNIT - III

Problem Solving techniques - Problem Solving process - corrective action - order of precedence - System failure analysis approach - flow chart - fault tree analysis - failure mode assessment and assignment matrix - organizing failure mode analysis - pedigree analysis.

UNIT - IV

Quality circles - organization - focus team approach – statistical process control - process chart - Ishikawa diagram - preparing and using control charts.

Quality Function Development (QFD) - elements of QFD - benchmarking-Types- Advantages & limitations of benchmarking - Taguchi Analysis - loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

UNIT - V

Value improvement elements - value improvement assault - supplier teaming. Business process reengineering & elements of Supply chain management.

Six sigma approach - application of six sigma approach to various industrial situations.

TEXT BOOKS:

1. Total Quality Management, Joseph & Susan Berg
2. Total Quality Management, Besterfield, Pearson.

REFERENCE BOOKS:

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.
3. Quality management, Bedi

Course outcomes

Upon successful completion of the module students will be able to:

- Develop an understanding on quality management philosophies and frameworks
- Develop in-depth knowledge on various tools and techniques of quality management
- Learn the applications of quality tools and techniques in both manufacturing and service industry

IV B.Tech I Semester

ENTREPRENEURSHIP

(CBCC-I)

L	T	P	C
3	1	0	3

Course Objective:

- To Understand the basic development of entrepreneurship as a profession.
- To Understand business models.
- To Write a business plan describing a new business venture.
- To Understand marketing strategies for small businesses.
- To Identify capital resources for new ventures and small businesses.

UNIT 1: Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vsIntrapreneur. The Entrepreneurial decision process.Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs.Opportunities for Entrepreneurs in India and abroad.Woman as Entrepreneur.

UNIT II : Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.

The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

UNIT III: Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls.E-commerce and Entrepreneurship, Internet advertising.

New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.

UNIT IV: Choosing location and layout, Issues related to Selection of layout.Global aspects of Entrepreneurship.

UNIT V : Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

Text Books:

1Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5thEdition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

REFERENCES:

1. Dynamics of Entrepreneurial Development and management,
Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.
4. The Entrepreneurial Connection, GurmeetNaroola TMH, 2001. 5. Indian Economy. Dutt&Sundaram S. Chand, 2005.
6. Essential of Entrepreneurship and small businessmanagement, Thomas W. Zimmerer& Norman M. Scarborough, PHI, 4/e, 2005.
7. Industrial Relations &Labour Laws, Srivastava, Vikas, 2005.
8. Industrial Law, ND Kapoor, Sultan Chand & Sons, 2005

Course outcomes

Upon successful completion of this course, a student will be able to:

- Understand the basic development of entrepreneurship as a profession.
- Understand business models.
- Write a business plan describing a new business venture.
- Understand marketing strategies for small businesses.
- Identify capital resources for new ventures and small businesses.
- Have a basic knowledge of human resource management for small business.
- Understand the social responsibilities of small business managers.

IV B.Tech I Semester

RELIABILITY AND MAINTENANCE

(CBCC-I)

L	T	P	C
3	1	0	3

Course Objective:

Successful completion of the course will enable the students to:

- Summarize reliability engineering and its management throughout the product life cycle.
- Perform reliability engineering analysis.
- Compare the characteristics and differences in common Life Testing methodologies.
- know the maintenance of mechanical components.

UNIT – I

Maintenance Engineering: Objective and functions, organization and administration, economics and maintenance policies. Types ofmaintenance systems-planned, unplanned, preventive, predictive, conditional monitoring, total predictive
maintenance.

UNIT – II

Failure Analysis: Analysis of source identification, classification and selectivity of failures, catastrophic, wear out and cumulativefailures, failure rate Mortality distribution, statistical and reliability concept of failure analysis, equipment replacementpolicy.

UNIT – III

Reliability EngineeringConcept, bath tub curve, elements, Hazard Models- constant, linearly increasing, weibull. System Reliability -Series configuration, parallel configuration, mixed configuration, reliability improvement – Improvement ofcomponents, Redundancy – element, unit, standby, repairable and non-repairable systems, reliability, availability,maintainability, MTBF, MTTR, reliability allocation for simple series system.

UNIT – IV

Maintenance ManagementMaintenance planning, maintenance scheduling, work orders, work measurement, maintenance cost budgeting,store and spare control, maintenance planning and control techniques, Incentives for maintenance work.

UNIT – V

Maintenance of Mechanical SystemIntroduction, Bearings, Friction Clutches, Couplings, Fastening Devices, Chains, Gear Drives, Support Equipment, Cooling Towers.

TEXT BOOKS

1. Maintenance Engineering & Management – R.C Mishra, K. Pathak – Prentice Hall of India, New Delhi

2. Maintenance Engineering – S. Shrivastava – S. Chand & Sons – New Delhi

REFERENCE BOOKS

1. Industrial Maintenance – H.P. Garg – S. Chand Publication, New Delhi

2. Maintenance Planning & Control – A. Kelly – TMH, New Delhi

3. Concept in Reliability – LS. Srinath – Affiliated East-West Press, New Delhi

Course outcomes

Upon completion of the subject, students will be able to

- Analyse the interference between strength and stress, or life data for estimating reliability;
- Apply the appropriate methodologies and tools for enhancing the inherent and actual reliability of components and systems, taking into consideration cost aspects;
- Specify life test plans for reliability validation.
- Do maintenance work for various mechanical components like gears, couplings, friction plates etc,.

IV B.Tech I Semester

COMPUTATIONAL FLUID DYNAMICS

(CBCC-II)

L	T	P	C
3	1	0	3

Course Objective:

This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems. In this course Students will develop the equations describing fluid flow and numerical solutions to these equations. Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluate these approaches. Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

UNIT I

Introduction: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

Learning outcome &Suggested Student Activities:

This chapter gives the overall view of the various kinds of numerical methods adopted. It also discusses about various solutions for the numerical methods adopted in CFD. The applications of finite difference methods with examples in conduction and convective heat transfer are introduced.

UNIT II

Finite Differences: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

Learning outcome &Suggested Student Activities:

This chapter gives how to descretize partial differential equations, including the governing flow equations which is the foundation for the finite difference method. Explicit and implicit approaches represent the fundamental distinction between various numerical techniques.

UNIT III

Errors and Stability Analysis: introduction, first order wave equation, stability of hyperbolicand elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

Review Of Equations Governing Fluid Flow And Heat Transfer:

Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

Learning outcome &Suggested Student Activities:

This chapter focuses on numerical errors that are generated and how the numerical calculations become unstable and also entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation.

UNIT IV

Steady Flow: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

Learning outcome &Suggested Student Activities:

This unit gives the fundamental principles of fluid mechanics, its governing differential equations and boundary conditions.

UNIT V

Simple Cfd Techniques: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Learning outcome & Suggested Student Activities:

This unit gives the information about some techniques for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations.

TEXT BOOKS:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press
2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.

REFERENCE BOOKS:

1. Computational Fluid Dynamics for Engineers, Ronnie Anderson (2012), 2nd edition, Cambridge University Press, India.
2. Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot(2010),3rd edition, Springer, Germany.
3. Essential computational fluid Dynamics - olegzikanov, wiley India.
4. Introduction to computational fluid dynamics - pradip, Niyogi S.K. Chakrabary, M.K. Laha - pearson.

IV B.Tech I Semester

MECHATRONICS

(CBCC-II)

L	T	P	C
3	1	0	3

Course Objective:

To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries.Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems. Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT I

Introduction: Definition - Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Learning outcome &Suggested Student Activities:

This unit helps the students to understand the importance of mechatronics subject and controlling the various machines, robots etc. Students may observe CNC machines in CAD/CAM lab to understand the mechatronics concepts.

UNIT II

Signal Conditioning: Introduction - Hardware - Digital I/O , Analog input - ADC , resolution , speed channels Filtering Noise using passive components - Resistors, capacitors - Amplifying signals using OP amps -Software - Digital Signal Processing

Learning outcomes & Suggested Student Activities:

This unit helps the students to understand how to convert the analog signals into useful required form. These signal condition systems may be observed in electronics and communication engineering department labs.

UNIT III

Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts - Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Bearings- Motor / Drive Selection.

Learning outcome & Suggested Student Activities:

In this unit the students learn about the pneumatic and hydraulic systems and about some precisions mechanical component which are useful in the field of automation. This automation system can be observed in many processing industries and manufacturing industries to handle the materials and control the machines (or) process.

UNIT IV

Electronic Interface Subsystems: Motors Isolation schemes- opto coupling, buffer IC's - Protection schemes - circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ mosfets.

Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors - DC brushless motors - DC servo motors - PWM's - Pulse Width Modulation - Variable Frequency Drives.

Learning outcome & Suggested Student Activities:

The objective of this unit is to make the student aware of electronic systems, electromechanical drives used in automation. Some of the systems may be observed electrical and electronics labs for better understanding.

UNIT V

Microcontrollers Overview: 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications, Programming -Assembly.

Programmable Logic Controllers: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection, interface - R232 etc.,-Applications.

Learning outcome & Suggested Student Activities:

This unit helps the student to know about microcontrollers and to programming of programmable logic controls. Students may visit pharmaceutical industries, thermal power plants etc. To observe the PLC based control systems know about the interface between processing equipment and central system.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , WBolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

REFERENCE BOOKS:

1. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.
3. Mechatronics System Design, Devdasshetty,Richard,Thomson.

IV B.Tech I Semester

CONCURRENT ENGINEERING

(CBCC-II)

L	T	P	C
3	1	0	3

Course Objective:

Student has to understand the concept and need for sequential engineering or Concurrent engineering and it‟s benefit for the modern industry. Student has to understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available sofarThe student has to know the different procedures to be followed during the design, modifications, and optimization techniques for the Design for Manufacture (DFM). The student has to understand the importance of quality of the product and know the methods of evaluating the quality. The student must be able to assess the reliability & economics of the Design for Manufacture (DFM) being done/ learned.

UNIT I

Introduction: Sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cycle costs.

Support Force: Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process.

Learning Outcome & Suggested Student Activities:

Students can understand the meaning, objectives and benefits of the concurrent engineering, life-cycle design of the products, structure and organisation and implementation process of the CE.
Students are advised to refer text book mikell P. Groover for CE definition & advantages and for solid modeling.

UNIT II

Design Product For Customer: Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). Modeling of Concurrent engineering design- Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns

Learning Outcome & Suggested Student Activities:

Student can understand the design of the product as per the customer requirements and also understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available so far. Students are advised to visit industries like IFB, ITW for better understanding of the concept.

UNIT III

Design For Manufacture (DFM): Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM.Evaluation of manufacturability and assembliability.

Learning Outcome & Suggested Student Activities:
Students can understand the role of design for manufacturing in concurrent engineering, different DFM methods, creative design methods and computer based approach to DFM. Student can be explained the procedures being followed by companies such as KPIT Cummins-Pune and made to visit the same which is nearby.

UNIT IV

Quality By Design: Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach.

Learning Outcome & Suggested Student Activities:
Students can understand the importance of quality during the product design and methods used to evaluate the quality. Student can be given a small component for Design for Manufacture (DFM) in consultation with industries

UNIT V

Design For X-Ability: Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies.

Learning Outcome & Suggested Student Activities:
Students can understand the design of the product for reliability, maintainability and economics.

TEXT BOOKS:

1. Concurrent Engineering- Kusiak - John Wiley & Sons
2. Concurrent Engineering- Menon - Chapman & Hall

REFERENCE BOOKS:

1. Integrated Product Development/Anderson MM and Hein, L.Berlin, Springer Verlog,1987.
2. Design for Concurrent Engineering/ Cleetus, J. Concurrent Engg. Research Centre,Morgantown,WV, 1992.

SUGGESTED LINKS:

- www.lumbs.lu.se/database/alumini/03-04/theses/jeganova-julija.pdf
- www.rug/nl/staff/e.w.berghout/nijlandberghout_flcmgt.pdf

Student can be directed to industries who uses the Concurrent Engineering concepts.

IV B.Tech I Semester

PRODUCTION AND OPERATIONS MANAGEMENT

(CBCC-II)

L	T	P	C
3	1	0	3

Course Objective:

- To make the students understand the functions of production planning & controls, generating of new products, issues in product design and strategies of aggregate planning.
- To provide the knowledge on principles of forecasting, forecasting methods, types and its accuracy.
- To provide the knowledge on facilities location, various types layouts and assembly line balancing.
- To provide the knowledge on lean management, concepts of JIT, six sigma, quality control, MRP,ERP and LOB.
- To make the students understand the inventory management and scheduling techniques.

UNIT I

Functions of Production Planning Controls operations and productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design. Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

Learning Outcome & Suggested Student Activities:

At the end of this unit students can get the concepts on Production planning & controls operations and its functions, productivity and productivity measurements, design of goods and services and aggregate planning

UNIT II

Forecasting - Importance of forecasting - Types of forecasting, their uses - General Principles of forecasting - Forecasting techniques - qualitative methods and quantitive methods - accuracy of forecasting methods.

Learning Outcome & Suggested Student Activities:

Students can understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands.

UNIT III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, CORELAP.

Learning Outcome & Suggested Student Activities:

At the end of the unit the student will be able to understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time.Can compare the rural &urban sites, methods of selection.

UNIT IV

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control. MRP, -lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

Learning Outcome & Suggested Student Activities:

Students can understand the how philosophy of lean management applied to develop lean enterprise and basic concepts JIT, Six sigma control.

UNIT V

Scheduling Policies - Techniques, flow shop and job shop Scheduling techniques. Inventory management - Functions of inventories - relevant inventory costs - ABC analysis - VED analysis - EOQ model - Inventory control systems - P-Systems and Q-Systems-(S, s) Policy.

Learning Outcome & Suggested Student Activities:

At the end of the unit the student will be able to understand the scheduling policies, flow shop and job shop scheduling techniques and concepts of Inventory, Classification, Function‟s, it associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up.

TEXT BOOKS:

1. Modern Production , Operations Management , Baffa&RakeshSarin.
2. Operation Management by B. Mahadevan,PearsonEdu.
3. Operation and O.M by Adam & Ebert- PHI Pub.,

REFERENCE BOOKS:

1. Operations Management - S.N. Chary.
2. Inventory Control Theory and Practice , Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach , John E. Biegel.
4. Production Control , Moore.
5. Operations Management , Joseph Monks.
6. Operation Management by Jay Heizar& Read new Pearson
7. Elements of Production Planning and Control, Samuel Eilon.

SUGGESTED LINKS:

- http://www.technologyevaluation.com/search/for/inventory-management-pdf.html
- http://freevideolectures.com/Course/3096/Operations-and-Supply-Chain-Management/10
- http://www.learnerstv.com/video/Free-video-Lecture-6944-Management.htm;
- http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-852j-integrating-the-lean-enterprise-fall-2005/lecture-notes/
- http://freevideolectures.com/Course/2688/Human-Resource-Management/13
- http://www.slideshare.net/satya4/plant-layout-16143741
- http://freevideolectures.com/Course/2371/Project-and-Production-Management/32
- http://www.tcyonline.com/video-tutorials-computerised-layout-planning/101568
- http://www.learnerstv.com/video/Free-video-Lecture-2496-Management.htm;
- http://www.slideshare.net/jrdn_27/qualitative-and-quantitative-methods-of-research
- http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Management_Science_II/Pdf/3_5.pdf
- http://www.academicearth.org/lectures/product-development-process-observation

IV B.Tech I Semester

METROLOGY AND MEASUREMENTS LABORATORY

L	T	P	C
0	0	3	2

Course objectives:-

- To educate students on different measurement systems and on common types of errors
- To introduce different types of sensors, transducers and strain gauges used for measurement.
- To give knowledge about thermocouples, thermometers and flow meters used for measurements To introduce measuring equipments used for linear and angular measurements.
- To familiarize students with surface roughness measurements on machine components

Any 6 experiments from each section

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/ Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Calibration of transducer or thermocouple for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Study and calibration of capacitive transducer for angular measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotometer for flow measurement.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
8. Study and calibration of Mcleod gauge for low pressure.

Course outcomes:-

At the end of course the students will have:

- Apply the procedures to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness by using different instruments.
- Measure effective diameter of Thread profile using different methods 3. Conduct different machine alignment tests
- Apply the procedures to measure Temperature, Displacement, flow measurement and pressure measurement

IV B.Tech I Semester

COMPUTER AIDED ENGINEERING (CAE) LABORATORY

L	T	P	C
0	0	3	2

Course Objectives

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- To validate a Finite Element model using a range of techniques.
- To communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.
- To discuss the accuracy of the Finite Element solutions.

FE Analysis using ANSYS Package for different structures that can be descretized with 1-D,2-D & 3-D elements to perform the following analysis:

1. Static Analysis
   a. Stress analysis of 2D truss.
   b. Stress analysis of a plate with a circular hole and L-Bracket – 2D and 3D
   c. Stress analysis of beams (cantilever, simply supported & fixed ends)
   d. Stress analysis of an axi-symmetric component
   e. Model analysis of stepped bar

2. Thermal Analysis
   a. Conductive heat transfer analysis of a 2D and 3D components
   b. Conduction & Convective heat transfer analysis of a 2D and 3D component
   c. Coupled field analysis of a component
3. Modal Analysis
   a. mode frequency analysis of a 2D component
   b. mode frequency analysis of beams (cantilever, simply supported, Fixed ends)
4. Transient analysis
   a. Transient analysis of a cantilever beam
5. Verifying ANSYS results with formulae's of simple problems in mechanics of solids and heat transfer (any two each)

CAM (Any Six exercises)

a. Introduction to CNC & NC Machines
b. Introduction to CNC & NC part programming - for Different operations like Turning,
c. Threading, Milling, Drilling etc., (G-Codes & M-Codes)
d. Experiments on CNC lathe -Turning, Threading operations
e. Experiments on Milling Machine - Plane Milling, Drilling Operations
f. Experiment on Robot - pick up an object with & without using teach window
g. Developing a CNC code for a given job using any one of the following
  i. Solid works- CAM
  ii. PRO-E- CAM
  iii. MASTER CAM
  iv. Edge CAM
  v. APT programming

Course outcomes

After completion of the course student can be able:

- Ability to solve engineering problems using the commercial software's like ANSYS, SIMUFACT, ABAQUS, SIMULIA.
- Ability to write the CNC programme for various components on CNC Machines.

IV B.Tech II Semester

INDUSTRIAL ENGINEERING AND MANAGEMENT

L	T	P	C
3	1	0	3

Course objectives

- To analyze the characteristics and contributions of enterprising people
- To assess their own entrepreneurial and enterprising potential To develop an understanding of the general role of Small Business Enterprises
- To develop skills to start, run and manage SMEs
- Understand the role of entrepreneurship in economic development.
- Identify the general characteristics of entrepreneurs.
- Know the differences between entrepreneurial and managerial type jobs.
- Understand the significance and sources of capital. Participate in the preparation of a complete business plan.
- Have an understanding of individual personalities and interpersonal skills needed for effective communications in a diverse business environment.
- Have an introductory understanding of global entrepreneurship concepts.
- Acquire entrepreneurial quality, competency & motivation.
- Understand the concept & process of entrepreneurship- its contribution & role in the growth & development of individual & the nation.

UNIT I

Introduction To Management:

Concepts of Management - nature, importance and Functions of Management, Taylor‘s Scientific Management Theory, Fayol‘s Principles of Management, Maslow‘s Theory of Human Needs, Douglas McGregor‘s Theory X and Theory Y, Leadership Styles, Social responsibilities of Management.

Designing Organizational Structures:

Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, team structure) their merits, demerits and suitability.

UNIT II

Plant location; definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant**,** Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study.

Materials Management: EOQ, ABC Analysis, Purchase Procedure and Stores Management.Inventory — functions. Types, inventory classification techniques.

Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle, Channels of distribution.

UNIT III

Human Resources Management (HRM):

Concepts of HRM ,Personnel Management and Industrial Relations (PMIR), Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and

Welfare Administration, Job Evaluation, Merit Rating and methods.

UNIT IV

Inspection And Quality Control- types of inspections — Difference between inspection & quality control. Statistical Quality Control-techniques, variables and attributes- variable control charts. and R charts. attributes control charts. p charts and c charts. Acceptance sampling plan-single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles.ISO 9000 series procedures.

UNIT V

Strategic Management:

Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation.

Project ManagemenT (PERT/CPM):
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).
Assignments, case studies and mini project.

BOOKS:

1. Manwlicturing Organization and Management. Antrind Pearson. 2nd Edition. 2004.
2. Industrial Engineering and Management O.P. KhannaDhanpatRai.

REFERENCES:

1. Stoner. Freeman. Gilbert. Managemem. 6th Ed, Pearson Education. New Delhi, 2005.
2. Fanner Selvam, Production and Operations Management, PHI, 2004.
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering. Galgotia Publications, Pvt Limited.
4. Ralph M Barnes. Motion and Time Studies. John Wiley and Sons. 2004. 5. Chase. Jacobs. Aquilano. Operations Management. TM Ii 10th Edition. 2003. 6. I[RT CPM, affiliate Fast-West Press. New Delhi. 2000.

Learning outcome

The M.S. prepares engineers for a lifelong career addressing the critical technical and managerial needs of private and public organizations. The program emphasizes developing analytic abilities, making better decisions, developing and executing strategies while also leading people who innovate. Unlike an MBA, our master's program addresses the technical as well as the behavioral challenges of running organizations and complex systems. We emphasize quantitative analytic skills and an entrepreneurial spirit.

IV B.Tech II Semester

POWER PLANT ENGINEERING

L	T	P	C
3	1	0	3

Course Objective:

- To understand the student present day energy demand.
- To make the student to aware of components of power plants that run using conventional and non- conventional methods, factors affecting the site selection for a power plant and concept of base load plant and peak load plant.
- To make the student aware of Pros and Cons of various power plants.
- To enable the student to recognize the importance of secondary energy source.

UNIT I

Introduction To The Sources Of Energy - Resources and Development of Power in India.

Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection,

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

Learning outcome & Suggested Student Activities:

Student can recognize the importance of power production suited to the demand. Student can have an idea of various power plants. Student can understand economics of power distribution, Power Tariff, Load Factor and other related terms. Student can know the impact of power plants on the environment. Students are advised to visit various power plants.

UNIT II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO_2 Recorders

Learning outcome & Suggested Student Activities:

Student is able to understand the latest high pressure boilers, concept of fluidized bed combustion and importance of handling and storage. Student can able to learn the waste heat recovery methods. In addition, student can know various cooling towers and its application. Student is advised to visit the cogeneration plants to under the waste heat recovery concept.

UNIT III

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

GAS TURBINE PLANT : Introduction - Classification - Construction - Layout With Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

Learning outcome & Suggested Student Activities:

Student can grasp concepts of diesel power plant and gas turbine plants. Student can distinguish open cycle and closed cycle gas turbine cycles. Normally, every college will be equipped with diesel power plant. Students are suggested to visit near bydiesel power plant and gas turbine plant. The students have already studied these units in Thermal Engineering-I & II. The student can make uses of these notes of thermal engineering.

UNIT IV

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects And Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

Learning outcomes & Suggested Students Activities:

Student can have knowledge on water power. Student can able to understand the methods of storing water and can have an idea over constructions of dams and spill ways. Student can enable to draw the layout of hydel power plant. Student s are advised to visit nearby hydel power plants.

UNIT V

Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types Of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student can be familiar with the power generation through secondary energy sources. Student can able to understand the power generation through solar energy, wind energy, MHD and Nuclear energy. Student can enable to distinguish various nuclear reactors. Also, student can know the methods of dumping radiation waste and can discern the impact of radiation effect on human living. Student is suggested to visit any nuclear power station.

TEXT BOOKS:

1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.
2. A course in power plant Engineering, Arora and S. Domkundwar.

REFERENCE BOOKS:

1. A Text Book of Power Plant Engineering , Rajput , Laxmi Publications, 4th edition, 2012.
2. Power plant Engineering, Ramalingam, Scietech Publishers
3. power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

SUGGESTED LINKS:

- http://www.nprcet.org/e%20content/Misc/e-Learning/EEE/II%20YEAR/EE2252%20-%20Power%20Plant%20Engineering.pdf

R15 REGULATIONS

COURSE STRUCTURE

FOR

B.TECH –MECHANICAL ENGINEERING
w.e.f.

2015 ADMITTED BATCH

DEPARTMENT OF MECHANICAL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

Y.S.R. (DIST), ANDHRA PRADESH, INDIA – 516390.

COURSE STRUCTURE OF R15 REGULATIONS FOR B.TECH IN MECHANICAL ENGINEERING

B. Tech I Year I Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing/Lab	Credits
1	15AHS01	Functional English	3+1	-	3
2	15ABS06	Mathematics - I	3+1	-	3
3	15ACS01	Computer Programming	3+1	-	3
4	15ABS03	Engineering Chemistry	3+1	-	3
5	15ABS05	Environmental Studies	3+1	-	3
6	15AME02	Engineering Mechanics	3+1	-	3
7	15AHS02	English Language Communication Skills Lab	3+1	-	2
8	15ACS02	Computer Programming Lab	-	3	2
9	15ABS04	Engineering Chemistry Lab	-	3	2
		Total	25	09	24

B. Tech I Year II Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing/Lab	Credits
1	15AHS03	English for Professional Communication	3+1	-	3
2	15ABS07	Mathematics - II	3+1	-	3
3	15ABS01	Engineering Physics	3+1	-	3
4	15ACS04	Data Structures	3+1	-	3
5	15AME01	Engineering Drawing	3+1	-	3
6	15AME04	Basic Mechanical Engineering	3+1	-	3
7	15AME05	Engineering Drawing using Auto CAD Lab	-	3	2
8	15ABS02	Engineering Physics Lab	-	3	2
9	15AME03	Engineering and IT Workshop	-	3	2
		Total	24	09	24

II Year I Semester

S.No.	Course Code	Subject Name	Theory/Tutorial	Drawing/ Lab	Credits
1	15ABS08	Mathematics - III	3+1	-	3
2	15AME07	Mechanics of Solids	3+1	-	3
3	15ABEE01	Basic Electrical and Electronics Engineering	3+1	-	3
4	15AME08	Material science and Metallurgy	3+1	-	3
5	15AME09	Thermodynamics	3+1	-	3
6	Choice based credit course of inter department ANNEXURE-I		3+1	-	3
7	15AME10	Material science and Mechanics of Solids Lab	-	4	2
8	15ABEE02	Electrical and Electronics Lab	-	4	2
9	15AHS04	Human Values and Professional Ethics(Audit Course)	2		
		Total	26	6	22

ANNEXURE-I

Choice Based Credit Course of Inter Department
offered in

B.TECH II YEAR I SEMESTER

BRANCH	SUBJECT CODE	SUBJECT NAME
PHYSICS	15ABS12	Basics of Nano Science and Nano Technology
MATHEMATICS	15ABS14	Set Theory and Mathematical Logic
	15ABS23	Mathematical Modeling
CHEMISTRY	15ABS15	Green Chemistry and Catalysis for Sustainable Environment
	15ABS16	Instrumental Methods of Chemical Analysis
	15ABS17	Chemistry of Nano Material and Application
ENGLISH	15AHS08	Campus Recruitment Training & Soft Skills
	15AHS09	Competitive & Spoken English
CE	15ACE09	Green Buildings
	15ACE10	Disaster Management and Mitigation
	15ACE11	Water Harvesting and Conservation
ECE	15AEC08	Basic Electronics
	15AEC09	Fundamentals of Digital Electronics
	15AEC10	Electronic Measurements & Instrumentation
ME	15AME11	Robotics
	15AME12	Mechanical Manufacturing Process
	15AME13	Non-Conventional Sources of Energy
EEE	15AEE08	Principles of electrical engineering
	15AEE01	Electrical engineering materials
	15AEE09	Electrical measuring instruments
CSE	15ACS04	Data Structures
	15ACS11	Object oriented Programming
	15ACS08	Operating Systems

II Year II Semester

S.No.	Course Code	Subject Name	Theory/ Tutorial	Drawing/ Lab	Credits
1	15ABS09	Probability and Statistics	3+1	-	3
2	5AME16	Kinematics of Machinery	3+1	-	3
3	5AME17	Thermal Engineering	3+1	-	3
4	5AME18	Fluid Mechanics and Hydraulic Machinery	3+1	-	3
5	5AME19	Machine Drawing	3+1	-	3
6	5AME20	Manufacturing Technology	3+1	-	3
7	5AME21	Thermal Engineering Lab		4	2
8	5AME15	Fluid Mechanics and Hydraulic Machinery Lab	-	4	2
9	5AME22	Comprehensive Online Examination	-		1
		Total	26	8	23

III YEAR I SEMESTER

S.No.	Course Code	Subject Name	Theory/ Tutorial	Drawing/ Lab	Credits
1	15AHS05	Managerial Economics And Financial Analysis	3+1	-	3
2	15AME24	Dynamics Of Machinery	3+1	-	3
3	15AME25	Machine Tools	3+1	-	3
4	15AME26	Elements Of Machine Design	3+1	-	3
5	15AME27	Heat Transfer	3+1	-	3
6	15AME30	Advanced Thermal Engineering	3+1	-	3
7	15AME28	Manufacturing Technology Lab	--	3	2
8	15AME29	Heat Transfer Lab	-	3	2
9	15AHS06	Advanced Communication Skills Lab (Audit Course)	-	-	-
		TOTAL	24	6	22

III YEAR II SEMESTER

S.No.	Course Code	Subject Name	Theory / Tutorial	Drawing/ Lab	Credits
1	15AME31	CAD/CAM	3+1	-	3
2	15AME32	Refrigeration And Air Conditioning	3+1	-	3
3	15AME33	Advanced Machine Design	3+1	-	3
4	15AME34	Metrology And Instrumentation	3+1	-	3
5		**MOOC-I**	3+1	-	3
6	**Choice Based Credit Courses** (Inter-Department)		3+1	-	3
7	15AME38	Machine Tools Lab	-	4	2
8	15AME39	CAD/CAM Lab	-	4	2
9	15AME40	Comprehensive Online Examination	-	-	1
		TOTAL	24	8	23

ANNEXURE-II

CHOICE BASED CREDIT COURSE OF INTER DEPARTMENT

Branch	Subject Code	Subject Name
MATHEMATICS	15ABS18	FUZZY SETS AND APPLICATIONS
	15ABS19	OPTIMIZATION TECHNIQUES
CHEMISTRY	15ABS20	CHEMISTRY ENERGY MATERIALS
	15ABS21	CHEMISTRY OF LIFE
	15ABS22	CHEMISTRY OF POLYMERS AND THEIR APPLICATIONS
CE	15ACE35	REMOTE SENSING & GIS
	15ACE36	ENVIRONMENTAL IMPACT ASSESTMENT & MANAGEMENT
	15ACE37	FINITE ELEMENT METHODS
EEE	15AEE19	POWER ELECTRONICS
	15AEE34	RENEWABLE ENERGY SOURCES
	15AEE35	UTILIZATION OF ELECTRICAL ENERGY
ME	15AME35	OPTIMIZATION TECHNIQUES BY MATLAB
	15AME36	MECHATRONICS & MEMS
	15AME37	AUTOMOTIVE ELECTRONICS
ECE	15AEC34	FUNDAMENTALS OF COMMUNICATION SYSTEMS
	15AEC35	INDUSTRIAL ELECTRONICS
	15AEC36	NEURAL NETWORKS & FUZZY LOGIC
CSE	15ACS35	MOBILE COMPUTING
	15ACS36	OPTIMIZATION TECHNIQUES
	15ACS37	MACHINE LEARNING

IV YEAR I SEMESTER

S.No.	Course Code	Subject Name	Theory/ Tutorial	Drawing/ Lab	Credits
1	15AME51	Automobile Engineering	3+1	-	3
2	15AME52	Operations Research	3+1	-	3
3	15AME53	Finite Element Method	3+1	-	3
4		**MOOC-II**	3+1	-	3
5	CHOICE BASED CREDIT COURSES (**DEPARTMENT SPECIFIC**)		3+1	-	3
	15AME54	A. Energy Systems			
	15AME55	B. Industrial Management			
	15AME56	C. Entrepreneurship			
	15AME57	D. Product Design			
6	CHOICE BASED CREDIT COURSES (**DEPARTMENT SPECIFIC**)		3+1	-	3
	15AME58	A. Computational Fluid Dynamics			
	15AME59	B. Mechanical Vibrations			
	15AME60	C. Fluid Power Systems			
	15AME61	D. Production Operations Management			
7	15AME62	Metrology, Instrumentation & Dynamics Lab	-	4	2
8	15AME63	Computer Aided Engineering Lab	-	4	2
		TOTAL	24	8	22

IV YEAR II SEMESTER

S.No.	Course Code	Subject Name	Theory/ Tutorial	Drawing/ Lab	Credits
1	15AME81	Automation And Robotics	3+1	-	3
2	15AME82	Mechatronics	3+1	-	3
3	15AME83	Power Plant Engineering	3+1	-	3
4		**MOOC-III**	3+1	-	3
5	15AME99	Project Work And Seminar		20	10
		TOTAL	16	20	22

I B.Tech I Sem

15AHS01-FUNCTIONAL ENGLISH
(Common For All Branches)

L	T	P	C
3	1	0	3

1. Introduction:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, and advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed books serve the purpose of preparing them for everyday communication and to face the global competitions in future.

The texts prescribed for detailed study focus on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

2. Objectives:

1. To enable the students to communicate in English for academic and social purpose.
2. To enable the students to acquire structure and written expressions required for their profession.
3. To develop the listening skills of the students.
4. To inculcate the habit of reading and critical thinking skills.
5. To enhance the study skills of the students with emphasis on LSRW skills.

3. SYLLABUS:

UNIT –I

Reading: What Is My Name? —P Sathyavathi
Writing: Paragraph writing
Listening: Listening for sounds, stress
Functional English: Greeting, taking leave and introducing oneself and others
Grammar: Nouns -classification
Vocabulary: Homonyms
Non Detailed Study: Listening Skills from English and Soft Skills

UNIT-II

Reading : SWOT Analysis of the Indian software Industry (from Mindscapes)
Writing : Essay Writing
Listening : Listening for theme -1
Functional English: Making requests
Grammar: Pronouns
Vocabulary : Homophones
Non detailed Study: Teamwork Skills

verified
checked

UNIT-III
Reading : How To Regain Green Cover? (From Mindscapes)
Writing Descriptive essays
Listening :Listening for theme -2
Functional English : Asking for the time and directions
Grammar: Articles
Vocabulary : Homographs
Non detailed Study : Emotional Intelligence Skills
UNIT-IV
Reading : The Kitchen — Vimala
Writing Narrative essays- Expository essays - Argumentative essays
Listening: Listening for main ideas
Functional English: Inviting -Apologizing
Grammar: Kinds of verbs – Auxiliaries- Adjectives
Vocabulary : Synonyms - Antonyms.
Non detailed Study : Assertive Skills
UNIT-V
Reading: Adivasis — Kancha Ilaiah
Writing: Letter Writing –official letters-business letters
Listening: Listening for details
Functional English: Interrupting - Asking for and giving opinions
Grammar: Tenses -Adverbs
Vocabulary: Prefixes -Suffixes
Non detailed Study: Learning Skills

Prescribed Text books:
Detailed text: **English for Fluency**, K Purushottam, Orient Black Swan,2013.
Non detailed text: **English and Soft Skills**, S P Danavel, Orient Black Swan 2013Edition.
References:

1. Mindscapes, English For Technologists And Engineers, Orient Black Swan,2012.
2. A Practical Course in Effective English Speaking Skills. J.K.Gangal, PHI, New Delhi.2012
3. Fundamentals of Technical Communication, Meenakshi Raman, Oxford University Press,2015.
4. Spoken English, R.K. Bansal & JB Harrison, Orient Longman,2013, 4Th edition.
5. Murphy's English Grammar with CD, Murphy, Cambridge University Press,3 Rd edition.
6. Advanced English Grammar , Martin Hewings Cambridge University Press 2007

Expected Outcomes:
At the end of the course, students would be expected to:
1. Have improved communication in listening, speaking, reading and writing skills in general.
2. Have developed their oral communication and fluency in group discussions and interviews.
3. Have improved awareness of English in science and technology context.
4. Have achieved familiarity with a variety of technical reports.

I B.Tech I Sem

15ABS06-MATHEMATICS – I
(Common For All Branches)

L T P C
3 1 0 3

Objectives

- To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications.
- To prepare students for lifelong learning and successful careers using mathematical concepts of differential and Integral calculus, ordinary differential equations and vector calculus.
- To develop the skill pertinent to the practice of the mathematical concepts including the students' abilities to formulate and modeling the problems, to think creatively and to synthesize information.

UNIT – I

Exact, linear and Bernoulli equations, Applications to first order equations; Orthogonal trajectories, Simple electric circuits, Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x), Method of variation of parameters.

UNIT – II

Linear equations with variable coefficients: Euler-Cauchy Equations, Legendre's linear equation. Applications of linear differential equations- Mechanical and Electrical oscillatory circuits.

UNIT – III

Functions of Severable Variables:
Functions of severable variables, level curves, Limits, Continuity, Partial derivatives, chain Rule, Directional derivative, gradient vectors, Tangent planes & normal line, Maximum, Minimum & Saddle points of functions of two or three variables, Constrained Maxima & Minima, Method of Lagrange multipliers.

UNIT – IV

Multiple Integrals:
Double Integrals, Area, Change of integrals to Polar Coordinates, Change of order of integration, Triple Integrals in Cartesian, Cylindrical and Spherical Coordinates.

UNIT – V

Vector Calculus:
Line integral, work, circulation, flux, path independence, potential function, conservative fields; Green's theorem in the plane (without proof), Surface area & Surface Integral; Stokes theorem, Gauss divergence theorem (without proof) and simple problems.

2.7.2018

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Weir, MD, Hass J, Giordano FR: Thomas' Calculus Pearson education 11th ED, 2008.(Unit-III, IV & V)

References:

1. Engineering Mathematics-I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.

Outcomes: At the end of the course, the student will be able to attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications, using Ordinary Differential Equations, Multiple Integrals and Vector Calculus.

2.7.2018

I B.Tech I Sem

15ACS01-COMPUTER PROGRAMMING
(Common For All Branches)

L	T	P	C
3	1	0	3

Course Objectives:

- To make the student understand problem solving techniques
- Students will be able to understand the syntax and semantics of C programming language and other features of the language

Course Outcomes:

- Student can effectively apply problem solving techniques in designing the solutions for a wide-range of problems
- Student can choose appropriate data structure and control structure depending on the problem to be solved
- Student can modularize the problem and also solution

UNIT –I

Fundamentals of Computers: What is Computer, Applications of Computers, Evaluation of Computers, Generations of Computers, Basic I/O Devices, Computer Software, Types of computer, Software Development Methodology, Top-Down Vs Bottom –Up Approaches, Problem Solving, Fundamental Techniques to Solve The Problem, Representation of a solution to a Problem, Developing a computer program, Number Systems.

Fundamentals of C: An Overview of C, A Brief History of C , C Is a Middle-Level Language , C Is a Structured Language ,C Is a Programmer's Language Compilers Vs. Interpreters , The Form of a C Program, The Library and Linking, Separate Compilation, Compiling a C Program, C's Memory Map.

UNIT –II

Expressions: The Basic Data Types, Modifying the Basic Types, Identifier Names, Variables, The Four C Scopes, Type Qualifiers, Storage Class Specifiers,, Variable Initializations, Constants.

Operators: The Assignment Operator, Arithmetic Operators, The Increment and Decrement Operators, Relational and Logical Operators, Bitwise Operators, The ? Operator, The & and * Pointer Operators, The Compile-Time Operator sizeof, The Comma Operator, The Dot (.) and Arrow (–>) Operators, The [ ] and ( ) Operators, Precedence Summary, Expressions, Statements.

Conditional, unconditional and Iteration Statements: Selection Statements, Iteration Statements, Jump Statements, Expression Statements

UNIT –III

Arrays and Strings: Single-Dimension Arrays, Generating a Pointer to an Array, Passing Single Dimension Arrays to Functions , Strings, Two-Dimensional Arrays, Multidimensional Arrays, Indexing Pointers, Array Initialization, Variable-Length Arrays, A Tic-Tac-Toe Example.

Console I/O: Reading and Writing Characters, Reading and Writing Strings. Formatted Console I/O: printf( ), scanf( ), Suppressing Input.

Functions: The General Form of a Function, Understanding the Scope of a Function, Function Arguments, argc and argv— Arguments to main( ), The return Statement ,What Does main( ) Return? , Recursion, Function Prototypes, Declaring Variable Length Parameter Lists, The "Implicit int" Rule, Old Style Vs. Modern Function Parameter Declarations, The inline Keyword.

UNIT-IV

Pointers: What Are Pointers?, Pointer Variables, The Pointer Operators, Pointer Expressions, Pointer Assignments, Pointer Conversions, Pointer Arithmetic, Pointer Comparisons, Pointers and Arrays, Arrays of Pointers, Multiple Indirection, Initializing Pointers, Pointers to Functions, C's Dynamic Allocation Functions, Dynamically Allocated Arrays, restrict-Qualified Pointers, Problems with Pointers.

Structures, Unions, Enumerations, and typedef: Structures , Arrays of Structures, A Mailing List Example, Passing Structures to Functions, Structure Pointers, Arrays and Structures within Structures.

Unions, Bit-Fields , Enumerations, Using sizeof to Ensure Portability, typedef.

UNIT –V

File I/O: Standard C Vs. Unix File I/O, Streams and Files, File System Basics, fread( ) and fwrite(), Using fread( ) and fwrite( ), fseek( ) and Random-Access, fprintf( ) and fscanf( ), The Standard Streams, The Console I/O Connection, Using freopen( ) to Redirect the Standard Streams.

The Preprocessor and Comments: The Preprocessor, #define, #error, #include, Conditional Compilation Directives, #undef, Using defined, #line . #pragma, The # and ## Preprocessor Operators,Predefined Macro Names,Comments, Single-Line Comments.

Text book:

1. **"Computer Fundamentals and C Programming"** :Dr. P. Chenna Reddy, Professor of CSE, JNTUA College of Engg, Pulivendula, YSR District, Andhra Pradesh, INDIA. (unit-I)
2. **"The Complete Reference C":** Fourth Edition Herbert Schildt Osborne/McGraw-Hill.(Unit-2,3,4,5).

References:

1. "Programming in C", Pradip Dey, Manas Ghosh, Oxford Higher Education
2. "Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson.
3. "Programming in C", Reema Thareja, Oxford Higher Education.
4. "Computer Fundamentals and C Programming", First Edition, Dr.P.Chenna Reddy, Available at: www.pothi.com.
5. "Data Structure and Program Design in C", Second Edition, Kruse, Tondo, Leung, Mogalla, Pearson.
6. "Programming with C", R.S. Bichkar, University Press.
7. "Computer Science A Structured Programming Approach Using C", Third Edition, Fourouzan & Gilberg, Cengage Learning
8. "Programming with C", Byron Gottfried, Third Edition, Schaum's Outlines, 3rd edition, 2010, Mc Graw Hill.

R-15

I B.Tech I Sem

15ABS03-ENGINEERING CHEMISTRY

(Common for CE & ME)

L	T	P	C
3	1	0	3

Course Objectives :

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, engineering materials and water chemistry.

UNIT-I: Water Treatment

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching, ozonisation, U.V. treatment)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralisation of brackish water: Reverse Osmosis and Electrodialysis

UNIT-II: Electrochemistry

i).Review of electrochemical cells, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries),Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

ii). Voltammetry: Basic Principles and applications (Ferrous/Ferric System)

Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples : analysis of Glucose and urea

iii).Corrosion: Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating.

UNIT-III: Polymers

i). Introduction: Basic concepts of polymerisation, Types of poloymerisation (Chain Growth (Addition), Step growth (Condensation)), Mechanism: cationic, anionic, free radical and coordination covalent, Polydispercity Index.

Plastomers: Thermosetting and Thermoplatics, Preparation, properties and Engineering applications, PVC, Bakelite, nylons, Polyester Elastomers (rubbers) Natural Rubber; Processing of natural rubber, Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, buna-N, Polyurethene, Polysulfide (Thiokol) rubbers

ii).Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline.

iii).Liquid Crystals: Introduction, classification and applications

iv).Inorganic Polymers: Introduction, Silicones, Polyphospazins (-(R)2-P=N-), applications

UNIT-IV: FUEL TECHNOLOGY

Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.

i). Solid Fuels–Coal, Coke: Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.

ii).Liquid Fuels:

Petroleum: Refining of Petroleum, Gasoline: Octane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis

Power Alcohol: Manufacture, merits and demerits of Power Alcohol

iii). Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat's apparatus, Solving of problems on Combustion.

iv). Bio Fuels: Biogas, Biodiesel and their significance

UNIT-V: CHEMISTRY OF ENGINEERING MATERIALS

i).Semiconducting and Superconducting materials-Principles and some examples

ii).Magnetic materials – Principles and some examples

iii).Cement: Composition, Setting and Hardening (Hydration and Hydrolysis)

iv).Refractories: Classification, properties and applications

v).Lubricants: Classification and characteristics of lubricants, Theory of lubrication.

Expected Outcomes (EO): The student is expected to:

- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.
- Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.

Text Books:

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, New Delhi, Foruth Edition, 2013.
2. A Text Book of Engineering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2012.

References:

1. A Text book of Engineering Chemistry by S.S Dhara, S.S.Umare, S. Chand Publications, New Delhi, 12th Edition, 2010.
2. Engineering Chemistry, K. Sesha Maheswaramma and Mrudula Chugh, Pearson Education, First Edition, 2013.
3. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH, Publications India Pvt Limited, Chennai, 2nd Edition, 2012.
4. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi, Acme

I B.Tech I Sem

15ABS05-ENVIRONMENTAL STUDIES

(Common for CE & ME)

L	T	P	C
3	1	0	3

Objectives

- To investigate the relationship between human life and environment from scientific prospective
- To help you apply the fundamentals of Environmental science to important local, regional, national and global environmental problems and potential issues

UNIT-I:

i) **Multidisciplinary** nature of environmental studies

The **Multidisciplinary** nature of environmental studies Definition; Scope and importance, Need for public awareness.

ii) **Natural Resources:**

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT-II:

i) **Ecosystems**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem: -

a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

ii) Biodiversity and its Conservation

Introduction-Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation.

Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III: Environmental Pollution:

Definition - Causes, effects and control measures of: -

a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution

e. Noise pollution f. Thermal pollution g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV: Social Issues and the Environment

From Unsustainable to Sustainable development. Urban problems related to energy.

Water conservation, rain water harvesting, watershed management.

Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

Wasteland reclamation.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.

Issues involved in enforcement of environmental legislation. Public awareness.

UNIT-V:

i) **Human Population and the Environment**

Population growth, variation among nations. Population explosion-Family welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. - Women and Child Welfare. Role of information Technology in Environment and human health.

- Case Studies.

ii) Field Work

- Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Expected Outcome:

- **Describe the structure and function of significant environmental systems**
- **Use scientific reasoning to identify and understand environmental problems and evaluate potential solutions**
- **Critically evaluate arguments regarding environmental issues**

Text Books:

1. Shashi Chawla, A Text Book of Environmental Studies, Mc Graw Hill Education, 4th edtion, 2014

2. De A.K., Environmental Chemistry, Wiley Eastern Ltd , 2012

Reference Books

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).

2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

3. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

dray

I B.Tech I Sem

15AME02-ENGINEERING MECHANICS

(Common for CE & ME)

L	T	P	C
3	1	0	3

Objective:

Through this course students will advance their development of the following specific capabilities:

1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.

UNIT I

Introduction of Engineering Mechanics - Basic concepts - System of Forces - Moment of Forces and its Application - Couples and Resultant of Force System - Equilibrium of System of Forces - Degrees of Freedom - Free body diagrams -Types of Supports - Support reactions for beams with different types of loading - concentrated, uniformly distributed and uniformly varying loading.

UNIT II

Friction: Types of friction- laws of Friction - Limiting friction- Cone of limiting friction- static and Dynamic Frictions - Motion of bodies - Wedge, Screw jack and differential Screw jack.

UNIT III

Centroid and Center of Gravity: Centroids of simple figures - Centroids of Composite figures - Centre of Gravity of bodies - Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids - Moment of Inertia of composite masses.(Simple problems only)

UNIT IV

Kinematics: Rectilinear and Curvilinear motion - Velocity and Acceleration - Motion of A Rigid Body - Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation - Central Forces of motion - Equations of Plane Motion - Fixed Axis Rotation - Rolling Bodies - Work Energy Method - Equation for Translation - Work Energy application to Particle Motion, Connection System - Fixed axis Rotation and Plane Motion.

UNIT V

Analysis of Perfect Frames: Types of frames - cantilever frames and simply supported frames - Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple Compound and Torsional pendulum- Numerical problems

Text Books:

1. Engineering Mechanics by Bavikatti - Pearson Education.
2. Engineering Mechanics by A.Nelson.
3. Engineering Mechanics - B. Bhattacharyya, Oxford University Publications.

Reference Books:

1. Engineering Mechanics by Fedrinand L.Singer - Harper Collings Publishers.
2. Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
3. Engineering Mechanics (Statics and Dynamics) by Hibller and Gupta; Pearson Education.
4. Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company.
5. Engineering Mechanics by Chandramouli, PHI publications.
6. Engineering Mechanics -Arthur P. Boresi and Richard J. Schmidt. - Brooks/Cole - Cengage Learning.

Course outcomes:

After learning this course, Students will be able to

- Solve for the resultants of any force systems
- Determine equivalent force systems
- Determine the internal forces in plane frames, simple span trusses and beams
- Solve the mechanics problems associated with friction forces
- Obtain the centroid, first moment and second moment of an area .
- Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference
- Analyze the forces causing the motion of a particle

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I B.Tech I Sem

15AHS02-ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

(Common For All Branches)

L	T	P	C
0	0	3	2

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives:

- To enable students to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

Syllabus:

UNIT-I

1. Phonetics -importance
2. Introduction to Sounds of Speech
3. Vowels and consonants sounds
4. Phonetic Transcription

UNIT-II

5. Word Stress
6. Strong and weak forms
7. Sentence stress and Intonation

UNIT-III

8. Communication skills –process & barriers
9. Role Plays & JAM
10. Describing people/objects/places

UNIT-IV

11. Debates & Group Discussions
12. Speeches for Special Occasions
13. Group Discussions
14. Interview skills

UNIT-V

15. Writing video speeches
16. Book reviews -oral and written

Minimum Requirement For Elcs Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

   System Requirement (Hardware component):

   Computer network with Lan with minimum 60 multimedia systems with the following specifications:

   i) P – IV Processor
      a) Speed – 2.8 GHZ
      b) RAM – 512 MB Minimum
      c) Hard Disk – 80 GB

   ii) Headphones of High quality

Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.

Reference Books:

1. Spring Board Success, Sharada Kouhik, Bindu Bajwa, Orient Blackswan, Hyderbad, 2010.
2. Technical English – Dr. M. Sambaiah- Wiley India Pvt. Ltd..NewDelhi. 2014.
3. A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian),2012.
4. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd
5. Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
6. A Hand book for English Laboratories, E.Suresh Kumar, P.Sreehari, Foundation Books,2011

Expected Outcomes:

- Become active participants in the learning process and acquire proficiency in spoken English.

Speak with clarity and confidence thereby enhance employability skills.

verified

I B.Tech I Sem

15ACS02-COMPUTER PROGRAMMING LAB

(Common For All Branches)

L	T	P	C
0	0	3	2

WEEK	LIST OF EXPERIMENTS
1	Practice DOS Commands necessary for design of C Programs.
2	Practice LINUX Commands necessary for design of C Programs.
3	Practice the Raptor Tool
4	a. Write a program to perform arithmetic operations. b. Write a program to exchange two numbers without using temporary variable c. Write a program to exchange two numbers with temporary variable d. Write a program to find the maximum of three numbers
5.	a. Write a program for s=ut+1/2at^2 b. Write a program to find area of square, circle and rectangle. c. Write a program to find the maximum of two numbers using ternary operator. d. Write a program for sum of first N natural numbers.
6	a. Write a program to compute the factorial of a given number. b. Write a program to check whether the number is prime or not. c. Write a program to check for number palindrome. d. Write a program to generate Fibonacci numbers in the given range.
7	a. Write a program to find the sum of the digits of a number. b. Write a program to find the sum of positive and negative numbers in a given set of numbers. c. Write a program to perform the operations addition, subtraction, multiplication of complex numbers. d. Write a program to find the sum of first and last digit numbers in a given number.
8	a. Write a program to read two matrices and print their sum and product in the matrix form. b. Write a program to find the maximum of a set of numbers. c. Write a program to read matrix and perform the following operations. a. Find the sum of Diagonal Elements of a matrix. b. Print Transpose of a matrix. c. Print sum of even and odd numbers in a given matrix.
9	a. Write a program to accept a line of characters and print the count of the number of Vowels, Consonants, blank spaces, digits and special characters. b. Write a program to insert a substring in to a given string and delete few characters from the string. Don't use library functions related to strings. c. Write a program to read two strings and perform the following operations without using built-in string Library functions and by using your own implementations of functions. i. String length determination ii .Compare Two Strings iii. Concatenate them, if they are not equal iv. String reversing
10	a. Write programs using recursion for Factorial of a number, GCD, LCM, Towers of Hanoi. b. Write a program for tic-tac-toe game. c. Write a program to implement numerical methods Lagrange's interpolation, Trapezoidal rule.

11	a. Write a program to exchange two numbers using pointers. b. Write a program to calculate the length of string using pointers. c. Write a program to using pointers to read in an array of integers and print its elements in reverse order. d. Write a program to generate pseudo random generator.
12	a. Write a program to evaluate the sum of the following series up to 'n' terms $e^x=1+x+x^2/2!+x^3/3!+x^4/4!+$-------- b. Write a program that prints a triangle of stars. Print 1 star in row 0, 3 stars in row 1, 5 stars in row 2, and so on. Here is what this looks like: For the non-star characters, use dot or space. ....*.......... ....***......... ....*****........ ....*******....... ......*********...... c. Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
13	a. Write a program to read last n characters of the file using appropriate file function. b. Write a program to copy the contents one of one file into another file using fgetc and fputc functions. c. A file consists of information about employee salary with fields employee id, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employee id, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions is user specified. Compute the Gross and Net salary of the employee and update the file.
14	a. Write a program to perform Base (decimal, octal, hexadecimal, etc) conversion b. Write a program to read a set of strings and sort them in alphabetical order. c. Write a program to Convert Decimal to Hexa Decimal? d. Write a program to Convert Binary to Decimal? e. **Write a Program to Add two numbers using Command Line Arguments.**

NEW PROGRAMS:

1. Write a program to implement magic square.
2. Write a program to print 50 students details using structures.
3. Write a program to create one structure and declare it inside union then accept values for structure members and display them.
4. Write a program to find the speed of ordinary, express, super luxury buses based on their distance and time.
5. Write c Program to accept N integer numbers and store even and odd integers in separate arrays.
6. Write a c program to input real numbers and find the mean, variance and standard deviation.

I B.Tech I Sem

15ABS04-ENGINEERING CHEMISTRY LAB
(Common for CE & ME)

L	T	P	C
0	0	3	2

Programme Objective:

- Will learn practical understanding of the redox reaction
- Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention
- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology

List Of Experiments

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Manganese by colorimetry.
5. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Alkalinity of Water
7. Determination of acidity of Water
8. Preparation of Phenol-Formaldehyde (Bakelite)
9. Determination of Viscosity of oils using Redwood Viscometer I
10. Determination of Viscosity of oils using Redwood Viscometer II
11. Conductometric titration of strong acid Vs strong base (Neutralization titration).
12. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
13. Estimation of Chloride ion using potassium Chromate indicator (Mohrs method)
14. Acid-Base neutralisation by pH method.

(Any 10 experiments from the above list)

Course Outcomes

- Would be confident in handling energy storage systems and would be able combat chemical corrosion
- Would have acquired the practical skill to handle the analytical methods with confidence.
- Would feel comfortable to think of design materials with the requisite properties
- Would be in a position to technically address the water related problems.

Text Books:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.

2. Chemistry Practical – Lab Manual by K.B.Chandra Sekhar, G.V. Subba Reddy and K.N.Jayaveera, SM Publications, Hyderabad, 3rd Edition, 2012.

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I B.Tech II Sem

15AHS03-ENGLISH FOR PROFESSIONAL COMMUNICATION

(Common for all Branches)

L	T	P	C
3	1	0	3

1. Introduction:

English is a global language and has international appeal and application. It is widely used in a variety of contexts and for varied purposes. The students would find it useful both for social and professional development. There is every need to help the students acquire skills useful to them in their career as well as workplace. They need to write a variety of documents and letters now extending into professional domain that cuts across business and research also. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed books serve the purpose of preparing them for everyday communication and to face the global competitions in future.

The texts prescribed for detailed study focus on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

2. Objectives:

1. To develop confidence in the students to use English in everyday situations.
2. To enable the students to read different discourses so that they appreciate English for science and technologies.
3. To improve familiarity with a variety of technical writings.
4. To enable the students to acquire structure and written expressions required for their profession.
5. To develop the listening skills of the students.

3. Syllabus:

UNIT –I

Reading : Lawley Road — R.K. Narayan
Writing: Emails - Application letters and curricula vitae
Listening: Listening for information
Functional English: Agreeing and disagreeing - Suggesting and advising
Grammar: Types Of sentences
Vocabulary: Compound words -Collocations
Non Detailed Study : Problem-Solving Skills

UNIT-II

Reading: Environmental Consciousness- Solution to Plastic Pollution-Soma Basu
Writing: Technical Note making -Memorandums – agenda-Official reports
Listening: Listening for facts

Functional English: Giving instructions - Asking for clarifications and permission
Grammar: Question tags
Vocabulary: Prepositions
Non Detailed Study: Interview Skills

UNIT-III

Reading: The Man Behind 'i'
Writing: Summaries –
Listening: Listening for the gist –
Functional English: Telephone skills
Grammar: Adjectives
Vocabulary: Conjunctions
Non Detailed Study: Adaptability Skills

UNIT-IV

Reading: The Bet — Anton Chekhov
Writing: Technical documentation-Concise writing-Paraphrases –
Listening: Listening for opinions -Presentations
Functional English: Individual Presentations
Grammar: Subject-verb agreement
Vocabulary: Phrasal verbs- Idioms.
Non Detailed Study: Non-Verbal Communication Skills

UNIT-V

Reading: The Gift of the Magi — O. Henry
Writing: Information transfer
Listening: Listening for opinions
Functional English: Group Presentations
Grammar: Active and passive voice
Vocabulary: Commonly confused words- One-word substitutes
Non Detailed Study: Written Communication Skills

Text books:

Detailed text: **English for Fluency** , K Purushottam,Orient Black Swan,2013.
Non detailed text: **English and soft skills,** S P Danavel, Orient Black Swan 2013Edition.

References:

1. **Mindscapes**, English For Technologists and Engineers, Orient Black Swan,2012.
2. **Effective Technical Communication,** Rizvi,Tata McGraw-Hill Education, 2007.
3. **Technical Communication,** Meenakshi Raman, Oxford University Press.2011.
4. **English Conversations Practice,** Grant Taylor, Tata Mc GrawHill publications,2013.
5. **Practical English Grammar.** Thomson and Martinet, OUP, 2010.

Expected Outcomes:

At the end of the course, students would be expected to:

1. Have acquired ability to participate effectively in group discussions.
2. Have developed ability in writing in various contexts.
3. Have acquired a proper level of competence for employability.

verified

I B.Tech II Sem

15ABS07-MATHEMATICS – II

(Common for all Branches)

L	T	P	C
3	1	0	3

Objectives: Our emphasis will be more on conceptual understanding and applications of Fourier series, Laplace transforms, Fourier transforms, Z transforms and solutions of partial differential equations.

UNIT – I

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of Laplace transforms – Applications of Laplace transform to ordinary differential equations of first and second order.

UNIT – II

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions- Parseval's formula- Complex form of Fourier series.

UNIT – III

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

UNIT – IV

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace's equation under initial and boundary conditions.

UNIT – V

z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.

References:

1. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Engineering Mathematics, Volume - II, E. Rukmangadachari, Pearson Publishers.

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Outcomes:

At the end of the course, the student will be able to attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications, using discrete and continuous transforms and partial differential equations.

I B.Tech II Sem

15ABS01-ENGINEERING PHYSICS
(Common for CE & ME)

L	T	P	C
3	1	0	3

Objectives:

1. To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
2. To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and non-destructive evaluation using ultrasonic techniques.
3. To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.
4. To open new avenues of knowledge and understanding semiconductor based electronic devices , basic concepts and applications of semiconductors and magnetic materials have been introduced which find potential in the emerging micro device applications.
5. To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in emerging technologies are elicited.

UNIT-I: Physical Optics, Lasers And Fibre Optics

Physical Optics: Interference (Review) – Interference in thin film by reflection –Newton's rings –Diffraction (Review) - Fraunhofer diffraction due to single slit, double slit and diffraction grating.

Lasers: Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients — Population inversion – Excitation mechanism and optical resonator – Nd:YAG laser - He-Ne laser – Semiconductor Diode laser - Applications of lasers

Fiber optics: Introduction - construction and working principle of optical fiber –Numerical aperture and acceptance angle – Types of optical fibers – Attenuation and losses in Optical fibers –Block diagram of Optical fiber communication system – Applications of optical fibers

UNIT-II: Crystallography And Ultrasonics

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes

in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Powder method.
Ultrasonics: Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

UNIT-III: Quantum Mechanics And Electron Theory
Quantum Mechanics: Matter waves – de'Broglie hypothesis and properties - Schrodinger's time independent wave equations – Physical significance of wave function - Particle in one dimensional infinite potential well.
Electron theory: Classical free electron theory – Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution – Source of electrical resistance – Kronig-Penny model (qualitative treatment) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

UNIT-IV Semiconductors And Magnetic Materials
Semiconductors: Intrinsic and extrinsic semiconductors (Qualitative treatment) – Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors – Formation of p-n junction.
Magnetic materials: Introduction and basic definitions – Origin of magnetic moments – Bohr magnetron – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials (Qualitative treatment) – Hysteresis - Soft and hard magnetic materials, applications of magnetic materials.

UNIT-IV: Superconductivity And Physics Of Nanomaterials
Superconductivity: Introduction - Effect of magnetic field - Meissner effect – Type I and Type II superconductors – Flux quantization – Penetration depth - BCS theory (qualitative treatment) — Josephson effects –Applications of superconductors.
Physics of Nanomaterials: Introduction - Significance of nanoscale and types of nanomaterials – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches: ball mill, chemical vapour deposition, and sol gel –Applications of nanomaterials.

Text books:
1. Engineering Physics – K.Thyagarajan, 5th Edition, MacGraw Hill Publishers, NewDelhi, 2014.
2. Physics for Engineers - N.K Verma, 1st Edition, PHI Learning Private Limited, Delhi,2014.

Reference Books:
1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, 10th Edition, S.Chand and Company, New Delhi, 2014.
2. Engineering Physics – D K Pandey, S. Chaturvedi, 2nd Edition, Cengage Learning, New Delhi, 2013.

3. Engineering Physics – D.K Bhattacharya, Poonam Tandon, 1nd Edition, Oxford University Press, New Delhi, 2015.

Outcomes:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with defects in crystals and ultrasonic non-destructive techniques.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and the bases for the band theory are focused.
- The properties and device applications of semiconducting and magnetic materials are illustrated.
- The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.

I YEAR II SEM

15ACS04-DATA STRUCTURES

(Common for ME, ECE and CSE)

L	T	P	C
3	1	0	3

UNIT-I

Stacks & Queues: stacks, stacks using dynamic arrays, Queues, circular queues using dynamic arrays, amazing problem, evaluation of expressions.

Linked List: single linked list and chains, representing chains in C, Linked stacks and queues, polynomials, additional list operations, equivalence classes, sparse matrices, double linked list.

UNIT –II

Trees : Introduction, Binary tree, Binary tree traversals , Additional binary tree operations, Threaded binary trees, Heaps, Binary search trees, Selection trees, Forests, Representation of disjoint sets, Counting binary trees.

UNIT-III

Graphs: The graph abstract data type, Elementary graph operations, Minimam cost spanning trees, Shortest paths and transitive closure.

Sorting: Motivation, Insertion sort, Quick sort, Merge sort , Heap sort, sorting on several keys, list and table sorts, external sorting.

UNIT –IV

Hashing: Introduction, Static hashing, dynamic hashing, Bloom Filters.

Priority Queues: Single ended and double ended priority queues, leftist trees, Binominal Heaps, Fibonacci Heaps, Pairing Heaps, Symmetric Min-Max Heaps, and Interval Heaps.

UNIT-V

Efficient binary search trees: Optimal binary search trees, AVL Trees, RED Black Trees, Splay Trees, M- Way search trees, B-Trees, B+ -Trees.

Text Books:

1. Fundamentals of Data structures in C, 2nd edition, HOROWITZ, SAHNI, ANDERSON-FREED.

I B.Tech II Sem

15AME01-ENGINEERING DRAWING

(Common for CE & ME)

L	T	P	C
3	1	0	3

Course Objective:

- By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.
- This course develops the engineering imagination i.e., so essential to a successful design, By learning techniques of engineering drawing changes the way one things about technical images.
- It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing is the language of engineers, by studying this course engineering and technology students will eventually be able to prepare drawings of various objects being used in technology.

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance-Conventions in Drawing-Lettering - BIS Conventions. Curves used in Engineering Practice.

a) Conic Sections including the Rectangular Hyperbola- General method only,
b) Cycloid, Epicycloids and Hypocycloid
c) Involutes

UNIT II

Projection of Lines: Inclined to one or both planes, Problems on projections, Finding True lengths. **Projections of Planes**: Projections of regular plane surfaces/figures, Projection of lines and planes using auxiliary planes.

UNIT III

Projections of solids: Projections of regular solids inclined to one or both planes – Auxiliary Views. **Sections of Solids**: Section Planes and Sectional View of Right Regular Solids- Prism, cylinder, Pyramid and Cone. True shapes of the sections.

UNIT IV

Development of Surfaces: Development of Surfaces of Right Regular Solids-Prism, Cylinder, Pyramid, Cone and their Sectional Parts.

UNIT V

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes Figures, Simple and Compound Solids-Conversion of isometric Projections/Views of Orthographic Views-Conventions.

Text Books:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai

Reference Books:

1. Engineering Drawing, Johle, Tata McGraw-Hill Publishers
2. Engineering Drawing, Shah and Rana,2/e, Pearson Education
3. Engineering Drawing and Graphics, Venugopal/New age Publishers
4. Engineering Graphics, K.C. John, PHI,2013
5. Engineering Drawing, Basant Agarwal/ C.M.Agarwal

Suggestions:

1. Student is expected to buy a book mentioned under Text books " for better understanding.
2. Students can find the applications of various conics in engineering and application of involute on gear teeth. The innovation for drawing can be had on line from introduction to engineering drawing with tools-youtube http-sewor,Carleton.ca/-g,kardos/88403/drawings.html conic sections-online, red woods.edu

This subject also paves the way for learing Auto Cad, CAD / CAM, CATIA and Pro E which are advanced software packages needed for every mechanical engineer (To be taught & examined in First angle projection). The skill acquired by the student in this subject is very useful in conveying his ideas to the layman easily.

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I YEAR II SEM

15AME04-BASIC MECHANICAL ENGINEERING

L	T	P	C
3	1	0	3

Course objectives: Student can be able to:

- Apply skills and understanding of Mechanical engineering sciences
- Test, evaluate and execute engineering solutions to problems and projects that are practical and of a complexity encountered in professional practice.
- Understand various Mechanical fields like Thermal, Production & Manufacturing
- Develop intellectually and technically through continued learning.

UNIT-I

Introduction: Introduction to Thermodynamics - Concept of a System – Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Zeroth Law, Energy Interactions - Heat and Work, Types of Work, Work interactions in a closed System for various processes

UNIT-II

First and Second Laws of Thermodynamics: First Law: Cycle and Process, Specific Heats (cp and cv), Heat interactions in a Closed System for various processes, Limitations of First Law, Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator), Efficiency/COP, Second Law: Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, Statement of Clausius Inequality, Property of Entropy, T-S and P-V Diagrams,

Internal Combustion Engines: IC Engines: 2 - Stroke and 4 - Stroke Engines, S.I. Engine and C.I. Engine: Differences, P-V and T-S Diagrams

UNIT-III

Manufacturing Processes: Engineering Materials: Classification, Properties of Materials, Manufacturing Processes: Metal Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working

UNIT-IV

Refrigeration System and Refrigerants: Principle and working of standard vapor compression refrigeration system and Brief description of Refrigerants

Power Transmission: Transmission of Mechanical Power: Belt Drives – Simple Numerical Problems, Gear Drives – Simple Numerical Problems

Basics of Automotive Vehicle: Lay out of Automobile Transmission; Brakes – Types, Clutch, Differential

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UNIT-V

Machine Tools and Machining Processes: Machine Tools Machine Tools: Lathe Machine, Lathe Operations, Milling Machine-Types, Milling Operations, Shaper and Planer Machines: Differences, Quick-Return Motion Mechanism, Drilling Machine: Operations, Grinding Machine: Operations

References:

1. Elements of Mechanical Engineering – M. L. Mathur, F. S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi.
2. Engineering Heat Transfer - Gupta & Prakash, Nem Chand & Brothers, New Delhi.
3. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.

Course outcomes

After completion of the course the student can be able to

- Apply fundamental concepts of Mechanical to problems in engineering applications
- Apply the knowledge gained to design a component or a system that meets the specific criteria
- Work on multi-disciplinary group projects to enhance interpersonal and leadership skills
- Make effective oral presentations of ideas on engineering design solutions

I YEAR II SEM

15AME05-ENGINEERING DRAWING THROUGH AUTOCAD LAB

L	T	P	C
0	0	3	2

Course objective:

Student should be able to:

- apply all basics commands in AutoCAD
- create produce 2D drawing
- Use the functions and commands of AutoCAD software to create isometric and three-dimensional drawings and models.

1. Introduction to Autocad like Starting AutoCAD, AutoCAD's Screen Layout, Working with Commands, Saving Your Work and AutoCAD's Cartesian Workspace.
2. Creating a Simple Drawing using Basic Drawing & Editing Commands like drawing a line, circle, pattern, rectangular, circles, Erasing Objects, Viewing Your Drawing and Undoing and Redoing Actions.
3. Making Your Drawings More Precise using commands like Object Snap, Object Snap Tracking, Drawing with SNAP and GRID, Selecting Objects for Editing, Moving, Copying, Rotating, Scaling, and Mirroring objects.
4. Drawing Organization and Information using Creating New Drawings With Templates, Layer State, Changing an Object's Layer, Getting Information From Your Drawing using Measuring Objects, Working with Properties Drawing Arcs, Drawing Polylines, Editing Polylines, Drawing Polygons and Drawing Ellipses.
5. Creating More Complex Objects using Advanced Editing Commands and Inserting Blocks like Trimming and Extending, Stretching Objects, Creating Fillets and Chamfers, Offsetting Objects, Creating Arrays of Objects, Inserting Blocks from Tool Palettes, Inserting Blocks using Insert, Inserting Blocks with Design Center.
6. Modeling of simple machine parts and components in 2D and 3D using auto CAD,
7. Annotating Your Drawing using some additional features like Working with Annotations Adding Text in a Drawing, Modifying Multiline Text, Formatting Multiline Text, Hatching, Dimensioning Concepts, Adding Linear Dimensions, Adding Radial and Angular Dimensions, Editing Dimensions, Adding Notes to Your Drawing

Course outcomes

After completing this course, students will be able to:

- Navigate the interface comfortably
- Use the fundamental features and precision drafting tools in AutoCAD to develop accurate technical drawings.
- Present drawings in a detailed and visually impressive manner

I B.Tech II Sem

15ABS02-ENGINEERING PHYSICS LABORATORY
(Common for CE and ME)

L	T	P	C
0	0	3	2

Lab Objective:

- Will recognize the important of optical phenomenon like Interference and diffraction.
- Will understand the role of optical fiber parameters and signal losses in communication.
- Will recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor
- Will understand the applications of B H curve.
- Will acquire a practical knowledge of studying the crystal structure in terms of lattice constant.
- Will recognize the application of laser in finding the particle size and its role in diffraction studies.
- Will learn to synthesis of the nano materials and recognize its importance by knowing its nano particle size and its impact on its properties.

Any 10 of the following experiments has to be performed

1. Determination of radius of curvature of a Plano-convex lens by forming Newton's rings.
2. Determination of wavelength of given source using diffraction grating in normal incidence method.
3. Determination of Numerical aperture, acceptance angle of an optical fiber.
4. Energy gap of a Semiconductor diode.
5. Hall effect – Determination of mobility of charge carriers.
6. B-H curve – Determination of hysteresis loss for a given magnetic material.
7. Determination of Crystallite size using X-ray pattern (powder) using debye-scheerer method.
8. Determination of particle size by using laser source.
9. Determination of dispersive power of a prism.
10. Determination of thickness of the thin wire using wedge Method.
11. Laser : Diffraction due to single slit
12. Laser : Diffraction due to double slit
13. Laser: Determination of wavelength using diffraction grating
14. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
15. Synthesis of nanomaterial by any suitable method.

Reference:

1. Engineering Physics Practicals – NU Age Publishing House, Hyderabad.
2. Engineering Practical physics – Cengage Learning, Delhi.

Lab Outcomes:

- Would recognize the important of optical phenomenon like Interference and diffraction.
- Would have acquired the practical application knowledge of optical fiber, semiconductor, dieclectric and magnetic materials, crystal structure and lasers by the study of their relative parameters.
- Would recognize the significant importance of nanomaterials in various engineering fields.

I B.Tech II Sem

15AME03-ENGINEERING AND IT WORKSHOP

(Common for all Branches)

L	T	P	C
0	0	3	2

PART A: ENGINEERING WORKSHOP

Course Objective:

- The objective of this Lab is to provide the basic concepts about different manufacturing processes, use of various workshops tools and exposer to the power tools.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Trades For Exercises:

At least 2 exercise in each:

1. Carpentry
2. Fitting
3. House-wiring
4. Foundry
5. Tin smithy
6. Welding.

Text Book:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/Scitech Publishers.
2. Workshop practice manual by K.Venkata Reddy B.S Publications

Codes / Tables : will be provided

Question Paper pattern : Test in any two trades out of 6 trades.

Course outcomes

- Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops.
- This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing.
- Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems.
- Workshop curricula build the hands on experiences which would help to learn manufacturing processes and production technology courses in successive semesters.

Workshop practice is also important since only practice can make the man perfect.

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I B.Tech II Sem

15AME03-ENGINEERING AND IT WORKSHOP

(Common for all Branches)

L	T	P	C
0	0	3	2

PART B: IT Workshop

Course Objectives:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Course Outcomes:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

Preparing your Computer (2 weeks)

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Productivity tools (6 weeks)

Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 5: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 6: Presentations : creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Task 7:ACCESS:

Optional Tasks:

Task 7: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material
- Air conditioner
- UPS and Inverter
- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

References:

1. "Introduction to Computers", Peter Norton, Mc Graw Hill
2. "LaTeX Companion" – Leslie Lamport, PHI/Pearson.
3. "MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.

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4. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
5. "Networking your computers and devices", Rusen, PHI
6. "Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH.

II B.Tech I Sem

15ABS08-MATHEMATICS-III

(Common for all Branches)

L	T	P	C
3	1	0	3

Objectives:

- This course aims at providing the student with the concepts and applications of Matrices, Numerical Techniques and Curve fitting.

UNIT – I

Elementary row transformations-Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations. Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonolization of matrix. Calculation of powers of matrix and inverse of a matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

UNIT – II

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.

UNIT – III

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT – IV

Curve fitting: Fitting of a straight line – Second degree curve – Exponentional curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Newton's – Cotes formula - Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT – V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive approximations-Euler's, Runge-Kutta 2nd and 4th order Methods– Milne's Predictor-Corrector Methods.

Text Books:

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

2.7.2018

References:

1. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Outcomes:

At the end of the course, student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.

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II YEAR I SEM

15AME07-MECHANICS OF SOLIDS

L	T	P	C
3	1	0	3

Course Objectives

- To solve advanced solid mechanics problems using classical methods Outcomes:
- To understand the theory of elasticity including strain/displacement and Hooke's law relationships;
- To analyze solid mechanics problems using classical methods and energy methods;
- To solve torsion problems in bars and thin walled members;
- To solve for stresses and deflections of beams under unsymmetrical loading;
- To locate the shear center of thin wall beams;
- To obtain solutions to column buckling and plate problems;

UNIT I

Simple Stresses & Strains: Elasticity and plasticity - Types of stresses & strains - Hooke's law - stress & strain diagram for mild steel - Working stress - Factor of safety - Lateral strain, Poisson's ratio & volumetric strain - Elastic moduli & the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain energy - Resilience - Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes- theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

UNIT II

Shear Force And Bending Moment : Definition of beam - Types of beams - Concept of shear force and bending moment - S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads - Point of contra flexure - Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT III

Flexural Stresses: Theory of simple bending - Assumptions - Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis -Determination bending stresses - section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections - Design of simple beam sections.

Shear Stresses: Derivation of formula - Shear stress distribution across various beams sections like rectangular, circular, triangular, I , T angle sections.

UNIT IV

Torsion Of Circular Shafts- Theory of pure torsion- Derivation of torsion equations; $T/J=q/r=N\theta/L$ - Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus.

Deflection Of Beams: Bending into a circular arc - slope, deflection and radius of curvature - Differential equation for the elastic line of a beam - Double integration and Macaulay's methods - Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems - Moment area method - application to simple cases including overhanging beams.

UNIT V

Thin Cylinders: Thin seamless cylindrical shells - Derivation of formula for longitudinal and circumferential stresses - hoop, longitudinal and Volumetric strains - changes in diameter, and volume of thin cylinders - Riveted boiler shells - Thin spherical shells.

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Thick Cylinders: Lame's equation - cylinders subjected to inside & outside pressure - compound cylinders.

Text Books:

1. Mechanics of Materials by Gere and Timoshenko, C B S Publishers & Distributors, 2nd Edition, 2004.
2. Strength of Materials by R.K. Bansal, Laxmi Publishers, 5th Edition,2012.
3. Strength of Materials by S S Rattan, The McGraw-Hill Companies, 2 Editon,2011

Reference Books:

1. Strength of Materials by S. Ramamrutham, Dhanpat Rai Publthishers

Course outcomes

Successful completion of this course, students should be able to:

- Understand the fundamental concepts of stress and strain and the relationship between both through the strain-stress equations in order to solve problems for simple tridimensional elastic solids.
- Calculate and represent the stress diagrams in bars and simple structures
- Solve problems relating to pure and non-uniform bending of beams and other simple structures.
- Solve problems relating to torsional deformation of bars and other simple tri-dimensional structures.
- Understand the concept of buckling and be able to solve the problems related to isolated bars Distinguish between isostatic and hiperstatic problems and be able to use various methods for the resolution of both.
- Be familiar with at least one software program for the evaluation of structures.

II YEAR I SEM

15ABEE01-BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common for ME and CSE)

L	T	P	C
3	1	0	3

PART-A: BASIC ELECTRICAL ENGINEERING

Objectives: This course aims at providing fundamental concepts of electrical circuits, DC, AC Machines and Electrical instruments, which help to increase knowledge and to apply principles in their applications

UNIT I: Fundamentals of Electrical Circuits & Instruments
Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, Series, Parallel circuits and Star-Delta and Delta-Star transformations.
Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT II: DC Machines
Principle of operation of DC Generator – EMF equation – types - DC motor types torque equation applications – Three point starter

UNIT III: AC Machines
Principle of Operation of alternators – regulation by synchronous impedance method principle of operation of induction motor – slip – torque characteristics – applications Principle of Operation of single phase transformers –EMF equation – losses –efficiency and regulation

TEXT BOOKS

1. Network Analysis – A Sudhakar, Shyammohan S.Palli, 3 ed., 2009. TMH Publications.
2. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand &Co.

REFERENCES

1. Network analysis and Synthesis – CL Wadhwa, 3 ed., 2007, New Age International Publishers.
2. Introduction to Electrical Engineering – M.S Naidu and S.Kamakshaiah, THM Publications.
3. Basic Electrical Engineering by Kothari and Nagarath, THM Publications, 2nd Edition

COURSE OUTCOME: Students able to apply fundamental concepts, principle of electrical engineering for their applications

V.S.
BoS – Chairman

Service course to M.E & CSE

R-15

II YEAR I SEM

15ABEE01-BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common for ME and CSE)

L	T	P	C
3	1	0	3

PART – B: BASIC ELECTRONICS ENGINEERING

Objective:

- The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering.

Course Outcomes:

Upon completion of the course, students will:

a. Analyze the operating principles of major electronic devices, its characteristics and applications.
b. Design and analyze the DC bias circuitry of BJT and FET.
c. Design and analyze basic transistor amplifier circuits using BJT and FET.

UNIT – IV

Semiconductor Devices: The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics, Applications of Diodes, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters.

UNIT – V

Transistors: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT in CB, CE and CC Configurations, Relation between I_C, I_B and I_E. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications-Transistor as an Amplifier, Transistor as a Switch, Single stage CE Amplifier-Response of CE amplifier.

UNIT – VI

Oscillators and Op-Amps: Sinusoidal Oscillators, Barkhausen Criteria for Oscillator Operation, Components of an Oscillator, Classification of Oscillators, LC Tuned, RC Phase Shift Oscillator circuits.

Symbol of an Op-Amp, Characteristics of an Ideal Op-Amp, Basic Forms of Op-Amps in open and closed loop-Inverting & Non-Inverting Amplifiers, Applications of Op-Amps, summing, subtractor, Comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press., 2008.

service course to
R-15
ME&CSE

REFERENCES:

1. Electronics Devices and Circuits Theory, R.L.Boylestad,Lousis Nashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, K. Lal Kishore, 3rd Edition, BSP, 2008.
3. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
4. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

II YEAR I SEM

15AME08-MATERIAL SCIENCE AND METALLURGY

L	T	P	C
3	1	0	3

Course Objectives

Student can be able to:

- Know the fundamental science and engineering principles relevant to materials.
- Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
- Have the experimental and computational skills for a professional career or graduate study in materials.
- Possess a knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.
- Be able to communicate effectively, to work in teams and to assume positions as leaders.

UNIT – I

Structure of Metals : Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

Constitution of Alloys : Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT -II

Equilibrium of Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

UNIT –III

Cast Irons and Steels : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys :

Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT –IV

Heat treatment of Alloys:

Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – V

Ceramic materials:

Crystalline ceramics, glasses, cermets, abrasive materials, nonmaterial's-definition, properties and application of the above.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Text Books :

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.
3. Materials Science and Engineering / William and collister.

References:

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Elements of Material science / V. Rahghavan
4. An introduction to materialscience / W.g.vinas & HL Mancini
5. Material science & material / C.D.Yesudian & harris Samuel
6. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
7. Engineering materials and metallurgy/R. K. Rajput/ S.Chand.

Course outcomes

After completion of this course the student will have:

- The ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
- The ability to integrate understanding of the scientific and engineering principles underlying the four major elements: structure, properties, processing, and performance related to material systems appropriate to the field
- The ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems

R-15

II YEAR I SEM

15AME09-THERMODYNAMICS

L	T	P	C
3	1	0	3

Course Objectives

During the course the students will develop their skills and knowledge in the following areas:

- Thermodynamic systems: properties and processes
- Calculations of changes in a thermodynamic system
- Calculations of applied thermodynamic systems

UNIT- I

Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic System, Surrounding, boundary, universe, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,.

Work & Heat Transfer: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

UNIT- II

First Law Of Thermodynamics: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I. Limitations of first law, thermal reservoir, heat pump, heat engine.

Flow Systems: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

UNIT- III

Second Law Of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II, Kelvin Flank statement.

Entropy And Availability: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability, Gibbs & Helmholtz functions.

UNIT- IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties, Rankine cycle.

THERMODYNAMIC RELATIONS: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius- Clapeyron equation.

UNIT-V

Properties Of Gases And Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases-Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles, P-V & T.S diagrams, Thermal Efficiency, mean effective pressure.

Note: Steam tables Mollier Diagrams Shall be supplied.

Text Books :

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.
3. Advanced thermodynamics – by R.Yadav
4. Thermal Engineering – by R.K. Raj put

References :

1. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd.
2. Thermodynamics by Chattopadhyay, oxford
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH
4. Thermodynamics – J.P.Holman, McGrawHill
5. An introduction to Thermodynamics, YVC Rao, New Age
6. Engineering Thermodynamics – Jones & Dugan

Course Outcomes

After the course the students must be able to:

- describe the four basic laws of thermodynamics.
- explain basic thermodynamic concepts such as temperature, pressure, work and heat
- describe state properties such as internal energy, enthalpy and entropy.
- apply state funktions for processes such as the steam expansion in a turbine
- define models for closed and open systems based on transport of heat, work and mass, and apply these on thermodynamic cycles. Apply thermodynamic models on ideal and real power cycles

II YEAR I SEM

15AME10-MATERIAL SCIENCE AND MECHANICS OF SOLIDS LAB

L	T	P	C
0	0	4	2

Course Objectives: The object of the course to make the student

- To understand the Microstructure of Engineering Materials.
- To Identify the Grain Boundary layers and Grains size of Different Engineering Materials.

(a) Material Science Lab

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – Carbon steels.
3. Study of Micro Structures of Cast Irons.
4. Study of Micro Structures of Non-Ferrous alloys.
5. Study of Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out hardness of various treated and untreated steels.

(b) Mechanics Of Solids Lab

Objective: The object of the course to make the student to understand the behaviour of materials under different types of loads.

List Of Exercises :

1. Tension test.
2. Torsion test.
3. Hardness test.
4. Shear test.
5. Spring test (compression & Expansion).
6. Izod test.
7. Charpy test

List Of Major Equipemnt:

1. UTM for conducting tension test on rods
2. Torsion testing machine
3. Brinnell's/Rock well's hardness testing machine.
4. Shear testing machine
5. Spring testing machine
6. IZod testing machine.

Course Outcomes:

After completion of this course the student can be able to

- Do the research on materials to develop the new Materials
- Apply the new materials on real applications
- Know the usage of materials in Design area.

II YEAR I SEM

15ABEE02- ELECTRICAL AND ELECTRONICS ENGINEERING LAB

(Common for ME and CSE)

L T P C
0 04 2

PART – A: ELECTRICAL LAB

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Open Circuit Characteristics of DC Shunt Generator.
4. Swinburne's Test on DC Shunt Machine(Predetermination of efficiency of a given DC shunt Machine Working as Motor and Generator).
5. Brake test on DC Shunt Motor. Determination of Performance Characteristics
6. OC &SC Tests on Single phase transformer (Predetermination of efficiency and regulation at given power factors)

V.Sia

Bos-Chairman

Service course to ME&CSE

R-15

II YEAR I SEM

15ABEE02- ELECTRICAL AND ELECTRONICS ENGINEERING LAB

(Common for ME&CSE)

L T P C
0 04 2

PART – B: ELECTRONICS LAB

Objectives: This Lab provides the students to get an electrical model for various semiconductor devices. Students can find and plot V-I characteristics of all semiconductor devices. Student learns the practical applications of the devices. They can learn and implement the concept of the feedback and frequency response of the small signal amplifier

Outcomes: Students able to learn electrical model for various semiconductor devices and learns the practical applications of the semiconductor devices

List Of Experiments:(For Laboratory Examination-Minimum of Six Experiments)

1. Identification, specifications and testing of R, L and C components (color codes), Potentiometers, Bread board, Identification and specification of active devices, Diodes, BJTs, low power JFETs, MOSFETs, UJTs, Linear and Digital ICs
2. P-N Junction Diode Characteristics
   a. Germanium Diode (Forward bias& Reverse bias)
   b. Silicon Diode (Forward bias only)
1. Zener Diode Characteristics
   a. V-I Characteristics
   b. Zener Diode act as a Voltage Regulator
2. Rectifiers (without and with c-filter)
   a. Half-wave Rectifier
   b. Full-wave Rectifier
3. BJT Characteristics (CE Configuration)
   a. Input Characteristics
   b. Output Characteristics
4. FET Characteristics(CS Configuration)
   a. Drain (Output) Characteristics
   b. Transfer Characteristics
5. Applications of Op-Amps:
   a. Summing
   b. Subtractor
   c. Differential

Equipment required for Laboratory

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. Bread Boards
11. Connecting Wires
12. CRO Probes etc.

II B.Tech I SEM

15AHS04-HUMAN VALUES AND PROFESSIONAL ETHICS

(Common for all Branches)

L	T	P	C
3	1	0	3

Objectives

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of Others

UNIT-I: Human Values

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

UNIT-II: Engineering Ethics

Senses of 'Engineering Ethics'- Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg's theory- Gilligan's theory- Consensus and controversy – Models of professional roles- Theories about right action- Self-interest - Customs and religion –Uses of Ethical theories – Valuing time –Cooperation – Commitment.

UNIT-III : Engineering As Social Experimentation

Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking –respect for persons.

UNIT-IV: Engineers Responsibility For Safety And Risk

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer- Designing for safety.

UINIT-V: Global Issues

Globalization – Cross Cultural issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics and Research – Analyzing Ethical Problems in research – Intellectual property Rights(IPR).

Out Comes:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
- Identify the multiple ethical interests at stake in a real-world situation or practice
- Articulate what makes a particular course of action ethically defensible
- Assess their own ethical values and the social context of problems

- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research

Text Books

1. Engineering Ethics includes Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. Engineering Ethics by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – TMH- 2003.
4. Professional Ethics and Morals by Prof.A.R.Aryasri, Dharanikota Suyodhana, Maruthi Publications.
5. Professional Ethics and Human Values by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
6. Professional Ethics and Human Values by Prof.D.R.Kiran-
7. Indian Culture, Values and Professional Ethics by PSR Murthy-BS Publication.

Verified

II B.Tech II Sem

15ABS09-PROBABILITY AND STATISTICS

(Common for CE, ME and CSE)

L	T	P	C
3	1	0	3

Objectives: To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, Statistical Quality Control and Queuing theory

UNIT – I

Basic concepts of Probability – Random variables – Expectation – Discrete and continuous Distributions – Distribution functions. Binomial, Poisson and Normal distributions – Related properties.

UNIT – II

Test of Hypothesis: Population and Sample - Confidence interval of mean from Normal distribution - Statistical hypothesis - Null and Alternative hypothesis - Level of significance. Test of significance - Z test for means and proportions.

UNIT – III

Small samples - t- test, F-test and Chi-square test (testing of goodness of fit and independence).

UNIT – IV

Statistical Quality Control: Concept of quality of a manufactured product -Defects and Defectives - Causes of variations - Random and assignable - The principle of Shewhart Control Chart-Charts for attribute and variable quality characteristics- Constructions and operation of $\overline{X}$ - Chart, R-Chart, p - Chart and C-Chart.

UNIT – V

Queuing Theory: Pure Birth and Death process, M/M/1 & M/M/S & their related simple problems.

Text Books:

1. Probability and Statistics for Engineers by Richard A. Johnson, 8th edition, PHI Learning Private Ltd.-2011.
2. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
3. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.

References:

1. Operations Research by S.D. Sharma, KEDAR NATH RAM NATH, Publications.
2. Statistical methods by S.P. Gupta, S.Chand publications.

2.7.18

3. Probability and Statistics for Engineers and Scientists by Ronald E. Walpole, Sharon L. Myers and Keying Ye, Pearson eighth edition.
4. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.

Outcomes:

At the end of the course, the student will be able to analyze the problems of engineering & industry using the techniques of Probability, Statistics and Queuing theory and draw appropriate inferences.

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II YEAR II SEM

15AME16-KINEMATICS OF MACHINERY

L	T	P	C
3	1	0	3

Course Objectives:

On completing the course, the student will be able to:

- Understand the fundamentals of the theory of kinematics and dynamics of machines.
- Understand techniques for studying motion of machines and their components.
- Use computer software packages in modern design of machines.

UNIT – I

Mechanisms And Machines: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain.Mobility of mechanisms.

UNIT-II

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types – Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

UNIT – III

Kinematics

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

Gears: Higher pairs, toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference.Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and Worm gearing.

Gear Trains: Introduction –Types of gears – Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains.Differential gear of an automobile.

UNIT – V

Cams: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal and uniform acceleration–and retardation Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

Analysis Of Motion Of Followers: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

Text Books :

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers.
2. The Theory of Machines, J.E. Shiegley, McGraw Hill .
3. Theory of Machines, Thomas Bevan, CBS.

References :

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
3. Theory of machines, P.L. Ballaney, Khanna Publishers.
4. Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers

Course Outcomes

Upon successful completion of this course, the student will be able to:

- Distinguish kinematic and kinetic motion.
- Identify the basic relations between distance, time, velocity, and acceleration.
- Apply vector mechanics as a tool for solving kinematic problems.
- Create a schematic drawing of a real-world mechanism.
- Determine the degrees-of-freedom (mobility) of a mechanism.

Suggestions:

Students may visit nearby machine tool shops and automobile workshops to know about different mechanisms, gears, gear trains, flexible drives and cams. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

Web References :

http://nptel.iitk.ac.in
http://ptumech.loremate.com/tom1/node/1
http://www.youtube.com/watch?v=6coD3oOuhr8

II YEAR II SEM

II YEAR II SEM

15AME17-THERMAL ENGINEERING

L	T	P	C
3	1	0	3

Course Objectives

- To make students familiar with the design and operating characteristics of modern internal combustion engines
- To apply analytical techniques to the engineering problems and performance analysis of internal combustion engines
- To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions
- To introduce students to the environmental and fuel economy challenges facing the internal combustion engine
- To introduce students to future internal combustion engine technology and market trends

UNIT-I

I.C. Engines : Definition of Engine and Heat Engine, I.C Engine Classification – Parts of I.C. Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C. Engines SI & CI Engines, Valve and Port Timing Diagrams.

UNIT-II

S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems.

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System, Lubrication Systems-Flash, Pressurized and Mist Lubrication.

Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

UNIT-III

Combustion Of I.C Engines

S I engine : Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

UNIT – IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

UNIT-V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

- **Students are advised to refer the text book of "Internal Combustion Engine Fundamentals" by John B. Heywood.**

Text Books:

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.

References:

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons.
2. Internal Combustion Engines by K.K. Ramalingam, Scitech Publications.
3. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI
4. Thermal Engineering, Rudramoorthy - TMH
5. Thermodynamics & Heat Engines, B. Yadav, Central Book Depot., Allahabad
6. I.C. Engines, Heywood, McGrawHIll.
7. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
8. Thermal engineering data book-B.Srinivasulu Reddy, JK International Pub.
9. I.C Engines by S.S Thipse – Jaico

Course outcomes

After Completion of this course the student can be able to:

- Exposure to the engineering systems needed to set-up and run engines in controlled laboratory environments
- Develop skills to run engine dynamometer experiments
- Learn to compare and contrast experimental results with theoretical trends, and to attribute observed discrepancies to either measurement error or modeling limitations
- Develop an understanding of real world engine design issues
- Develop an ability to optimize future engine designs for specific sets of constraints (fuel economy, performance, emissions)

Web Resources

http://autoclub.rso.siuc.edu/frange.html
http://www.howstuffworks.com/engine1.htm
http://inventors.about.com/library/inventors/blinternalcombustion.htm
http://www.animatedengines.com/

II YEAR II SEM

15AME18-FLUID MECHANICS AND HYDRAULIC MACHINERY

L	T	P	C
3	1	0	3

Course Objectives:

- The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

UNIT - I : Fluid Statics: Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapour pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

Fluid Kinematics: stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

Fluid dynamics: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.

UNIT – II: Conduit Flow: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine current meter.

UNIT – III: Turbo Machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

Hydroelectric Power Stations: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

UNIT – IV: Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies hydraulic design-draft tube- theory- functions and efficiency.

Performance Of Hydraulic Turbines : Unit and specific quantities, characteristic c governing of turbines, selection of type of turbine, cavitation, surge tank, hammer.

UNIT – V: Centrifugal Pumps: Classification, working, work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves, NPSH.

Text Books :

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics by FM Streeter, TMH
3. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.

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Reference Books :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &.
2. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age Internat.
3. hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004

Course Outcomes

- Read and follow directions for laboratory experiments.
- Operate fluid flow equipment and instrumentation.
- Collect and analyze data using fluid mechanics principles and experimentation methods.
- Prepare reports following accepted writing and graphical techniques.
- Perform exercises in small teams.
- Demonstrate principles discussed in Fluid Mechanics lecture course.
- Student can able to identify the type of turbine with known specific speed.
- Student can able to identify and design the pumps with known specific speed and manometric head

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II YEAR II SEM

15AME19-MACHINE DRAWING

L	T	P	C
3	1	0	3

Course Objectives:

- To make the students understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.
- To make the students understand and draw assemblies of machine parts and to draw their sectional views

UNIT- I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions

a) Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.

b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

c) Title boxes, their size, location and details-common abbreviations & their liberal usage

Learning Outcomes & Suggested Student Activities

This unit is useful to prepare the students for representing their ideas at International standards and will be able to convey in without much effort globally with ease. Students will acquire skills to draft on a drawing sheet without much effect. Students are advised to visit machine shop.

UNIT-II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws,

b) Keys, cottered joints and knuckle joint,

c) Rivetted joints for plates, welding joints.

d) Shaft coupling, spigot and socket pipe joint.

e) Journal and foot step bearings.

Learning Outcomes & Suggested Student Activities

Students can represent various details of an object quickly without much time and ambiguity. These drawings can be easily prepared and understood by both the people in a manufacturing industry and the consumers too. Students are advised to visit machine shop.

UNIT- III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.

a) Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.

b) Other machine parts- Screw jack, Machine Vice, single tool post, swivel joint.

c) Valves: Steam stop valve, feed check valve. Non return value.

Learning Outcomes &Suggested Student Activities

Students can understand the working principles of an assembly or subassembly so that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still produce any useful product serving effectively. It is not necessary that all the components to be made locally only. Students are advised to visit body building and assembly unit.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text Books:

1. Machine Drawing- K.L. Narayana, P.Kannaiah&K.Venkata Reddy, New Age Publishers
2. Machine Drawing- Dhawan, S.Chand Publications

References:

1. Machine Drawing- P.S. Gill.
2. Machine Drawing- Luzzader
3. Machine Drawing – Rajput
4. Textbook of Machine Drawing-K.C.John,2009, PHI learning

Suggestions:

1. Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.
2. Student should visit an automobile shop while the unit is being disassembled / assembled. Student should go through the exercises given under assembly drawings refereeing to various books in the library to improve his assimilation capacity.

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II YEAR II SEM

15AME20-MANUFATURING TECHNOLOGY

L	T	P	C
3	1	0	3

Course Objectives

- analyse the practical applications of a variety of forming and machining processes;
- analyse and formulate the costs of various manufacturing processes in terms of fixed and variable costs and break even point;
- formulate practical design methods to materials working techniques;
- interpret the geometry of tooling used on various metal cutting machines;
- analyse the effects of heat, lubrication and various cutting tool materials on the metal cutting process.

UNIT – I

Casting: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Principles of Gating, Gating ratio and design of Gating systems, Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment.

Methods of Melting: Crucible melting and cupola operation, steel making processes.

UNIT – II

Welding: Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

Cutting of Metals: Oxy – Acetylene Gas cutting, Plasma Cutting , Inert Gas welding, TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive non-destructive testing of welds.

UNIT – III

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, plastic blow and injection moulding, Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.

UNIT- IV

Extrusion Of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

Forging processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

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UNIT - V

Plastic –types, properties and their applications; processing of plastic – different methods – blow and injection molding, process capabilities and equipment details. Ceramic – Processing of different types of ceramics- compaction of metal powders, sintering, finishing operations, process capabilities.

Text Books:

1. Manufacturing Technology / P.N. Rao/TMH
2. Manufacturing Technology/ kalpakjian, Pearson education

References:

1. Production Technology / R.K. Jain
2. Process and materials of manufacturing –Lindberg/PE
3. Principles of Metal Castings / Rosenthal.
4. Welding Process / Paramar
5. Manufacturing Technology / R.K. Rajput, Laxhimi Pub
6. Workshop Technology Vol-, by Raghuvamsi

Course Outcomes

- examine the principles associated with basic operations involving the forming, machining and welding of engineering materials;
- interpret the advantages and limitations of each process and its influence on the properties of the material in the finished component;

analyse the basic processes used in performing forming, machining and welding operations on engineering materials;

II YEAR II SEM

15AME21-THERMAL ENGINEERING LAB

L	T	P	C
0	0	4	0

Course Description & Objectives: Students undergoing this course would gain knowledge about the working of I.C engines and will have the knowledge about the working of ignition and fuel system.

1. Valve Timing Diagram of 4 Stroke Diesel Engine
2. Port Timing Diagram of Single Cylinder 2 - Stroke Petrol Engine
3. Assembly and Disassembly of Diesel and Petrol Engines
4. Performance Test on 2 - Stage Reciprocating Air Compressor
5. Performance Test on 2 – Stroke Single Cylinder Petrol Engine Coupled to D.C Generator Loaded Resistance Rheostat with Motoring Test Rig
6. Performance Test on 4 – Stroke 4 Cylinder Petrol Engine Coupled to D.C Generator Loaded Resistance Rheostat with Motoring Test Rig
7. Performance Test on Refrigeration Test Rig
8. Performance Test on Air Conditioning Test Rig
9. Study of Boilers
10. Demonstration of Diesel and Petrol engines by cut models.

Course Outcomes:

Upon the successful completion of the course, learners will be able to:

- Explain the various working cycles of engine
- Describe the various types of combustion in IC engines.
- Illustrate the engine combustion parameters.
- Describe the different types of modern engines.

Explain the modern electronic engine management system (EMS) of IC engines.

II YEAR II SEM

15AME15-FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

L	T	P	C
0	0	4	2

Objective: The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

Syllabus :

1. Impact of Jets on Vanes.
2. Performance test on Pelton wheel.
3. Performance test on Francis turbine.
4. Performance test on Kaplan turbine.
5. Performance test on Single Stage Centrifugal Pump.
6. Performance test on Multi Stage Centrifugal Pump.
7. Performance test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of Friction factor for a given Pipe Line.
11. Determination of Loss of Head due to Sudden Contraction in a Pipeline.
12. Turbine Flow meter.

Course outcomes:-

Students who successfully complete this course will have demonstrated an ability to:

- Identify, name, and characterize flow patterns and regimes.
- Understand basic units of measurement, convert units, and appreciate their magnitudes.
- Utilize basic measurement techniques of fluid mechanics.
- Discuss the differences among measurement techniques,

III B.Tech I Semester

15AHS05 – MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common for CE and ME)

L	T	P	C
3	1	0	3

Course Objective:

Prepare engineering students to analyze cost/revenue data and carry out make economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis.

UNIT-I

Introduction to Managerial Economics & Demand Analysis: Definition of Managerial Economics, Characteristics and Scope – Managerial Economics and its relation with other subjects- Basic economic tools in Managerial Economics.

Demand Analysis: Meaning- Demand distinctions- Demand determinants- Law of Demand and its exceptions.

Elasticity of Demand & Theory of Production and Cost Analysis: Definition -Types of Elasticity of demand - Measurement of price elasticity of demand: Total outlay method, Point method and Arc method- Significance of Elasticity of Demand.

UNIT-II

Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting - Forecasting demand for new products- Criteria of a good forecasting method.

Theory of Production and Cost Analysis: Production Function- Isoquants and Isocosts, MRTS, Cobb-Douglas Production function.

Cost Analysis: Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break even analysis -Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP.

UNIT -III

Introduction to Markets & Pricing Policies: Market structures: Types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition.

Pricing Policies: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Bundling Pricing, and Peak Load Pricing.Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model, Smart market mechanism model.

UNIT-IV

Types of Industrial Organization & Introduction to business cycles: Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types.

Introduction to business cycles: Meaning - Features of business cycles.

Capital and Capital Budgeting: Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples of capital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems).

UNIT V

Introduction to Financial Accounting: Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts (with simple adjustments) - Limitations of Financial Statements.

Interpretation and analysis of Financial Statement: Ratio Analysis – Liquidity ratios, Profitability ratios and solvency ratios – Preparation of changes in working capital statement and fund flow statement.

LEARNING OUTCOMES:

1. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
2. Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

Text Books:

1. J.V. PrabhakarRao: Managerial Economics and Financial Analysis, Maruthi Publications, 2011
2. N. AppaRao. & P. Vijaya Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi, 2011

References:

1. A R Aryasri - Managerial Economics and Financial Analysis, TMH 2011
2. Suma damodaran- Managerial Economics, Oxford 2011
3. S.A. Siddiqui& A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, 2011.

III B.Tech I Semester

15AME24 - DYNAMICS OF MACHINERY

L	T	P	C
3	1	0	3

Course objective:

- To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

UNIT I

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Brakes and Dynamometers: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers - absorption and transmission types, General description and methods of operation.

Learning outcome & suggested Student Activities:

After completion of this unit, students are able to solve the numerical problems on brakes, students can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. Students ,may go through text books given for more number of problems on brakes and dynamometers.

UNIT II

Turning Moment Diagrams And Fly Wheels: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed - Fly wheels and their design, Fly wheels for Punching machines.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to design a flywheel for IC engine. Students may go through text books given for more number of problems on flywheels.

UNIT III

Governors: Watt, Porter and Proell governors. Spring loaded governors - Hartnell and Hartunggovernors with auxiliary springs. Sensitiveness, isochronism and hunting.Effort and power of a governor.

Learning outcome & suggested Student Activities:

The outcome of this unit is to study the basics and definitions related to governors and forces acting on various governors. After completion of this unit students are able to solve numerical problems on different governors. Students may go through text books given for more number of problems on governors.

UNIT IV

Balancing: Balancing of rotating masses - single and multiple - single and different planes.

Balancing Of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples,V-engine, multi cylinder in- line and radial engines for primary and secondary balancing.

Learning outcome & Suggested Student Activities:

After completion of this unit students can solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines. Students may go through text books given for more number of problems on balancing of rotating masses and balancing of reciprocating masses in locomotives and IC engines.

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UNIT V

Vibration: Free and forced vibration of single degree of freedom system- undamped and damped, Simple problems on free, forced and damped vibrations. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, whirling of shafts and critical speeds. Vibration Isolation & Transmissibility. Raleigh's method.

Torsional Vibrations – undamped - two and three rotor systems.

Learning outcome & Suggested Student Activities:

Upon completion of this unit, the student will perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. Students may go through text books given for more number of problems on single degree of freedom system, transverse and torsional vibrations.

TEXT BOOKS:

1. Theory of Machines by R.S.Khurmi and Guptha.
2. Theory of Machines, S.S. Rattan, MGH Publishers, 3rd Edition, 2013.
3. Theory of Machines by P.L Ballaney – Lakshmi Publications.

REFERENCE BOOKS:

1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition, 2012.
2. The theory of Machines, J.E. Shiegley, McGraw Hill .
3. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

NOTE: End Exam Should be conducted in Drawing Hall.

SUGGESTED LINKS:

- http://nptel.iitm.ac.in/video.php?subjectId=112104114
- http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html
- http://nptel.iitm.ac.in/video.php?subjectId=112104121,
- http://www.youtube.com/watch?v=FA04XFpJgwE
- http://www.youtube.com/watch?v=FydJu1A1oeM&list=PL46AAEDA6ABAFCA78&index=7

III B.Tech I Semester

15AME25 - MACHINE TOOLS

L	T	P	C
3	1	0	3

Course Objective:

- The objectives of this course are to introduce to demonstrate the fundamentals of machining processes and machine tools.
- To develop knowledge and importance of metal cutting parameters, tool materials, cutting fluids and tool wear mechanisms.
- To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes.

UNIT I

Elementary treatment of metal cutting theory - Elements of cutting process - Geometry of single point tool and angles, chip formation and types of chips - built up edge and its effects, chip breakers. Mechanics of orthogonal cutting -Merchant's Force diagram, cutting forces - cutting speeds, feed, depth of cut, heat generation, tool life, machinability. cutting Tool materials and cutting fluids -types and characteristics .

Learning outcome & suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the interface in the machining zone between the tool and the work piece and how the physical and mechanical parameters dictate the cutting performance.

UNIT II

Engine lathe - Principle of working- specification of lathe - types of lathes - work holders and tool holders -Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes - collet chucks - other work holders - tool holding devices - box. Principal features of automatic lathes - classification - Single spindle and multi-spindle automatic lathes.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of turning. Student shall be made familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation.

UNIT III

Drilling and Boring Machines - Principles of working, specifications, types, operations performed - tool holding devices - twist drill - Boring tools - machining time calculation. Shaping, Slotting and Planning machines -Principles of working - Principal parts - specification, classification, Operations performed. Machining time calculations

Learning outcome & suggested Student Activities:

After completion of this unit students are able to understand the basic principle of drilling, boring, shaping and planning operation, parts of the drilling, boring, shaping and planning machines and tool holding devices, operations performed on drilling, shaping and planning and machining time calculations.

UNIT IV

Milling Machine - Principles of working - specifications - classifications of milling machines - Principal features - machining operations, Types and geometry of milling cutters- methods of

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indexing - Accessories to milling machines.

Grinding Machine -Theory of grinding - classification- cylindrical and surface grinding machine - Tool and cutter grinding machine - special types of grinding machines - Grinding wheel: Different types of abrasives - bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels.Lapping, Honing and Broaching machines.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation, parts of the milling machine and types of milling and grinding machines.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures - Principles of location and clamping - Types of clamping & work holding devices, Typical examples of jigs and Fixtures.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures - Principles of location and clamping. Some examples of jigs and fixtures.

TEXT BOOKS:

1. Manufacturing Technology: Metal Cutting and Machine Tools, 3e (Volume 2), P.N.Rao, Tata McGraw-Hill Education.
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012.

REFERENCE BOOKS:

1. Manufacturing Technology-Kalpakzian- Pearson.
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2ndeditstion, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1 edition, 2001
4. Production Technology by K.L.Narayana, IK International Pub.
5. Unconventional Machining process by V.K.Jain, Allied Pub
6. Machining and machine tools by AB. Chattopadyay, WileyEdn,2013
7. Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Taylor and Francies

SUGGESTED LINKS:

www.hgfarley.com
www.kennametal.com/ - United States
www.mini-lathe.com/links.htm;machinedesign.com/.../designer-s-guide-tometalcutting-machinery-0608 - www.metalwebnews.com/wc.html
www.britannica.com/EBchecked/topic/463000/planer www.americanmachinist.com
www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm

III B.Tech I Semester

15AME26 - ELEMENTS OF MACHINE DESIGN

L	T	P	C
3	1	0	3

Course Objective:

- The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied.
- This subject will help to the students to learn to analyze and design basic machine elements in mechanical systems.
- By this subject student will become familiar on design principles, materials selection, stresses developed in machine elements under different loads.
- The students will also get knowledge on design of the permanent and temporary joints.

UNIT I

Introduction: General considerations of design, design process. Selection of Engineering Materials - properties -Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

Stresses In Machine Members: Simple stresses - Combined stresses - Torsional and bending Stresses - impact stresses - stress -strain relation - Various theories of failure - factor of safety.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are capable to apply design procedures using theories of failure for different elements.

UNIT II

Design For Fluctuating Loads: Stress concentration -notch sensitivity - Design for fluctuating stresses - Endurance limit - Estimation of Endurance strength - Goodman's line - Soderberg's line. Design of components for finite and infinite life.

Learning Outcome & Suggested Student Activities:

After completion of this chapter students are able to design simple components under cyclic loading using Goodman"s and Soderberg"s criterions.

UNIT III :

Bolted Joints: Forms of screw threads, stresses in screw fasteners, Design of bolts with pre stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength

Welded Joints: Weld Symbols, Strength of fillet welded joints, stresses in welded joints, Eccentric loading in welded joints.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design bolted joints with different configuration, eccentric loading design of bolted joints. Further students are able to design welded joints with direct loading and eccentric loading.

UNIT IV

Design of Cotters and Knuckle Joints: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

Design of Shafts: Design of solid and hollow shafts for strength and rigidity - Design of shafts for combined bending and axial loads - Standard shaft sizes.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design cotter joint, knuckle joint and shafts

UNIT V

Design Of Mechanical Springs: Stress and deflections of helical Springs-Springs for fatigue loading - Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs.

Learning Outcome & Suggested Student Activities:

After completion of this unit, students are able to design helical sprigs for two wheel vehicle and laminated springs for trucks.

TEXT BOOKS:

1. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi.
2. Design of Machine Elements, V.B.Bhandari , TMH Publishers.
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi.
2. Machine Design, Schaum series, TMH Publishers, New Delhi.
3. Mechanical Engineering Design, JosephE.Shigely, TMH Publishers, New Delhi.
4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.
5. Machine Design, Pandya and Shah, Charotar Publishers, Anand.
6. Machine Design, R.L. Norton, Tata McGrawHill Publishers.
7. Machine Design by Groover - CBS Publications.

NOTE: Design data books are not permitted in the examinations.

SUGGESTED LINKS:

http://machinedesign.com/
http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6
http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8
http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19

III B.Tech I Semester

15AME27 - HEAT TRANSFER

L	T	P	C
3	1	0	3

Course Objective:

The students will gain the ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques , tools and skills required to solve typical thermal related problems, the analysis of energy flows in complicated systems and the design of efficient heat transfer equipments. Enables the student to utilize analogies to solve heat transfer problems. Further students gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

UNIT I

Introduction: Modes and Mechanisms of Heat Transfer - Basic Laws of Heat Transfer - General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation - General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates. Simplification and Forms of the Field Equation - Steady, Unsteady and Periodic Heat Transfer - Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres - Overall Heat Transfer Coefficient - Electrical Analogy - Critical Radius/Thickness of Insulation

Learning Outcome & Suggested Student Activities:

After the completion of the unit, student can able to grasp the concept of steady state conduction. Student can learn representing conduction equation in various forms. Student can imply concept successfully to problems encounter in day to day life

UNIT II

Heat Transfer in Extended Surface (Fins) - efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance - Significance of Biot and Fourier Numbers - Chart Solutions of Transient Conduction Systems - Problems on Semi-infinite Body.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student is expected understand the concept of extended surfaces and its applications. Also, student can aware transient heat conduction and how it vary w.r.t time. Student is expected to develop the ability to formulate practical conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution technique and evaluating the significance of results.

UNIT III

Convective Heat Transfer: Dimensional Analysis - Buckingham Π Theorem and Its Application for Developing Semi - Empirical Non-Dimensional Correlations for Convective Heat Transfer - Significance of Non-Dimensional Numbers - Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over - Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths - Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate - Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Learning outcome & Suggested Student Activities:

At the end of the chapter, Student will have the ability to formulate practical forced and natural convection heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance.

UNIT IV

Heat Transfer With Phase Change: Boiling, Pool Boiling - Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation - Nusselt's Theory of Condensation on a Vertical Plate - Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers - Overall Heat Transfer Coefficient and Fouling Factor - Concepts of LMTD and NTU Methods - Problems using LMTD and NTU Methods.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student will be able to calculate heat transfer in condensation and boiling systems, turbulent and laminar film condensation. Student can understand the concepts of critical heat flux and different models of critical heat flux. Student can able to grasp the fundamentals of heat exchangers and its analysis.

UNIT V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation - Irradiation - Total and Monochromatic Quantities- Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann - Heat Exchange Between Two Black Bodies - Concepts of Shape Factor - Emissivity - Heat Exchange Between Gray Bodies - Radiation Shields - Electrical Analogy for Radiation Networks.

Learning outcome & Suggested Student Activities:

At the end of the unit, student can have knowledge on fundamental laws of radiative heat transfer. Also, student can understand the concept of radiative heat transfer between black bodies and grey bodies. Student can know radiation shields and their applications. Student can determine shape factor for different geometries and can know its importance in determining radiative heat transfer.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International.
2. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001.

REFERENCE BOOKS:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011.
2. Heat Transfer, Ghoshdastidar, Oxford Univ. Press, 1st edition, 2004.
3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012.
4. Fundamentals of Heat and Mass Transfer, Kodandaraman, C.P., 3/e, New Age Publ.
5. Fundamentals of Heat and Mass Transfer, Incropera, 5/e, Wiley India.

6. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007

NOTE: Heat transfer Data books are permitted for Exam.

Web References:

- http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304
- http://web.cecs.pdx.edu/~gerry/heatAnimations/sphereTransient/#TOC
- http://www.youtube.com/watch?v=9WwSaIP5pbs
- http://www.youtube.com/watch?v=HIYCR7gXXFo;
- http://www.youtube.com/watch?v=S57nIs503fA
- http://energy.concord.org/ir/experiments-page3.html
- http://www.youtube.com/watch?v=cMmREKOhIV8
- http://www.youtube.com/watch?v=HiX7DKUIAOM
- http://www.youtube.com/watch?v=Gu1ApKpcxQc
- http://energy.concord.org/ir/experiments-page5.html

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III B.Tech I Semester

15AME30 - ADVANCED THERMAL ENGINEERING

L	T	P	C
3	1	0	3

Course Objective:

- This subject is designed to provide a sound knowledge in various aspects of thermal equipment's.
- This subject has an increasingly dominant role to play in the vital areas of power generation ,Automobiles, R&AC and energy sector. .

UNIT I

Basic Concepts: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance - Regeneration - Reheating- Combined- Cycles.

Learning Outcome & Suggested Student Activities:

Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation.

Students are advised to be acquainted with the terms related to steam, steam tables and mollierchart. Also, students are advised to visit the thermal power station to get real expose.

UNIT II

Boilers: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers

Steam Condensers: Requirements of steam condensing plants – Classification of condensers – working principles of different types – vacuum efficiency and condenser efficiency, air pump – cooling water requirement

Learning Outcome & Suggested Student Activities:

Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator. Students are advised to visit the Boilers in the power generation units to get better expose.

UNIT III

Steam Nozzles: Function of Nozzle - Applications - Types, Flow through Nozzles, Thermodynamic Analysis - Assumptions - Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line -Shock at the Exit.

Learning Outcome & Suggested Student Activities:

Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations. Student can able to understand the effect of metastable flow/ super saturation flow through nozzle.

UNIT IV

Impulse Turbine: Mechanical Details - Velocity Diagram - Effect of Friction - Power Developed Axial Thrust Blade or Diagram Efficiency - Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow - Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

Reaction Turbine: Mechanical Details - Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction -Velocity Diagram - Parson's Reaction Turbine - Condition for Maximum Efficiency.

Learning Outcome & Suggested Student Activities:

At the end of unit, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce. Students are advised to visit thermal power stations for better understanding the working of turbines. Students are suggested to participate in science exhibitions based on the concept of thermal power plants.

UNIT V

Gas Turbines: Simple Gas Turbine Plant - Ideal Cycle, Essential Components - Parameters of Performance - Actual Cycle - Regeneration, Inter Cooling and Reheating - Closed And Semi-Closed Cycles - Merits and Demerits.

Jet Propulsion: Principle of Operation - Classification of Jet Propulsive Engines - Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency - Turbo Jet, Turbo Prop, Pulse Jet Engines - Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Learning Outcome & Suggested Student Activities:

After the study of the unit, Student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices. Student can aware of using thrust equations in solving problems. Students advised to visit Gas power generation plants.

TEXT BOOKS

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publicatndons, 2013.
2. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2 Edition,2012.

REFERENCE BOOKS

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai.
4. Thermal Engineering, R.S Khurmi& JS Gupta, S.Chand, 2012.
5. Thermal Engineering-M.L.Mathur&F.S.Mehta, Jain bros, 2006.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B.UmamaheswarGowd and A. Nagraju, Siri Publ.

NOTE: Steam tables and Mollier charts to be supplied for exam.

III B.Tech I Semester

15AME28 - MANUFACTURING TECHNOLOGY LAB

L	T	P	C
0	0	3	2

Course objectives:

- To study and practice the various operations that can be preformed in metal casting, mechanical process, welding, processing of plastics and to equip with the practical knowledge required in the core industries.

Minimum of 10 Exercises need to be performed.

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1.
3. Moulding Melting and Casting - 1 Exercise.

II. WELDING LAB :

1. ARC Welding Lap & Butt Joint - 2 Exercises.
2. Spot Welding - 1 Exercise.
3. TIG Welding - 1 Exercise.
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device).

III. MECHANICAL PRESS WORKING:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.

IV. PROCESSING OF PLASTICS

1. Injection Moulding.
2. Blow Moulding.

Course outcomes

- Upon completion of this course, the students can able to demonstrate and fabricate different types of components using the various manufacturing techniques.

III B.Tech I Semester

15AME29 - HEAT TRANSFER LABORATORY

L	T	P	C
0	0	3	2

Course objectives:-

- Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems.
- The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the course, Heat and Mass Transfer.
- The laboratory consists of experiments on various conductive, convective, radiative, boiling and condensing mechanisms of heat transfer.

NOTE: Thermal Engineering data books are permitted in the examinations.

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through Composite Slab Apparatus Thermal Conductivity of metal (conductor).
4. Heat transfer in pin-fin.
5. Experiment on Transient Heat Conduction.
6. Heat transfer coefficient in forced convection.
7. Heat transfer coefficient in natural convection.
8. Experiment on Parallel and counter flow heat exchanger.
9. Emissivity of a gray body through Emissivity apparatus.
10. Experiment on Stefan Boltzman Apparatus.
11. Heat transfer in drop and film wise condensation.
12. Experiment on Critical Heat flux apparatus.
13. Experiment on heat pump.
14. Study of heat pipe and its demonstration.
15. Study of Two - Phase flow.

Course outcomes:-

After completion of this course the student can be able to:

- Apply the techniques in the lab are having wide applications in various industries such as sugar industries, petroleum industries, process industries, fertilizer industries, IC engines, thermal power plants, heat exchangers.
- Design new equipment related to heat transfer

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III B.Tech I Semester

15AHS06 - ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

(Common for ME, ECE and CSE)

L	T	P	C
0	0	3	0

1. INTRODUCTION

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS: The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

UNIT-I: COMMUNICATIVE COMPETENCY

1. Reading Comprehension – Techniques-Book Review
2. Listening comprehension – Video Talks-Eminent speeches
3. Verbal Competency - Vocabulary - Spotting Errors- Aptitude Tests

UNIT-II: TECHNICAL WRITING

1. Essentials of writing -Technical Paper/ Report writing-Concise writing
2. Administrative / Business Documentation – Circular Writing -Meeting – Agenda – Minutes-Resolutions

3. Project Writing – Framing Outline – Finding Problem- Documentation-Citation

UNIT-III: PRESENTATIONAL SKILLS

1. Oral presentations – Public Speaking –Paper & Seminar Presentation
2. Digital Presentations -Power point - Video Presentation -Poster presentation
3. Stage Dynamics – Body Language – Para Language

UNIT-IV: CORPORATE SKILLS

1. Etiquettes -Dress - Dining – Net Etiquettes
2. Telephonic skills –Mobile Etiquettes
3. Soft Skills – Intra – Inter Personal Skills

UNIT-V: GETTING READY FOR JOB

1. Before Interview -Curriculum vitae/ Resume-Covering letter-E-mail writing
2. During Interview – G.D-Mock Interviews– Psychometric Tests – Follow up
3. After interview - Excelling in Profession– Team spirit– Work culture

4. LEARNING OUTCOMES:

- Acquiring extensive range of vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects / Employability skills /developing organizational abilities in tune with corporate requirement
- Effective Speaking Abilities

5. MINIMUM REQUIREMENT:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids /LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

1. K-VAN SOLUTIONS-Advanced communication lab
2. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
3. TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
4. Train2success.com

7. BOOKS RECOMMENDED:

1. Objective English for Competitive Exams, HariMohana Prasad, 4th edition, Tata McGraw Hill.
2. Effective Technical Communication, AshrifRizvi, TataMcGrahill, 2011.

3. Technical Communication, Meenakshi Raman &Sangeeta Sharma, O U Press 2009.
4. Books on TOEFL/GRE/GMAT/CAT/IELTS, Barron's/DELTA/Cambridge University Press.2012.
5. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
6. Ultimate Psychometric Tests: Mike Bryon,VinodVasishtha for Kogan Page India Pvt. Ltd, New Delhi.
7. Soft Skills- Know Yourself And Know The World, Dr.K.Alex, Chand Publications ,Third revised edition 2014.
8. Management Shapers Series , Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
9. Word Power Made Handy, ShaliniVerma, S Chand Publications, 2011.

III B.Tech II Semester

15AME31 - CAD/CAM

L	T	P	C
3	1	0	3

Course objective:
The objective of the this subject is to enable the students to understand and handle design problems in symmetric manner, gain practical experience in handling 2-D drafting and 3-D modeling software systems, apply CAD in real life applications, understand the concepts G and M codes and manual part programming and know the applications of CNC machines. Further the students will become familiar on principles of computer graphics, geometric modeling, NC and CNC machines, group technology and FMS.

UNIT I
Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.
Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.
Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the basic concepts Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design. To understand the geometric model of the component in CAD technology of computer graphics. The techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.

UNIT II
Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations. Solid modelling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.
Learning outcome & suggested Student Activities:
Geometric Modeling constitutes the most important and complex part in most of CDA software Packages. Hence the students should focus on various requirements of information that are generated during geometric modeling stage, various types and its applications.

UNIT III
Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.
CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.
Learning outcomes & suggested Student Activities:
CNC has revolutionized the manufacturing automation. The flexibility of manufacturing achvied with the use of CNC and associated Technology. The students should aimed to understand the

principle of NC, CNC, Machining Centre and various methods of part programming. The student is advised to visit manufacturing industry where the CNC machines are using and also interact with CNC programmer in industry.

UNIT IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non-optical, integration of CAQC with CAD and CIM

Learning outcome & Suggested Student Activities:

Understanding the need of GT as a means of bringing the benefits of mass production to relatively smaller production. Understanding the need of computers in process planning and QC .Understanding the definition and concept of FMS, and its elements etc.

UNIT V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer Integrated Production Planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits.

Trends In Manufacturing Systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Learning outcomes &Suggested Student Activities:

Understanding the need of CAPP in Industrial point of view and students are able to understand time standards and production standards in manufacturing systems.

TEXT BOOKS:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI.
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010.

REFERENCE BOOKS:

1. Automation, Production systems & Computer integrated Manufacturing,Groover, P.E.
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008.
3. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson.
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH.
5. Computer Aided Design and Manufacturing, K.LalitNarayan , PHI, 2008.
6. Computer Aided Manufacturing, T.C. Chang, Pearson, 3rd edition, 2008

SUGGESTED LINKS:

- http://www.cadcamfunda.com/cam_computer_aided_manufacturing
- http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc- classnotes.pdf

III B.Tech II Semester

15AME32 - REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	1	0	3

Course Objective:

This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.

The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

Learning Outcome & Suggested Student Activities:

At the end of the chapter, student can able to understand the terminologies associated with refrigeration and also understand the basic principles of Refrigeration and applications. Student can also know the aspects of various natural refrigeration methods; understand the components of Air refrigeration system and the necessity of air craft refrigeration.

UNIT II

Vapour Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of The Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the components in the domestic refrigerator, analyzing the concepts of sub-cooling and super heating to improve the COP and also necessity of replacements for CFCs and HCFCs with new refrigerants.

UNIT III

Vapor Absorption Refrigeration (VAR) System- Description and Working of NH_3 - Water System and Li Br -Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

Learning Outcome & Suggested Student Activities:
After the completion of the chapter, student can know the purpose and function of each of the basic components of the absorption refrigeration system. Student can have knowledge on latest developments of Electrolux, thermo electric vortex tube methods.

UNIT IV

Introduction To Air Conditioning: Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads -- Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcome & Suggested Student Activities:
After the end of the chapter, student can have knowledge on the use of psychrometric terms in Air conditioning. Student can learn the use of psychrometric chart to know psychrometric properties of air. Student can able to understand the terms sensible heat load and latent heat load. This technical information is fundamental to all types of domestic, commercial and industrial systems for the calculations of heat loads. Student is advised to conduct experiment on A.C tutor in the laboratory.

UNIT V

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

Learning Outcome & Suggested Student Activities:
After the completion of the chapter, student can understand the components of A/C system and describe the cooling equipment combinations. Student can describe the concept of human comfort chart and the processes by which the body produces and rejects heat. Student can be familiar with the Heat pumpcircuit analysis.

TEXT BOOKS:

1. Refrigeration and Air Conditioning, R.S.Kurmi and J.K.Guptha. S.Chand Publications.
2. Refrigeration and Air Conditioning ,CPArora,TMH, 15th edition, 2013.
3. A Course in Refrigeration and Air conditioning, S.Carora&Domkundwar, Dhanpatrai.

REFERENCE BOOKS:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013.
2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4th edition, 2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychometric property Tables and charts are permitted in Exam

SUGGESTED LINKS:

- http://www.refrigerationbasics.com/index.htm http://www.howstuffworks.com/ac.htm
- http://www.ashrae.org

- http://www.taftan.com/thermodynamics/AIRCOND.HTM
- http://www.wisegeek.com/how-does-air-conditioning-work.htm
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20%20 Lecture%201.pdf
- http://www.ignou.ac.in/upload/Unit%201-32.pdf ,
- http:/nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20 Cond/pdf/RAC%20 Lecture%209.pdf
- http://www.nptel.iitm.ac.in/courses/IITMADRAS/Applied_Thermodynamics/Module_6/6_Simple_Vapor_ Compression_RS.pdf
- http://www.mcquay.com/mcquaybiz/literature/lit_ch_wc/AppGuide/AG31-007.pdf
- http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20Lecture%2014.pdf
- http://en.wikipedia.org/wiki/Thermoelectric_cooling
- http://server.fst.uga.edu/kerr/FDST%204060/pdf%20files/7%20Psychrometrics.pdf
- http://people.eng.unimelb.edu.au/mjbrear/436-432/chapter%208%20-%20psychrometry.pdf
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2031.pdf
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2029.pdf
- http://courses.washington.edu/me333afe/Comfort_Health.pdf
- http://web.me.unr.edu/me372/Spring2001/Heat%20Pumps.pdf

R-15

III B.Tech II Semester

15AME33-ADVANCED MACHINE DESIGN

L	T	P	C
3	1	0	3

Course Objective:

To aware the student about basic concepts design of power transmission elements, understand the design concepts of various types of keys and couplings and various types of bearings and gears. To know the students how to apply design concepts in designing of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

UNIT I

Design of Keys and Couplings: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design various rigid and flexible shaft couplings.

UNIT II

Design of Power Transmissions Systems: Design of Flat belt drives, V-belt drives drives, Selection of wire ropes.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design various belts and rope drives.

UNIT III

Design Of Sliding Bearings: Types of Journal bearings - Lubrication - Bearing Modulus-bearing materials - journal bearing design

Design Of Roller Bearings: Ball and roller bearings types - Static loading of ball & roller bearings, bearing life -Failure of bearings.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings.

UNIT IV

Design of Spur & Helical Gears: Spur gears- Helical gears, Nomenclature, Lewis equation, Load concentration factor - Dynamic load factor. Surface compressive strength - Bending strength - Design analysis of spur and Helical gears - Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design spur and helical gears for different input conditions.

UNIT V

Design Of Ic Engine Parts: Pistons- Construction, Design of piston. Cylinder, Cylinder block, Connecting Rod. Cranks and Crank shafts- Center and over hung cranks.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to know various forces acting on I C engine parts and failure criteria to be adopted for various parts.

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TEXT BOOKS:

1. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi.
2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2 edition, 2013.
3. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

REFERENCE BOOKS:

1. Machine Design, Schaum"sseries, TMH Publishers, New Delhi, 1st edition, 2011.
2. MechanicalEngineeringDesign,JosephE.Shigely,TMHPublishers,NewDelhi, 9th edition.
3. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2 edition, 2013.
4. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi.
5. Design of Machine Elements, M.F. Spotts, PHI Publishers, New Delhi.
6. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.

__NOTE:__ Design data books are permitted in the examinations.

SUGGESTED LINKS:

- http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf
- http://www.uni.edu/~rao/Md-15%20Keys%20and%20Couplings.pdf
- http://machinedesign.com/
- http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21
- http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
- http://www.youtube.com/watch?v=nMsB6Soz4Hc&list=PL3D4EECEFAA99D9BE&index=30
- http://www.mae.ncsu.edu/klang/courses/mae442/Tranmission/Journal%20Bearing.ppt
- http://nhbb.com/files/catalog_pages/HiTech_Catalog.pdf
- http://nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_9.pdf
- http://www.youtube.com/watch?v=8bml2pK6Ra0
- http://umpir.ump.edu.my/1778/1/Design_Of_Cooecting_Rod_Of_Internal_Combustion_Engine_A_Topology_Optimization_Approach.pdf
- http://www.d-p.com.gr/pistons/piston-designs.html

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R-15

III B.Tech II Semester

15AME34 - METROLOGY AND INSTRUMENTATION

L	T	P	C
3	1	0	3

Course objective:

Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods, Alignment tests on machine tools. Students will be able to understand various transducers to measure displacement like Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers and also learn about Calibration procedure, temperature and pressure calibration methods, measurement of flow stress, strain measurements acceleration and vibration.

UNIT I

LIMITS, FITS And TOLERNCES : Introduction, Definitions, fits and their types - unilateral and bilateral tolerance system, hole and shaft basis systems - interchangeability and selective assembly. Indian standard system - International Standard organization system for plain work.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle.Design of Go and No Go gauges.

Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the Limits, Fits and Tolerance. Indian standard system - International Standard organization system.After completion of this unit students are able to study the different types of Comparators,

UNIT II

Linear Measurement: Length standard, line and end & wavelength standards, slip gauges - calibration of the slip gauges, Dial indicator, micrometers, vernier height gauges.

Measurement Of Angles And Tapers: Different methods - Bevel protractor - angle gauges - spirit levels - sine bar - Sine plate, rollers and spheres used to determine the tapers.

Flatness Measurement: Measurement of flatness of surfaces - straight edges- surface plates - optical flat and auto collimators, interferometer and their uses.

Learning outcome & Suggested Student Activities:

He will know the principles of working of the most commonly used instruments for measuring linear and angular measurements.Optical measuring instruments, flatness measurement methods and measuring methods of surface roughness.

UNIT III

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R.M.S Values - R_a , R_z values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

Screw Thread Measurement: Elements of measurement - errors in screw threads - measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment

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tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand, Screw thread elements and measuring methods, Gear tooth profile measurement, Alignment tests on lathe, milling and drilling machine tools.

UNIT IV

Measurement Of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement Of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

Measurement Of Acceleration And Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand working of various instruments used for measuring for displacement, stress, strain, speed, acceleration and vibration.

UNIT V

Measurment Of Temperature: Standards and calibration, thermal expansion methods, thermo electric sensors(thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.

Measurement Of Pressure And Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement.

Measurement Of Force, Torque, Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power measurement(dynamometers), Vibrating wire force transducers.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand working of various instruments used for measuring for temperature, pressure, force, torque and power.

TEXT BOOKS:

1. Basic principles measurments and controle systems, S.Bhaskar, Anuradha Publications.
2. Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI.
3. Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.
4. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.

REFERENCE BOOKS:

1. BIS standards on Limits & Fits.
2. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.
3. Fundamentals of Dimensional Metrology,Connie Dotson ,4e, Thomson.
4. Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, McGrawHill, 2013.
5. Instrumentation, measurement &analysis, B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.

Web References:

- http://emtool box.nist.gov
- CambridgeViscosity.com/Viscometer
- www.e.FlukeCal.com/Calibration
- www.inscotemperature.com/
- www.solartronmetrology.com/
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

III B.Tech II Semester

15AME41 - MODERN MANUFACTURING METHODS
(MOOC)

L	T	P	C
3	1	0	3

Course Objective:

- To make the students to understand the advanced manufacturing techniques evolved in manufacturing scenario.
- To learn about the advanced manufacturing techniquesUSM,AJM,ECM,CM,EDM,PM,EBM,LSB,

UNIT I

NEED FOR MODERN MANUFACTURING METHODS: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications. Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand importance of non-traditional machining processes, features, classifications and applications of non-traditional methods.

UNIT II

Ultrasonic machining - Elements of the process, mechanics of material removal, process parameters, applications and limitations. Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the processes of USM and AJM, process parameters, application and limitations.

UNIT III

ELECTRO - CHEMICAL PROCESSES: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

CHEMICAL MACHINING: Fundamentals of chemical machining- Principle of material removal- maskants - etchants- process variables, advantages and applications.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the Electro-chemical process and applicable in manufacturing environment in terms of accuracy, surface finish and MRR and their relative advantages and disadvantages. He has to understand the chemical machining advantages and applications.

UNIT IV

THERMAL METAL REMOVAL PROCESSES: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved

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surface finish and machining accuracy - Applications of different processes and their limitations.
PLASMA MACHINING: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the types of thermal based metal removal processes, principle of working, accuracy in machining, surface finish, tool selection and other machining parameters.

UNIT V
ELECTRON BEAM MACHINING: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.
LASER BEAM MACHINING: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand and its the applications of electron beam and laser beam in manufacturing environment, accuracy, machining speed and etc, with respect to all non-traditional machining processes.

TEXT BOOKS:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Modern Machining Process , Pandey P.C. and Shah H.S., TMH

REFERENCE BOOKS:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian,Pearson
3. Manufacturing processes for engineering materials by SeropeKalpakjian and Steven R Schmid.

SUGGESTED LINKS:

- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv530-Page1.htm

III B.Tech II Semester

15AME38 - MACHINE TOOLS LABORATORY

L	T	P	C
0	0	3	2

Course objectives

This Lab focuses on using mechanical machines to meet the following targets:

- To improve the students' in practical knowledge on various machines Further, they would be required to do the projects relevantly and coherently in industries.
- To provide hands on training on various machine tools (Like Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine).

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine.
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping.
5. Job on Shaping and Planning.
6. Job on Slotting.
7. Job on Milling (groove cutting/ gear cutting).
8. Job on Cylindrical and Surface Grinding.
9. Job on Grinding of Tool angles.

Course outcomes

After completion of this course the student may be able

- To explain the concept of machining with various machine tools.
- To get hands on experience on various machine tools.

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III B.Tech II Semester

15AME39 - CAD/CAM LABORATORY

L	T	P	C
0	0	3	2

Course Objectives:-

- To review and train in CAD modeling.
- To train on part programming and program generation from a CAD model.
- To train on machining in various CNC machines.

I. COMPUTER AIDED DRAFTING

A. Introduction to 3D Modeling

1. Modeling of Component in 3D - V block.
2. Modeling of Component in 3D - Open Bearing.
3. Modeling of Component in 3D - Angular block.
4. Modeling of Component in 3D - Dovetail Guide.
5. Modeling of Component in 3D - Dovetail Bracket.
6. Modeling of Component in 3D - Dovetail stop
7. Geometric Modeling Using Pro-E or CATIA or solid works or iron CAD (Any four exercises).

B. Assembly Modeling: Student must do at least two exercises

1. Assembly of a screw jack parts.
2. Assembly of a knuckle joint.
3. Assembly of a Oldham's coupling.
4. Assembly of a footstep bearing.
5. Assembly of a stuffing box.
6. Assembly of a square tool post.

II. COMPUTER AIDED MANUFACTURING

CAM (Any Six exercises)

a. Introduction to CNC & NC Machines.
b. Introduction to CNC & NC part programming - for Different operations like Turning,
c. Threading, Milling, Drilling etc., (G-Codes & M-Codes).
d. Experiments on CNC lathe -Turning, Threading operations.
e. Experiments on Milling Machine - Plane Milling, Drilling Operations.
f. Experiment on Robot - pick up an object with & without using teach window.
g. Developing a CNC code for a given job using.
   i. Solid works- CAM
   ii. PRO-E- CAM
   iii. MASTER CAM
   iv. Edge CAM

Course Outcomes:-

After successful completion of this course:

- Students will be able to review and train in CAD modeling.
- Design a part or assembly of parts using Computer-Aided Design software.
- Apply top-down design principles to model a design.
- Students would get trained on machining in various CNC machines.

IV B.Tech I Semester

15AME51-AUTOMOBILE ENGINEERING

L	T	P	C
3	1	0	3

Course Objective:
The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods. The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT I

Introduction: Components of a Four Wheeler Automobile - Chassis and Body - Power Unit - Power Transmission - Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive - Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging - Oil Filters, Oil Pumps - Crank Case Ventilation.

Learning outcome & Suggested Student Activities:
Student can understand the function of each and every component of an automobile. Student can understand the use of turbo charging and super charging.

UNIT II

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel - Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.Propeller Shaft - Hotch - Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

Learning outcome & Suggested Student Activities:
At the end of the unit, student can have broad knowledge on each and every component of transmission system of a automobile.

UNIT III

Steering System: Steering Geometry - Camber, Castor, King Pin Rake, Combined Angle Toe-In, CenterPoint Steering. Types Of Steering Mechanism - Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears - Types, Steering Linkages.

Learning outcome & Suggested Student Activities:
After the completion of the chapter, student can able to understand purpose and methods of steering systems and their applications. Students may refer the following website.

UNIT IV

Suspension System: Objects of Suspension Systems - Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Learning outcome & Suggested Student Activities:
At the end of the unit. Student can have ample knowledge on suspension system and braking system of an automobile

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UNIT V

Emissions From Automobiles - Pollution Standards National and International - Pollution Control- Techniques - Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources- Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Electrical System: Charging Circuit, Generator, Current - Voltage Regulator - Starting System, BendixDrive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge - Oil Pressure Gauge, Engine Temperature Indicator.

Learning outcome & Suggested Activities:

Student can be able to grasp the knowledge on emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future.

TEXT BOOKS:

1. Automotive Mechanics - Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors.
2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.
3. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

REFERENCE BOOKS:

1. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.
2. Automotive engines , Newton, Steeds & Garret.

IV B.Tech I Semester

15AME52-OPERATIONS RESEARCH

L T P C
3103

Course Objective:
The subject should enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications, To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

UNIT I
Introduction To Or And Linear Programming – 1: OR definition- Classification of Models - Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two-Phase Simplex Method, Big-M Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

Learning Outcome & Suggested Student Activities:
At the end of the Unit, the student will be able to create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method.
(The student must refer to any of the text books and practice solving several problems as it is very common to make mistakes while solving due to lack of practice). The student should take up a real life problem and formulate it as a mathematical programming problem.

UNIT II
Linear Programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method, Transportation Problem - Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases -Unbalanced Transportation Problem, Degenerate Problem;Assignment Problem - Formulation; Optimal Solution -Traveling Salesman problem.

Learning Outcome &Suggested Student Activities:
At the end of this Unit, the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems. A large number of problems are to be solved by the student in order to gain much required capability of handling the problems without mistakes.

UNIT III
Game Theory: .Introduction - Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy -Games with Mixed Strategies - 2 X 2 Games – Dominance, Principle- Solution by Graphical Method of m X 2 & 2 X n games
Queuing Theory: Introduction -Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals,

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Exponential Service Times with finite queue length and non finite queue length.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.

UNIT IV

Sequencing:Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models.
PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float- CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration- PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Varianceof the Activities and Projects, and Probability of Completing the Project within scheduled time

Learning Outcome & Suggested Student Activities:
At the end of this Unit, student will be able to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability.

UNIT V

Dynamic Programming :Introduction - Bellman's Principle of Optimality - Applications of Dynamic Programming- Capital Budgeting Problem - Shortest Path Problem - Solution of Linear Programming Problem by DP
Replacement And Maintenance Analysis: Introduction - Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will be aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.

TEXT BOOKS:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.
2. Introduction to OperationsResearchFrederick K. Hiller,Bodhibrata Nag, PreetamBasu, Geralld J. Lieberman, TMH, 9th edition, 2011.

REFERENCE BOOKS:

1. Operations Research by R Panneerselvam, PHI, 2ndndition, 2012. ed
2. Operations Research, Wagner, PHI Publications , 2 edition.
3. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
4. Linear Programming, SusyPhillippose, PHI
5. Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.
6. Operations Research: Methods & Problems, Maurice Saseini, ArhurYaspan & LawrenceFriedman

7. Operations Research, Dr.C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers

Web References:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/
- http://nptel.iitm.ac.in/video.php?subjectId=112106134
- http://www.youtube.com/watch?feature=player_detailpage&v=ug7O1lSZyg0
- http://www2.ensc.sfu.ca/undergrad/courses/ENSC201/Unit09/lecture9.html
- http://pakaccountants.com/what-is-depreciated-replacement-cost/
- http://www.youtube.com/watch?feature=player_detailpage&v=H58TPQNr2kM
- http://www.youtube.com/watch?feature=player_detailpage&v=h0bdo06qNVw
- http://www.youtube.com/watch?feature=player_detailpage&v=xGkpXk-AnWU#t=104s
- http://nptel.iitm.ac.in/video.php?subjectId=112106134,
- http://www. Math.harvard.edu/archive/20_spring_05/handouts

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IV B.Tech I Semester

15AME53-FINITE ELEMENT METHODS

L	T	P	C
3	1	0	3

Course objective:
The subject should enable the students to learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements, find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions. To learn the application of FEM to various structural problems incorporating temperature. and boundary conditions and heat transfer problems.

UNIT I
Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions.
Approximate Methods For Solving The Differential Equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.
Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems.Solution methods for solving simultaneous equations.
Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to know introductory basic principles and approaches for solving FEM problems in different fields

UNIT II
Problems With One-Dimensional Geometry:
Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.
Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations.
Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.
Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to formulate FEM model for simple problems.

UNIT III
Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.
Higher Order And Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions - linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

Learning Outcome &Suggested Student Activities:
After completion of this unit students are able to write interpolation functions to higher order isoparametric elements.

UNIT IV
Finite Element Application In Solid Mechanics:
Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.
Axi-symmetric triangular elements: formulation of stiffness and load vectors. Introduction to 3D stress analysis.
Learning Outcome &Suggested Student Activities:
After completion of this unit students are able to derive element matrices for applying the principles to find stresses in beams and trusses and temperature distribution in composite walls and fins.

UNIT V
Heat Transfer And Fluid Mechanics Problems:
Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces.
Two Dimensional Potential Flow Problems: Potential function formulation and stream functionformulation.
Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to solve bars, trusses, beams and heat transfer problems using FEM and also to apply boundary conditions in realistic problems.

TEXT BOOKS:

1. Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu ,Pearson Education, New Delhi.
2. Finite Element Methods, S. S. Rao ,Pergamom Press, New York.

REFERENCE BOOKS:

1. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.
2. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.
3. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.
4. Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.
5. Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers.
6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

IV B.Tech I Semester

15AME54-ENERGY SYSTEMS

L	T	P	C
3	1	0	3

Course Objective:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analyse the environmental and cost economics of using renewable energy sources compared to fossil fuels.

UNIT - I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

SOLAR ENERGY STORAGE AND APPLICATIONS :

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

WIND ENERGY : Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

BIO-MASS : Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engineoperation and economic aspects.

UNIT-IV

GEOTHERMAL ENERGY : Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY : OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economicaspects.Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

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Course Outcome:

At the end of the course the student will

- Have knowledge about various renewable energy sources
- Be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

TEXT BOOKS:

1. Renewable energy resources, Tiwari and Ghosal, Narosa.
2. Non-Conventional Energy Sources ,G.D. Rai

REFERENCES :

1. Renewable Energy Sources, Twidell& Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering,B.S.Magal Frank Kreith&J.F.Kreith.
4. Principles of Solar Energy, Frank Krieth& John F Kreider.
5. Non-Conventional Energy, Ashok V Desai, Wiley Eastern 6. Non-ConventionalEnergy Systems, K Mittal , Wheeler.

IV B.Tech I Semester

15AME55-INDUSTRIAL MANAGEMENT

L	T	P	C
3	1	0	3

Course objectives

- To analyze the characteristics and contributions of enterprising people
- To assess their own entrepreneurial and enterprising potential To develop an understanding of the general role of Small Business Enterprises
- To develop skills to start, run and manage SMEs
- Understand the role of entrepreneurship in economic development.
- Identify the general characteristics of entrepreneurs.
- Know the differences between entrepreneurial and managerial type jobs.
- Understand the significance and sources of capital. Participate in the preparation of a complete business plan.
- Have an understanding of individual personalities and interpersonal skills needed for effective communications in a diverse business environment.

UNIT I

Introduction To Management:

Concepts of Management - nature, importance and Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Leadership Styles, Social responsibilities of Management.

Designing Organizational Structures:

Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, team structure) their merits, demerits and suitability.

UNIT II

Plant location; definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant, Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study.

Materials Management: EOQ, ABC Analysis, Purchase Procedure and Stores Management.Inventory — functions. Types, inventory classification techniques.

Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle, Channels of distribution.

UNIT III

Human Resources Management (HRM):

Concepts of HRM ;Personnel Management and Industrial Relations (PMIR), Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and

Welfare Administration, Job Evaluation, Merit Rating and methods.

UNIT IV

Supply Chain Management: Supply chain and keiretsu-market place uncertainties and channel relationship- building supply chain- porn objectives and supply chain- orientation and implementation of supply chain principles with a company- purchasing function and supply chain management- single source vs multi source - service supply relationship.

UNIT V

Strategic Management:

Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation.

Project Management (PERT/CPM):

Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).Assignments, case studies and mini project.

Learning outcome

The M.S. prepares engineers for a lifelong career addressing the critical technical and managerial needs of private and public organizations. The program emphasizes developing analytic abilities, making better decisions, developing and executing strategies while also leading people who innovate. Unlike an MBA, our master's program addresses the technical as well as the behavioral challenges of running organizations and complex systems. We emphasize quantitative analytic skills and an entrepreneurial spirit.

BOOKS:

1. Manwlicturing Organization and Management. Antrind Pearson. 2nd Edition. 2004.

REFERENCES:

1. Stoner. Freeman. Gilbert. Managemem. 6th Ed, Pearson Education. New Delhi, 2005.
2. Fanner Selvam, Production and Operations Management, PHI, 2004.
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering. Galgotia Publications, Pvt Limited.
4. Ralph M Barnes. Motion and Time Studies. John Wiley and Sons. 2004. 5. Chase. Jacobs. Aquilano. Operations Management. TM Ii 10th Edition. 2003. 6. I[RT CPM, affiliate Fast-West Press. New Delhi. 2000.
5. Industrial Engineering and Management O.P. KhannaDhanpatRai

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IV B.Tech I Semester

15AME56-ENTREPRENEURSHIP

L	T	P	C
3	1	0	3

Course Objective:

- To Understand the basic development of entrepreneurship as a profession.
- To Understand business models.
- To Write a business plan describing a new business venture.
- To Understand marketing strategies for small businesses.
- To Identify capital resources for new ventures and small businesses.

UNIT 1: Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur.

UNIT II : Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.
The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

UNIT III: Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls.E-commerce and Entrepreneurship, Internet advertising.
New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.

UNIT IV: Choosing location and layout, Issues related to Selection of layout.Global aspects of Entrepreneurship.

UNIT V : Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

Course outcomes:

Upon successful completion of this course, a student will be able to:

- Understand the basic development of entrepreneurship as a profession.
- Understand business models.
- Write a business plan describing a new business venture.
- Understand marketing strategies for small businesses.
- Identify capital resources for new ventures and small businesses.
- Have a basic knowledge of human resource management for small business.
- Understand the social responsibilities of small business managers.

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Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5th Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

REFERENCES:

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.
4. The Entrepreneurial Connection, GurmeetNaroola TMH, 2001. 5. Indian Economy. Dutt&Sundaram S. Chand, 2005.

   6. Essential of Entrepreneurship and small businessmanagement, Thomas W. Zimmerer& Norman M. Scarborough, PHI, 4/e, 2005.

   7. Industrial Relations &Labour Laws, Srivastava, Vikas, 2005.

   8. Industrial Law, ND Kapoor, Sultan Chand & Sons, 2005

IV B.Tech I Semester

15AME57-PRODUCT DESIGN

L T P C
3 1 0 3

Course Objectives

- To Design products creatively while applying engineering design principles
- To Apply principles of human factors, ethics and environmental factorsin product design
- To Work in groups or individually in their pursuit of innovative product design
- To implement value design for optimum product cost.

UNIT I

PRODUCT DEVELOPMENT PROCESS: General problem solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behaviour.

UNIT II

TASK CLARIFICATION: Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and Extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

UNIT III

CONCEPTUAL DESIGN: Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem formulation, Identifying the essential problems from the requirements list, Establishing functions structures, Overall function, Breaking a function down into sub-functions. Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures. Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of developing concepts. Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

UNIT IV

EMBODIMENT DESIGN - Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force transmission, Principle of Division of Tasks, Principle of Self-Help, Principle of Stability and Bi-Stability, Principle of Fault-Free Design Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design for Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluating Embodiment Designs.

UNIT V

MECHANICAL CONNECTIONS, MECHATRONICS AND ADAPTRONICS: Mechanical Connections - General functions and General Behaviour, Material connections, Form Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solutions, Examples. Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Course Outcomes

- Ability to apply knowledge of basic science and engineering fundamentals
- Ability to undertake problem identification, formulation and solution
- Understanding of the principles of sustainable design and development
- Understanding of professional and ethical responsibilities and commitment to them

TEXT BOOKS:

1. Engineering Design: G.Pahl; W. Beitz, et.al, Springer International Education 2010.
2. Product Design And Development: Kevin Otto: K. Wood Pearson Education 2013.

REFERENCE BOOKS:

1. Product Planning Essentials: Kenneth B. Kahn, Yes dee Publishing 2011.
2. Product Design and Development: K.T. Ulrich TMH Publishers 2011.

IV B.Tech I Semester

15AME58-COMPUTATIONAL FLUID DYNAMICS

L T P C
3 1 0 3

Course Objective:
This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems. In this course Students will develop the equations describing fluid flow and numerical solutions to these equations. Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluate these approaches. Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

UNIT I
Introduction: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

Learning outcome &Suggested Student Activities:
This chapter gives the overall view of the various kinds of numerical methods adopted. It also discusses about various solutions for the numerical methods adopted in CFD. The applications of finite difference methods with examples in conduction and convective heat transfer are introduced.

UNIT II
Finite Differences: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.
Learning outcome &Suggested Student Activities:
This chapter gives how to descretize partial differential equations, including the governing flow equations which is the foundation for the finite difference method. Explicit and implicit approaches represent the fundamental distinction between various numerical techniques.

UNIT III
Errors and Stability Analysis: introduction, first order wave equation, stability of hyperbolicand elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.
Review Of Equations Governing Fluid Flow And Heat Transfer:
Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.
Learning outcome &Suggested Student Activities:
This chapter focuses on numerical errors that are generated and how the numerical calculations become unstable and also entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation.

UNIT IV

Steady Flow: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

Learning outcome &Suggested Student Activities:

This unit gives the fundamental principles of fluid mechanics, its governing differential equations and boundary conditions.

UNIT V

Simple Cfd Techniques: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Learning outcome & Suggested Student Activities:

This unit gives the information about some techniques for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations.

TEXT BOOKS:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press
2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.

REFERENCE BOOKS:

1. Computational Fluid Dynamics for Engineers, Ronnie Anderson (2012), 2nd edition, Cambridge University Press, India.
2. Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot(2010),3rd edition, Springer, Germany.
3. Essential computational fluid Dynamics - olegzikanov, wiley India.
4. Introduction to computational fluid dynamics - pradip, Niyogi S.K. Chakrabary, M.K. Laha - pearson.

IV B.Tech I Semester

15AME59-MECHANICAL VIBRATIONS

L	T	P	C
3	1	0	3

Course Objective:

- To make the students to learn about basic concepts and definitions of mechanical vibrations and to write equation of motion for discrete spring-mass systems with different configuration using classical and energy methods.
- To make the students to learn about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about theory of vibrations of two degree freedom system and various types of vibration absorbers.
- To analyze the two degree and multi degree of Freedom systems.

UNIT I

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient.Simple problems.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to find natural frequency of un-damped single degree freedom systems and the behavior of single degree freedom systems with damping

UNIT II

Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibrometer, methods of vibration control- excitation reduction at source, system modification.

Learning Outcome & Suggested Student Activities:

After completion of this unit, students are able to solve vibration problems with forcing function. to know about various instruments.

UNIT III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

Learning Outcome &Suggested Student Activities:

After completion of this unit the students are able to analyze the two degree freedom systems with and without damping and to solve problems on vibration absorber

UNIT IV

Multi Degree Freedom Systems: Lagrangion method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.

Learning Outcome & Suggested Student Activities:

After completion of this unit the students are able to analyze the multi degree freedom systems using Stodola method, Holzer"s method and Matrix iteration method.

UNIT V

VIBRATION OF CONTINUOUS SYSTEMS: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

WHIRLING OF SHAFTS: Critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Learning Outcome &Suggested Student Activities:

After completion of this unit the students are able to find lowest natural frequency of the shaft using Rayleighs upper bound approximation and Dunkerleys lower bound approximation.

TEXT BOOKS:

1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.
2. Mechanical Vibrations by Groover.
3. Vibration of Mechanical Systems ,C. Nataraj, Cenage Learning, 1st edition, 2012.

REFERENCE BOOKS:

1. Mechanical Vibrations, S. Graham Kelly, Tata McGraw Hill.
2. Vibration Theory and Applications, William Thomson, Pearson Education, New Delhi
3. Vibration problems in Engineering, Timeoshenko and Young, John Wiley and sons Publishers, Singapore.
4. Singrasu S. Rao, Mechanical Vibrations, Pearson Education, New Delhi.

SUGGESTED LINKS:

- http://nptel.iitm.ac.in/video.php?subjectId=112104114
- http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html
- http://www.freestudy.co.uk/dynamics/forced%20vibrations.pdf
- http://aerade.cranfield.ac.uk/ara/arc/rm/2854.pdf
- http://www.youtube.com/watch?v=klqMuDDb0Tc&list=PL46AAEDA6ABAFCA78
- http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-20-structural-mechanics-fall-2002/lecture- notes/unit22.pdf
- http://www.youtube.com/watch?v=h7dUHXxfP9w&list=PL46AAEDA6ABAFCA78
- http://web.itu.edu.tr/~gundes/2dof.pdf
- http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/r_tiwari_dyn_of_mach/Chapter_12_Vibration%20of%20two-degree-of-freedom%20system.pdf
- http://www.youtube.com/watch?v=6gX4ox-r5t0&list=PL46AAEDA6ABAFCA78
- http://www.iitr.ac.in/outreach/web/CIRCIS/PG/AVN/RC/Revision%20of%20concepts4SDOF-Forced.pdf
- http://www.freestudy.co.uk/dynamics/forced%20vibrations.pdf
- http://www.youtube.com/watch?v=irudCaBrij0&list=PL46AAEDA6ABAFCA78&index=30
- http://www.youtube.com/watch?v=tCiHYyPX6NM&list=PL46AAEDA6ABAFCA78&index=28
- http://www.youtube.com/watch?v=DMILEZMXOmc
- http://www.newagepublishers.com/samplechapter/001216.pdf
- http://www.youtube.com/watch?v=fwpat51ffSs&list=PL46AAEDA6ABAFCA78&index=27

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IV B.Tech I Semester

15AME60-FLUID POWER SYSTEMS

L	T	P	C
3	1	0	3

Course Objectives:

- This course provides specialized instruction in maintaining and troubleshooting Hydraulic and Pneumatic systems.
- Explain the operation of the main elements of an industrial hydraulic and pneumatic system.

UNIT-I

OIL HYDRAULIC SYSTEMS: Hydraulic power generators – selection and specification of pumps, pump characteristics.

HYDRAULIC ACTUATORS: Hydraulic and rotary actuators – selection, specification and characteristics.

UNIT-II

CONTROL AND REGULATION ELEMENTS: Pressure – direction and flow control valves – relief valves, non-return and safety valves- actuation systems.

UNIT-III

HYDRAULIC CIRCUITS: Reciprocation, quick return, sequencing circuits- accumulator circuits- industrial circuits – press circuits – hydraulic milling machine – grinding, planning, copying, forklift, earth mover circuits – design and selection of components – safety and emergency mandrels.

UNIT-IV

PNEUMATIC SYSTEMS AND CIRCUITS: Pneumatic fundamentals- control elements position and pressure sensing – logic circuits- switching circuits- fringe condition modules and their integration – sequential circuits- cascade methods – mapping methods- step counter method – compound circuit design- combination circuit design.

UNIT-V

INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS: Pneumatic equipments- selection of components- design calculations- applications – fault finding equipments- hydro pneumatic circuits – use of microprocessors for sequencing – PLC- Low cost automation- robotic circuits.

Course outcomes:

Upon completion, the student should be able to:

- Define basic fluid power terms and units.
- Identify Hydraulic and Pneumatic graphic symbols.
- Describe fluid power components.
- Calculate basic operations for sizing hydraulic and pneumatic components.
- Perform basic fluid power maintenance procedures.

TEXT BOOKS:

1. Andrew Parr, "Hydraulics and Pneumatics", (HB), Jaico Publishing House, 1999
2. Bolton. W. "Pneumatic and Hydraulic systems", Butterworth – Heinneman, 1997

REFERENCES:

1. Antony Espossito, "Fluid power with Applications", prentice Hall, 1980
2. DudleytA.Pease and John J.Pippenger, "Basic fluid power", Prentice Hall, 1987

Web References:

1. http://www.pneumatics.com
2. http://www.fluidpower.com.tw

IV B.Tech I Semester

15AME61-PRODUCTION AND OPERATIONS MANAGEMENT

L	T	P	C
3	1	0	3

Course Objective:

- To make the students understand the functions of production planning & controls, generating of new products, issues in product design and strategies of aggregate planning.
- To provide the knowledge on principles of forecasting, forecasting methods, types and its accuracy.
- To provide the knowledge on facilities location, various types layouts and assembly line balancing.
- To provide the knowledge on lean management, concepts of JIT, six sigma, quality control, MRP,ERP and LOB.
- To make the students understand the inventory management and scheduling techniques.

UNIT I

Functions of Production Planning Controls operations and productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design. Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

Learning Outcome & Suggested Student Activities:

At the end of this unit students can get the concepts on Production planning & controls operations and its functions, productivity and productivity measurements, design of goods and services and aggregate planning

UNIT II

Forecasting - Importance of forecasting - Types of forecasting, their uses - General Principles of forecasting - Forecasting techniques - qualitative methods and quantitive methods - accuracy of forecasting methods.

Learning Outcome & Suggested Student Activities:

Students can understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands.

UNIT III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, CORELAP.

Learning Outcome & Suggested Student Activities:

At the end of the unit the student will be able to understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time.Can compare the rural &urban sites, methods of selection.

UNIT IV

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control. MRP, -lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

Learning Outcome & Suggested Student Activities:

Students can understand the how philosophy of lean management applied to develop lean enterprise and basic concepts JIT, Six sigma control.

UNIT V

Scheduling Policies - Techniques, flow shop and job shop Scheduling techniques. Inventory management - Functions of inventories - relevant inventory costs - ABC analysis - VED analysis - EOQ model - Inventory control systems - P-Systems and Q-Systems-(S, s) Policy.

Learning Outcome & Suggested Student Activities:

At the end of the unit the student will be able to understand the scheduling policies, flow shop and job shop scheduling techniques and concepts of Inventory, Classification, Functions, it"s associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up.

TEXT BOOKS:

1. Modern Production , Operations Management , Baffa&RakeshSarin.
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation and O.M by Adam & Ebert- PHI Pub.,

REFERENCE BOOKS:

1. Operations Management - S.N. Chary.
2. Inventory Control Theory and Practice , Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach , John E. Biegel.
4. Production Control , Moore.
5. Operations Management , Joseph Monks.
6. Operation Management by Jay Heizar& Read new Pearson
7. Elements of Production Planning and Control, Samuel Eilon.

SUGGESTED LINKS:

- http://www.technologyevaluation.com/search/for/inventory-management-pdf.html
- http://freevideolectures.com/Course/3096/Operations-and-Supply-Chain-Management/10
- http://www.learnerstv.com/video/Free-video-Lecture-6944-Management.htm;
- http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-852j-integrating-the-lean-enterprise-fall-2005/lecture-notes/
- http://freevideolectures.com/Course/2688/Human-Resource-Management/13
- http://www.slideshare.net/satya4/plant-layout-16143741
- http://freevideolectures.com/Course/2371/Project-and-Production-Management/32
- http://www.tcyonline.com/video-tutorials-computerised-layout-planning/101568
- http://www.learnerstv.com/video/Free-video-Lecture-2496-Management.htm;
- http://www.slideshare.net/jrdn_27/qualitative-and-quantitative-methods-of-research
- http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Management_Science_II/Pdf/3_5.pdf
- http://www.academicearth.org/lectures/product-development-process-observation

IV B.Tech I Semester

15AME62-METROLOGY, INSTRUMENTATION AND DYNAMICS LABORATORY

L	T	P	C
0	0	3	2

Course objectives:-

- To educate students on different measurement systems and on common types of errors.
- To introduce different types of sensors, transducers and strain gauges used for measurement.
- To give knowledge about thermocouples, thermometers and flow meters used for measurements To introduce measuring equipments used for linear and angular measurements.
- To familiarize students with different types of governors, static dynamic, dynamic and cam analyser equipments.

Any 4 experiments from each section
Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/ Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Calibration of transducer or thermocouple for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Study and calibration of capacitive transducer for angular measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotometer for flow measurement.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
8. Study and calibration of Mcleod gauge for low pressure.

Section C:

1. Experiment on static and dynamic balancing.
2. Experiment on universal governor
3. Experiment on CAM analysis machine.
4. Study of Inversion of Four Bar Mechanism.

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Course outcomes:-

At the end of course the students will have:

- Apply the procedures to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness by using different instruments.
- Measure effective diameter of Thread profile using different methods 3. Conduct different machine alignment tests.
- Apply the procedures to measure Temperature, Displacement, flow measurement and pressure measurement.
- Hands on training on universal governor, CAM analysis, static and Dynamic balancing equipments.

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IV B.Tech I Semester

15AME63-COMPUTER AIDED ENGINEERING (CAE) LABORATORY

L	T	P	C
0	0	3	2

Course Objectives

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- To validate a Finite Element model using a range of techniques.
- To communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.
- To discuss the accuracy of the Finite Element solutions.

I. Introduction to Analysis Software Package

II. Structural analysis:(Any Four exercises)

b. Analysis of a truss member under loading
c. Analysis of a rectangular plate with a hole
d. Analysis of a bracket plate with axial loading
e. Analysis of a bracket plate with eccentric loading
f. Static Analysis of a Corner Bracket
g. Static Analysis of beam
h. Analysis of Thermally Loaded support Structure
i. Analysis of Hinged support member

III. Thermal and Fluid Flow analysis:(Any two exercises)
a. Analysis of a square plate considering conduction
b. Analysis of a extended fin considering conduction and convection
c. Analysis of a compound bodies considering conduction and convection
d. Determination of velocity of a fluid and volumetric flow rates for 1-D Fluid flow

IV. CAE Through MATLAB
a. Introduction to MATLAB.
b. One dimensional Truss
c. One dimensional Beam
d. One dimensional Heat Conduction

Course outcomes

After completion of the course student can be able:

- Ability to solve engineering problems using ANSYS.
- Ability to solve the engineering problems using the MATLAB.

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IV B.Tech II Semester

15AME81-AUTOMATION AND ROBOTICS

L	T	P	C
3	1	0	3

Course Objective:
The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types. To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

UNIT I
INTRODUCTION TO AUTOMATION: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation. Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.
Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation.

UNIT II
AUTOMATED FLOW LINES: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.
ASSEMBLY LINE BALANCING: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.
Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines.

UNIT III
INTRODUCTION TO INDUSTRIAL ROBOTICS: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.
ROBOT ACTUATORS AND FEEDBACK COMPONENTS: Actuators, Pneumatic, Hydraulic actuators, Electric &Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.
Learning outcome & Suggested Student Activities:
Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure.

UNIT IV
MANIPULATOR KINEMATICS: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.
MANIPULATOR DYNAMICS: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

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Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot.

UNIT V

ROBOT PROGRAMMING: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

ROBOT APPLICATION IN MANUFACTURING: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand robot programming languages which may adopt in different applications of robot. Student also knows the control motion mechanism in all devices of robot and application of robots in manufacturing sector.

TEXT BOOKS:

1. Automation , Production systems and CIM, M.P. Groover /Pearson Edu.
2. Industrial Robotics – Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas, G.Odrey – McGraw Hill, 1986..

REFERENCE BOOKS:

1. Robotics and control - R K Mittal and I J nagrath,TataMcGraw Hill 2004.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering - integrated approach by Richard d Klafter-London: Prentice-Hall-1989.
4. Robotics, Fundamental Concepts and analysis –AshitaveGhosal, Oxford Press
5. Introduction to Robotics - John J. Craig, PearsonEdu.

SUGGESTED LINKS:

- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm
- http://www.cadcamfunda.com/cam_computer_aided_manufacturing
- http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf
- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo
- http://nptel.iitm.ac.in/video.php?courseId=1052
- http://www.nptel.iitm.ac.in/and iitb.ac.in ,
- http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm

IV B.Tech II Semester

15AME82-MECHATRONICS

L	T	P	C
3	1	0	3

Course Objective:
To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries. Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems. Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT I
Introduction: Definition - Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Learning outcome &Suggested Student Activities:
This unit helps the students to understand the importance of mechatronics subject and controlling the various machines, robots etc. Students may observe CNC machines in CAD/CAM lab to understand the mechatronics concepts.

UNIT II
Signal Conditioning: Introduction - Hardware - Digital I/O ,Analog input - ADC , resolution , speed channels Filtering Noise using passive components - Resistors, capacitors - Amplifying signals using OP amps -Software - Digital Signal Processing

Learning outcomes & Suggested Student Activities:
This unit helps the students to understand how to convert the analog signals into useful required form. These signal condition systems may be observed in electronics and communication engineering department labs.

UNIT III
Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts - Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Bearings- Motor / Drive Selection.

Learning outcome & Suggested Student Activities:
In this unit the students learn about the pneumatic and hydraulic systems and about some precisions mechanical component which are useful in the field of automation. This automation system can be observed in many processing industries and manufacturing industries to handle the materials and control the machines (or) process.

UNIT IV
Electronic Interface Subsystems: Motors Isolation schemes- opto coupling, buffer IC's - Protection schemes - circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ MOSFETS.
Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors - DC brushless motors - DC servo motors - PWM's - Pulse Width Modulation - Variable Frequency Drives.

Learning outcome & Suggested Student Activities:
The objective of this unit is to make the student aware of electronic systems, electromechanical drives used in automation. Some of the systems may be observed electrical and electronics labs for better understanding.

UNIT V
Microcontrollers Overview: 8051 Microcontroller , microprocessor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications, Programming -Assembly.
Programmable Logic Controllers: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection, interface - R232 etc.,-Applications.

Learning outcome & Suggested Student Activities:
This unit helps the student to know about microcontrollers and to programming of programmable logic controls. Students may visit pharmaceutical industries, thermal power plants etc. To observe the PLC based control systems know about the interface between processing equipment and central system.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, WBolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, Ganesh.S.H, Jones and Bartlett publications.

REFERENCE BOOKS:

1. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.
3. Mechatronics System Design, Devdasshetty,Richard,Thomson.
4. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

IV B.Tech II Semester

15AME83-POWER PLANT ENGINEERING

L	T	P	C
3	1	0	3

Course Objective:

- To understand the student present day energy demand.
- To make the student to aware of components of power plants that run using conventional and non- conventional methods, factors affecting the site selection for a power plant and concept of base load plant and peak load plant.
- To make the student aware of Pros and Cons of various power plants.
- To enable the student to recognize the importance of secondary energy source.

UNIT I

Introduction To The Sources Of Energy - Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

Learning outcome & Suggested Student Activities:

Student can recognize the importance of power production suited to the demand. Student can have an idea of various power plants. Student can understand economics of power distribution, Power Tariff, Load Factor and other related terms. Student can know the impact of power plants on the environment. Students are advised to visit various power plants.

UNIT II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO_2 Recorders

Learning outcome & Suggested Student Activities:

Student is able to understand the latest high pressure boilers, concept of fluidized bed combustion and importance of handling and storage. Student can able to learn the waste heat recovery methods. In addition, student can know various cooling towers and its application. Student is advised to visit the cogeneration plants to under the waste heat recovery concept.

UNIT III

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

GAS TURBINE PLANT : Introduction - Classification - Construction - Layout With Auxiliaries

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- Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

Learning outcome & Suggested Student Activities:

Student can grasp concepts of diesel power plant and gas turbine plants. Student can distinguish open cycle and closed cycle gas turbine cycles. Normally, every college will be equipped with diesel power plant. Students are suggested to visit near bydiesel power plant and gas turbine plant. The students have already studied these units in Thermal Engineering-I & II. The student can make uses of these notes of thermal engineering.

UNIT IV

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects And Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

Learning outcomes & Suggested Students Activities:

Student can have knowledge on water power. Student can able to understand the methods of storing water and can have an idea over constructions of dams and spill ways. Student can enable to draw the layout of hydel power plant. Student s are advised to visit nearby hydel power plants.

UNIT V

Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types Of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student can be familiar with the power generation through secondary energy sources. Student can able to understand the power generation through solar energy, wind energy, MHD and Nuclear energy. Student can enable to distinguish various nuclear reactors. Also, student can know the methods of dumping radiation waste and can discern the impact of radiation effect on human living. Student is suggested to visit any nuclear power station.

TEXT BOOKS:

1. Power plant Engineering, P.K. Nag, TMH, 3rd Edition, 2013.
2. A course in power plant Engineering, Arora and S. Domkundwar.

REFERENCE BOOKS:

1. A Text Book of Power Plant Engineering, Rajput, Laxmi Publications, 4th edition, 2012.
2. Power plant Engineering, Ramalingam, Scietech Publishers
3. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

SUGGESTED LINKS:

- http://www.nprcet.org/e%20content/Misc/e-Learning/EEE/II%20YEAR/EE2252%20-%20Power%20Plant%20Engineering.pdf

B.TECH - R15 REGULATIONS

CHOICE BASED CREDIT COURSES (INTER DEPARTMENT)

OFFERED

IN

II YEAR I SEMESTER

w.e.f.

2015 ADMITTED BATCH

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

PULIVENDULA – 516390, Y.S.R. (DIST), ANDHRA PRADESH, INDIA

ANNEXURE-I

Choice Based Credit Course of Inter Department
offered in

B.TECH II YEAR I SEMESTER

BRANCH	SUBJECT CODE	SUBJECT NAME
PHYSICS	15ABS12	Basics of Nano Science and Nano Technology
MATHEMATICS	15ABS14	Set Theory and Mathematical Logic
	15ABS23	Mathematical Modeling
CHEMISTRY	15ABS15	Green Chemistry and Catalysis for Sustainable Environment
	15ABS16	Instrumental Methods of Chemical Analysis
	15ABS17	Chemistry of Nano Material and Application
ENGLISH	15AHS08	Campus Recruitment Training & Soft Skills
	15AHS09	Competitive & Spoken English
CE	15ACE09	Green Buildings
	15ACE10	Disaster Management and Mitigation
	15ACE11	Water Harvesting and Conservation
ECE	15AEC08	Basic Electronics
	15AEC09	Fundamentals of Digital Electronics
	15AEC10	Electronic Measurements & Instrumentation
ME	15AME11	Robotics
	15AME12	Mechanical Manufacturing Process
	15AME13	Non-Conventional Sources of Energy
EEE	15AEE08	Principles of electrical engineering
	15AEE01	Electrical engineering materials
	15AEE09	Electrical measuring instruments
CSE	15ACS04	Data Structures
	15ACS11	Object oriented Programming
	15ACS08	Operating Systems

II B.Tech – I Sem

15ABS12-Basics of Nano science and Nanotechnology
(Choice Based Credit Courses (Inter-department))

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OBJECTIVES:

1. To understand the fundamentals of nanoscience and nanotechnology
2. To give a general introduction to different classes of nanomaterials
3. To impart basic knowledge on various synthesis and characterization techniques involved in Nanotechnology
4. To make the learner familiarize with nanotechnology potentialities.

Unit-I Basics of Nanoscience:
Introductory quantum mechanics for nano science- Historical back ground of nanoscience - Density of states for zero, one, two and three dimensional materials, Quantum confinement, Quantum wells, wires, dots, Factors affecting to particle size, Metal semiconductor (MS) and metal insulator (MI).

Unit-II Properties of Nanomaterials:
Mechanical, Thermal, Electrical, Optical, Magnetic and Structural properties, Carbon based materials- Fabrication, structure, electrical properties and mechanical properties.

Unit-III Synthesis of Nanomaterials:
Physical methods: Bottom up-Ball Milling, Physical vapour deposition, Laser pyrolysis, Sputter deposition.
Chemical methods: Hydrothermal, Sol-gel method, solution combustion method, Co-precipitation method.

Unit-IV Characterization:
Spectroscopic techniques: UV- Visible Spectroscopy, Fourier Transform infrared (FTIR) spectroscopy, Principles and analysis of X-ray diffraction (XRD); electron diffraction, Scanning Electron Microscope (SEM) – Transmission Electron Microscope (TEM).

Unit –V Applications:
Nano engineered materials – coatings – catalysts - nano scale thin films for water-repellent, antireflective and self cleaning surfaces. Communication systems, solar cells and energy storage applications.

TEXT BOOKS

1. ***A Textbook of Nanoscience and Nanotechnology***, Pradeep T.,Tata Mc Graw Hill Education Pvt. Ltd., 2012.
2. Introduction to Nano Technology, Charles P. Poole Jr & Frank J. Owens. John Wiley and Sons, 2003.
3. The Chemistry of nanomaterials: Synthesis, Properties and Applications, C.N.R. Rao, A. Muller and A.K. Cheetham, Vol – 1, Wiley Online Library, 2005.
4. The Physics of Micro/Nano- Fabrication, Ivor Brodie & Julius J.Muray, Springer, 1992.

REFERENCES

1. ***Nanoscience: Nanotechnologies and Nanophysics,*** Dupas C., Houdy P., Lahmani M., Springer-Verlag Berlin Heidelberg, 2007.
2. Quantum Physics, A. Ghatak & S. Lokanathan, 5th Edition, Mac Millan India, 2004.
3. Nanophysics and Nanotechnology, Edward L. Wolf, Wiley-VCH, 2006.
4. Elements of X-ray Diffraction, B.D.Cullity, Addision Wesely, 1978.
5. Concise Encyclopedia of Materials Characterization, Robert Cahn, 2nd Edition (Advances in Materials Science and Engineering), Elsevier Publication, 2005.

Outcomes:

- Students will have the exposure to the multidisciplinary area of nanoscience.
- The necessary foundation for advanced materials engineering subject.
- Familiarity about the necessary characterization tools for nanoscale.
- Overview on the importance of nanoscience and nanotechnology through recent applications.

II B.Tech – I Sem

15ABS14- SET THEORY AND MATHEMATICAL LOGIC

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Objectives:

- This course aims at providing the student with the concepts of statements, sets relations and Mathematical induction.

UNIT – I

Statement, truth values, negation, conjunction, disjunction, conditional and biconditional, contrapositive statement.

UNIT – II

Set, subset, superset, operations viz. union, intersection, complement etc. of sets; power set, cartesian product.

UNIT – III

Equivalence relations, equivalence classes, partition, fundamental theorem of equivalence relation, partial order relation, Poset, chain, upper & lower bounds in poset, greatest & least elements, maximal & minimal elements, supremum & infimum, Zorn's lemma, introduction to lattice theory. Functions, injection, surjection and bijection; image and pre-image of set under function and inverse mapping, composite mapping.

UNIT – IV

Peano's axioms, principle of mathematical induction, well ordering principle, axiom of choice.

UNIT – V

Finite and infinite sets, countable and uncountable sets, Schroeder Bernstein Theorem, Continuum hypothesis.

TEXT BOOKS:

1. P. R. Halmos, Naive Set Theory Springer, 2009.
2. Bartle, R. G. and Sherbert, D. R. Introduction to Real Analysis, (John Wiley and Sons, Third (Indian) Edition), 2007.

REFERENCES:

1. K. Hrbacek and T. Jech, Introduction to Set Theory , 3rd edition, CRC press, 1999.

Outcomes: The student will be able to analyze the Mathematical logical structures with the concepts of statements, sets, relations and Mathematical Induction.

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II B.Tech – **I Sem**

15ABS23-Mathematical Modeling
(Choice based Credit Course)

L	T	P	C
3	1	0	3

Objectives:

- This course aims at providing the basic knowledge to understand a Mathematical model and formulate a Mathematical model related to a real word problems of engineering, biological science etc.

UNIT – I

Mathematical Modeling: Need, Techniques, Classifications and Simple illustarations,
Mathematical modeling Through Ordinary differential equations of First Order : Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order.

UNIT – II

Mathematical modeling Through System of Ordinary differential equations of First Order: Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order.

UNIT – III

Mathematical modeling Through Ordinary differential equations of Second Order: Mathematical modeling of Planetary motion ; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order.

UNIT – IV

Mathematical modeling Through Difference equations : Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in Probability theory.

UNIT – V

Mathematical modeling Through Functional, Integral, Delay- Differential and Differential-Difference Equations: Mathematical modeling Through Functional equations;
Mathematical modeling Through Integral equations; Mathematical modeling Through Delay-Differential and Differential-Difference Equations.

TEXT BOOKS:

1. J. N. Kapoor. Mathematical Modeling, NEW AGE INTERNATIONAL PUBLISHERS.

REFERENCES:

1. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.

Outcomes: The student will be able to analyze the real word problem through the technique of modeling of that problem to have better insight of the real word problem.

II B.Tech – **I Sem**

15ABS15-GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

UNIT 1: Principles And Concepts Of Green Chemistry

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT 2: Catalysis And Green Chemistry

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

UNIT 3: Organic Solvents: Environmentally Benign Solutions

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT 4: Emerging Greener Technologies And Alternative Energy Sources

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical

Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

UNIT 5: Green Processes For Green Nanoscience

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition,

   Oxford University Press, USA

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:

   Green Nanoscience, wiley-VCH, 2013.

Course Outcomes:

Upon completion of this course the students should recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

II B.Tech – **I Sem**

15ABS16-INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- To understand the principles of different instruments
- To apply the instruments for analysis of various species in different matrices
- To apply instrumental methods for framing project works

UNIT – I: Molecular Spectrophotometry

Absorption spectra, Lamberts Law, Beer's Law - Combined law equation; Derivations from Beer's Law. Block diagram of a uv- visible spectrophotometer – quantitative analysis ; Direct method for the determination of metal ions; Chromium, Manganese, Iron etc in alloys.

UNIT – II: Infrared Spectroscopy

Interaction of infra-red radiation with molecules, Sources of IR Radiation ; Spectral regions; Block diagram of IR Spectrometer , Function of each component; Sampling Techniques; Application of IR Spectroscopy to functional group analysis (-OH, -NH_2, -CHO, -CO-R, -CONH).

UNIT III: Chromatography

Gas Chromatography: Principles of Gas Chromatography, block diagram of gas chromatograph, Function of each component, Detectors (FID, ECD), stationary phase for column, mobile phase, chromatogram, qualitative analysis, quantitative analysis, retention time, retention volume, capacity factor, area., normalization method. Analysis of gaseous and volatile impurities.

HPLC: Principles of high performance liquid chromatography, Block diagram of HPCL, Systems, functions of each component, stationary phases, eluting solvents, pumps, detectors, quantitative applications of HPLC for environmental analysis.

UNIT IV: Atomic Spectrophotometry

Principle of atomization, atomic absorption spectrometer, applications for metal ions, Atomic emission, application and principle of ICP-OES, X-ray fluorescence spectrometry- Applications

UNIT V: Thermal methods of analysis

TGA- Thermo Gavimetry – Principle, instrumentation and applications
DTA- Differential Thermal Analysis- Principle, instrumentation and applications
DSC- Differential Scanning Coulometry- Principle, instrumentation and applications

Text BOOK:

1. Principles of Instrumental Analysis, 6th Edition, Douglas A. Skoog, James Holler. J, Stanley R. Crouch, Cengage Learning, New Delhi, 2014.
2. Instrumentaiotn methods of analysis, Chatwal & Anand, Himalaya Publ;ications, 2003

REFERENCES:

1. Instrumental methods of analysis, Willand merrit and dean, caps publications & Distribution, 1999.
2. Vogels Text book of Quantitative chemical analysis, 6th edition ,Mendham J, Denny R.C,Barnes J.D, Thomas M.J.K, pearson education, 2002.
3. Modern Analytical Chemistry, 1st edition, David Harvey, McGraw-Hill Higher Education, 2010.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Differentiate between classical and instrumental methods of Chemical analysis.

2. Apply different types of Instrumental methods for analysis of various samples in water and other environmental samples

II B.Tech – **I Sem**

15ABS17-CHEMISTRY OF NANO MATERIALS AND APPLICATIONS
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- And also characterisae the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

Unit I:

Introduction:Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods: Bottom-Up approach:- Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-II

Top-Down approach:- Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterilas, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

UNIT.V

Engineering Applications of Nanomaterials

TEXT BOOKS:

1. NANO: The Essentials : T Pradeep, MaGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.

2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

Course Out Come: At the end of the course, the student will be able to:

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

II B.Tech – **I Sem**

15AHS08-CAMPUS RECRUITMENT TRAINING & SOFT SKILLS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Objectives:

1. To develop awareness in students of the relevance and importance of soft skills.
2. To provide students with interactive practice sessions to make them internalize soft skills.
3. To prepare the students for placements.
4. To train students to use language appropriately for interviews, group discussion and public speaking
5. To help the students to understand interpersonal skills.
6. To support them in building interpersonal skills.
7. To better the ability to work with others

Outcome:

After completing this course,

- The students would have Understood of what Soft Skills is,
- Understood the significance of soft skills in the working environment
- Turning out engineering students with a clear concept of soft skills and equipping them with readiness to implement them at work place.

UNIT I: Interview Dynamics-Preparation-Power Selling- Cracking the top Questions-Stress Control.

UNIT II: Intra Personal Skills: Knowing Strengths & Weaknesses – Goal Setting-Quotient Skills- Positive thinking- Problem Solving-analytical Skills.

UNIT III: Intra Personal Skills: Managerial Skills, Group dynamics- Negotiation Skills-Time Management.

UNIT IV: Verbal Skills: Dynamics of listening, Speaking, Reading & Writing skills- Email writing.

UNIT V: Non Verbal Skills: Body Language- Body Posture, Gestures, Eye Contact, Facial Expressions, Appearance, Space Distance /Proxemics , Touch/Haptics,. Para Language-Tone, Pace, Pause, Volume , Quality .

REFERENCE BOOKS:

1. M. Ashraf Rizvi: Effective Technical Communication, Tata McGraw Hill, New Delhi, 2014.
2. Alex.k, soft skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
3. Technical Communication, Principle and Practice, Meenakshi Raman and Sangita Sharma, OUP, 2009.

4. Sherfield, M. Robert at al Cornerstone Developing Soft Skills, 4th ed. Pearson Publication, New Delhi, 2014.
5. Shalini Varma, Body Language for your success mantra, 4th ed, S. Chand Publication, New Delhi, 2014.

II B.Tech – **I Sem**

15AHS09-COMPETITIVE & SPOKEN ENGLISH.

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Objectives:

- To train students to use language effectively in everyday conversations, to participate in group discussions, to help them face interviews, and sharpen public speaking skills
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence.
- To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To train students to use language appropriately for interviews, group discussion and public speaking
- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

Expected Outcomes:

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students.
- Speaking with clarity and confidence thereby enhancing employability skills of the students.
- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities.

Cracking

UNIT I: Creating the unknowing passage-Reading Comprehension- Listening Comprehension.

UNIT II: Correction of the Sentences Nouns – Pronouns – Verbs- Tenses- Articles- Prepositions- Sentences.

UNIT III: Competitive Vocabulary – Word Building – Memory techniques

UNIT IV: Functional English – Sentences – Construction – Neutralization of accent – Intonation.

UNIT V: Dynamics of Speaking – Communication Skills – Speech Preparation – Speaking Practices.

Reference books:

1. M. Ashraf Rizvi: **Effective Technical Communication**, Tata McGraw Hill, New Delhi, 2014.
2. Wren and Martin, **High School English Grammar and Composition,** S. Chand Publication, New Delhi, 2014.
3. Hari Mohan Prasad, **Objective English for Competitive Examination,** Tata McGraw Hill, New Delhi, 2014.
4. R.S. Aggarwal , **Objective General English,** S. Chand Publication, New Delhi.
5. R.K Bansal, **Spoken English : Manual of Speech and Phonetics,**4th Edition, Orient Black swan Pvt Ltd.-New Delhi, 2013.

II B.Tech – I Sem

15ACE09-GREEN BUILDINGS
(Choice Based Credit Courses (Inter-department))

	L T P C
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UNIT-I Introduction :Concept of Green Building, Need for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

UNIT-II Green Building Concepts and Practices Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;
Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

UNIT-III Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

UNIT-IV Air Conditioning Introduction,CII Godrej Green business centre,Design philosophy,Design interventions,Energy modeling, HVAC System design,Chiller selection,pump selection,Selection of cooling towers,Selection of air handing units,Precooling of fresh air,Interior lighting system,Key feature of the building. Eco-friendly captive power generation for factory,Building requirement.

UNIT-V Material Conservation Handling of non process waste, waste reduction during construction,materials with recycled content,local materials,material reuse,certified wood ,Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference Books: 1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

II B.Tech – I Sem

15ACE10-DISASTER MANAGEMENT AND MITIGATION

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

UNIT-I - Introduction To Disaster :Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster- Dimensions & Scope of Disaster Management - India's Key Hazards – Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT-II - Natural Disaster :Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT-III - Anthropogenic DisasteR :Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT-IV - Approaches In Disaster Management :Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan - Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

UNIT-V - Disaster Mitigation :Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management - Emergency Management Systems (EMS) in the Disaster Management Cycle - Remote Sensing and Geographic Information Systems(GIS) in Disaster Management. 2

Text Book:

1. Sharma.S.R, "Disaster management", A P H Publishers, 2011.

REFERENCES:

1. VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.
2. Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.

3. Gupta.H.K, “Disaster Management”, University Press, India, 2003.
4. Gupta.M.C, “Manuals on Natural Disaster management in India”, National Centre for Disaster Management,IIPA, New Delhi, 2001.

II B.Tech I-sem R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING: PULIVENDULA (AUTONOMOUS)

II Year B.Tech (Civil Engineering) I Semester	**T**	**L**	**C**
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15ACE11 – WATER HARVESTING AND CONSERVATION (CBCC)

OBJECTIVE: *The course aims at bringing awareness about the need for conservation of Water. The student will be taught different methods of Water Harvesting and also the methods of Water Conservation. He will also learn the principles of Watershed Management.*

UNIT – I

Origin, Occurrence & Movement of Groundwater:-Introduction-sources of ground water – Hydro geological Cycle – Infiltration – natural openings in rocks – zones of aeration , saturation and water table – classification of ground water – laboratory and field methods of sampling ground water- aquifers – aquifuges- aquicludes – aquitards – ill effects due to lowering of water table -Artificial recharge.

UNIT – II

Water Harvesting: Principles of water harvesting-methods of rainwater harvestingdesign of rainwater harvesting structures-Purification Techniques for direct use-Harvesting of surface runoff-onsite detention basin - ponds - types - Recycling of harvested water

UNIT – III

Water Recovery and Reuse: Perspective on recycle and reuse- factors affecting the development of water reclamation and reuse criteria- elements/components of water reclamation and reuse criteria / guidelines- sewage irrigation- Waste water reclamation-waste water recharge for reuse – Treatment Requirements for Water Reuse-methods.

UNIT – IV

Sustainable Watershed Approach & Watershed Management Practices: Concept of watershed-Introduction to watershed management- Integrated water resources management- natural resources management-agricultural practices-integrated farming-Conjunctive use of water resources-Community participation-Watershed Management Practices in Arid and Semiarid Regions-Case studies-Short term and long term strategic planning.

UNIT – V

Soil and Water Conservation: Scope of soil and water conservation-Mechanics and types of erosion-their causes-Soil erosion control measures - bank protectionvegetative barriers-contour bund- contour trenches-contour stone walls-contour ditchesterraces-outlets and grassed waterways-Gully control structures - temporary and permanent - design of permanent soil conservation structures-Design of farm ponds and percolation ponds.

TEXT BOOKS:

1. Watershed Management by Murty, J.V.S, New Age Intl., New Delhi .
2. Water Resources Conservation and Management by Chatterjee, S. N.,Atlantic Publishers.
3. Ground Water by S.Ramakrishnan, SCITECH Publishers.

REFERENCE BOOKS:

1. Advances in Soil and Water Conservation by Pierce, F.J. and Frye, W. W. (1998):, Ann Arbor Press, Michigan.
2. Soil and Water Conservation Engineering, 4th Ed. By Schwab, G. O., Fangmeier, D. D., Elliot, W. J. and Frevert, R. K. (1993), John Wiley and Sons Inc., USA
3. Watershed Management in India by Murthy, J.V.S., Wiley Eastern, New Delhi, 1994 .
4. Irrigation Water Management - Principles and Practice by Dilip Kumar Majumdar,, PHI Pvt.Ltd.NewDelhi-1.
5. Irrigation and Water Power Engineering by Madan Mohan Das & Mimi Das Saikia, PHI learning Pvt. Ltd., NewDelhi-1

Course Outcomes: *On completion of the course, the student will be able to*

a) Appreciate the importance of Water Conservation

b) Understand the methods of Water Harvesting

c) Understand the principles of Watershed Management and its importance in sustainability

II B.Tech – I Sem

15AEC08-BASIC ELECTRONICS
(Choice Based Credit Courses (Inter-department))

L T P C
3 1 0 3

UNIT – I:
Semiconductor devices: Diode, BJT, their structures and principle of operations.
Amplifiers: Functionality, specifications-voltage gain, current gain, input resistance, output resistance, dynamic range, bandwidth, linearity, power efficiency

UNIT- II:
Power electronics: Half wave and full wave rectification, filtering, regulation with Zener diode and linear regulators.
Filters: Low pass, high pass, band pass and band stop filters, specifications-cutoff frequency, roll off.

UNIT – III
Feedback Amplifiers: Basic concept of negative and positive feedback, application of negative feedback in amplifiers, effect on gain, bandwidth, input resistance, output resistance and de-sensitivity to parameter variations.
Oscillators: Barkhausen criterion, RC phase shift, Wien bridge, Colpitts, Hartley and Crystal oscillators, applications of oscillators.

UNIT – IV
Operational amplifier: Differential mode of operation, common mode rejection, typical op-amp specifications-open loop gain, differential input resistance, unity gain-bandwidth, inverting amplifier, non-inverting amplifier, summing amplifier, Instrumentation Amplifier, concept of active filters.

UNIT – V
Digital electronics: Review of Boolean algebra and signed number representation schemes in binary, implementation of Boolean functions using various logic gates, concept of combinatorial and sequential circuits, registers and counters from functional viewpoint.

Text Books:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press., 2008.

References:

1. Electronics Devices and Circuits Theory, R.L.Boylestad,Lousis Nashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, K. Lal Kishore, 3rd Edition, BSP, 2008.
3. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012

II B.Tech – **I Sem**

15AEC09-FUNDAMENTALS OF DIGITAL ELECTRONICS
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

UNIT-I:
Binary Systems: Introduction of Digital Computers and Digital Systems, Binary numbers, Base Conversion: Binary, Decimal, Hex, Octal. Complements: R's Complement, 2's and 10's Complement, (R-1)'s Complement, 1's and 9's Complement, Binary Codes: Decimal Codes, Error Detection codes, Reflected Code.

UNIT-II:
Binary Logic And Boolean Algebra: Basic Binary logic, Logic Gates: AND, OR, INVERTER, Postulates, Boolean algebra, Two value Boolean algebra, Basic theorems of Boolean algebra: De-Morgan's Theorems, Boolean functions Boolean forms: Canonical, Standard.

UNIT-III:
Boolean Function Implementation: Need for simplification, K–Map method: 2–Variable K–map, 3–Variable K–map, 4–variable K–map, K–Map using Don't care condition, Universal Gates: NAND, NOR, NAND Implementation, NOR Implementation.

UNIT-IV:
Basic Combinational Logic: Design procedure of combinational logic, Adder: Half Adder, Full Adder, Subtractor, Half Subtractor, Full Subtractor, Code Conversion, BCD – Excess-3 conversion.

UNIT-V:
Combinational Logic Using MSI And LSI: Binary Parallel Adder, Magnitude Comparator: 2 Input Comparator, Decoder: 2–4 Decoder, 3–8 Decoder, Encoder: 4–2 Encoder, 8–3 Encoder, Multiplexer: 4–1 multiplexer, Demultiplexers: 1–4 Demultiplexers.

Text Book:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, Zvi Kohavi and Nirah K.Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Digital Circuits, Anand Kumar, Prentice-Hall of India, Latest Edition
2. Digital electronics Principles, Malvino & Leech, Tata McGraw-Hills publication, Latest Edition.

II B.Tech – **I Sem**

15AEC10-ELECTRONIC MEASUREMENTS & INSTRUMENTATION

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives for electrical measurements and instrumentation:

1. This course introduces the basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
2. It also explains the measurements of RLC parameters using bridge principles.
3. The principles of magnetic measurements are also explained.
4. The principle of working of CRO and its applications are explained.

Course outcomes for electrical measurements and instrumentation:

1. Use wattmeters, pf meters, and energy meters in a given circuit.
2. Extend the range of ammeters and voltmeters
3. Measure active power, reactive power, power factor, and energy in both 1-phase and 3-phase circuits
4. Determine the resistance values of various ranges, L and C values using appropriate a.c bridges

UNIT – I:

Fundamentals of Measurements: Introduction, types of measurements, static & dynamic characteristics of measurement system, types of Errors, error sources and remedies.
Multimeter: Principle of measurement of D.C. Voltage and current, A.C. Voltage and current, Resistance, AC and DC sensitivity, Specifications.

UNIT – II:

Fundamentals of Cathode Ray Oscilloscope: Block diagram, CRO probes, Delay line, types of Oscilloscopes. Measurement of: Signal voltage, Current, Phase & Frequency using Lissajous patterns, Industrial applications of CRO.

UNIT – III:

Review of DC Bridges: Wheatstone bridge, Wien Bridge, errors and precautions in using bridges,
AC bridges: Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance- Shearing Bridge. Kelvin Bridge, Q-meter.

UNIT – IV:

Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep waveform generators, and their standards, specifications and principles of working (Block diagram approach).

UNIT – V:

Sensors and Transducers: Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Text Books:

1. A course in electrical & electronic measurements and instrumentation – AK Sawhney, Puneet Sawhney, 4^{th} Edition, Dhanpat Rai & Sons Educational and technical publisher, 2012.
2. Modern Electronic Instrumentation and Measurement Techniques, Albert D.Helfrick and William D.Cooper, Pearson / Prentice Hall of India, 2007

References:

1. Measurement Systems- Application and Design, Ernest O. Doebelin, TMH, 2007.
2. Electronic Instrumentation, H.S.Kalsi, 2^{nd} edition, Tata McGraw Hill, 2004.
3. Principles of Measurements and Instrumentation, Alan. S. Morris, 2^{nd} Edition, Prentice Hall of India, 2003.

II B.Tech – I Sem

15AME11-ROBOTICS

(Choice Based Credit Courses (Inter-department))

	L	T	P	C
	3	1	0	3

Course objectives

- To design, develop and complete robotic activities and challenges
- This course aims at providing the students the fundamental knowledge of the various subscriptions such as kinematics, Dynamics, controls, sensors, actuators, etc.
- It is aimed to provide adequate background in both analysis and design of robots.

UNIT – I

Fundamentals of Robots: Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

UNIT – II

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, The inverse kinematic of robots, Degeneracy and Dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT – III

Control of Manipulators: Open- and Close-Loop Control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID Control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

UNIT – IV

Robot Vision: Industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision system, Image acquisition, description of other components of vision system, image representation, image processing.

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UNIT – V

Robot Cell Design and Programming: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.

Methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

Text Books:

1. Industrial Robotics – Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey – Mc Graw Hill, 1986.
2. Robotics and control – R K Mittal and I J Nagrath, - Tata Mc Graw Hill

References:

1. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI Publications
2. Robot Analysis and Control - H. Asada and J.J.E. Slotine John Willey & Sons.
3. Fundamentals of Robotics: Analysis and control, Robert J. Schilling, Prentice Hall, 1990.
4. A robot Engineering text book – Mohsen shahinpoor, Harper & Row Publishers,1987
5. Introduction to Robotics: Mechanics and Control, John.J.Craig, Addison- Wesley, 1999
6. Robotics: Control, sensing, vision, and intelligence – K.S. FU, R.C. Gonzalez and C.S.G Lee. Mc Graw Hill, 1987.
7. Robotic Engineering an integrated approach- Richard D. Klafter Thomas – PHI publications

Course outcomes

By studying this course, students will be

- Familiar with the history, concept development and key components of robotics technologies.
- Understand basic mathematic manipulation of spatial coordinate representation and transformation.
- Understand and able to solve basic robot forward and inverse kinematic problems.
- Understand and able to solve robotic dynamics, path planning and control problems.
- Able to undertake practical robotics experiments that demonstrate the above skills.

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II B.Tech – **I Sem**

15AME12-MECHANICAL MANUFACTURING PROCESSES
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Objectives:
The objectives of this course are to introduce to demonstrate the various manufacturing processes. To develop knowledge and importance of surface treatment, processing of powder metals, glass, ceramics plastics. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes.

UNIT – I
Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT – II
Processing of Powder metals, Glass and Superconductors: Introduction, production of metal powders, compaction of metal powders, sintering, secondary and finishing operations, design considerations for powder metallurgy, Process capabilities, economics of powder metallurgy, forming and shaping of Glass, techniques for strengthening and treating Glass, design considerations for Glass, processing of superconductors.
Processing of ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying , sintering, Hot compaction, Area of application , finishing of ceramics.

UNIT – III
Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, and micromachining, High speed Machining

UNIT – IV
Processing Of Plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction - concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

UNIT – V
Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

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Text Books:

1. Manufacturing Engineering and Technology, Schmid and kalpakjin, Pearson Education.
2. Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH
3. Rapid Prototyping Principles and Applications, RafiqNoorani, Wiely Pub

Reference Books:

1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012
2. Process and materials of manufacturing -Lindberg, PE
3. Principles of Metal Castings, Rosenthal.
4. Welding Process, Parmar, Khanna publication.
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub

Course Outcomes:

After completion of this course student will be able to

- Understand the principles of processing of various powder metals, glass, ceramics and semiconductors.
- Understand the applications of rapid prototyping and processing of plastics

Suggested Links:

- www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt
- www.rose-hulman.edu/~stienstr/ME470/DFA.ppt
- www.design4manufacturability.com/DFM_article.htm
- http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm

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II B.Tech – I Sem

15AME13-NON-CONVENTIONAL SOURCES OF ENERGY

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objective:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analyse the environmental and cost economics of using renewable energy sources compared to fossil fuels.

UNIT - I

Principles Of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage And Applications :

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

Wind Energy : Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Bio-Mass : Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engineoperation and economic aspects.

UNIT-IV

Geothermal Energy : Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy : OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC.

Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux,

MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion,

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economic aspects.Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

1. Renewable energy resources, Tiwari and Ghosal, Narosa.
2. Non-Conventional Energy Sources ,G.D. Rai

References :

1. Renewable Energy Sources, Twidell& Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering,B.S.Magal Frank Kreith&J.F.Kreith.
4. Principles of Solar Energy, Frank Krieth& John F Kreider.
5. Non-Conventional Energy, Ashok V Desai, Wiley Eastern 6. Non-Conventional Energy Systems, K Mittal , Wheeler.

Course Outcome:

At the end of the course the student will

1. Have knowledge about various renewable energy sources
2. Be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

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II B.Tech – **I Sem**

15AEE08-PRINCIPLES OF ELECTRICAL ENGINEERING

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives for Principles of Electrical Engineering:

1. Students can learn about fundamental concepts circuits, DC, AC Machines.
2. Students can learn about Electrical instruments.
3. Student learn how to apply electrical principles in their applications.
4. Student can able verify theorems such as super position, thevinins and maximum power transfer and the measurements of RLC parameters using bridge principles

UNIT I: Fundamentals of Electrical Circuits

Circuit Concept–R-L-C Parameters -Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference. Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Real and Reactive Power, Complex Power. Examples. Star Delta Transformation Technique. Thevenin's, Norton's and Superposition Theorems for D.C Excitations.

UNIT II: DC Machines

Principle of Operation of DC Machines, Constructional features, EMF equation, Types of Generators, Magnetization and load characteristics of DC Generators.

DC motors, Types of DC Motors, Characteristics of DC Motors, Losses and Efficiency, Swinburne's Test, Speed control of DC Shunt and series Motors, Flux and Armature voltage control methods.

UNIT III: Transformers & Induction machines

Principle of Operation of Single Phase transformer, Types, Constructional Features, EMF equation, Phasor Diagrams for no load and loaded conditions, efficiency of Transformer and regulation, OC and SC Tests, predetermination of Efficiency and Regulation (Simple Problems). Concept of rotating field, Principle of Operation of induction motors.

UNIT IV: Special Machines

Principle of operation of Shaded pole motors, Capacitor motors, AC Servo motors, AC Tachometers, Synchros, Stepper motors and its characteristics.

V.Jera
BoS–Chairman

UNIT V: Electrical Measurements

Moving Coil & Moving Iron Instruments (Ammeter & Voltmeter).Dynamometer Type Watt meters & Energy Meters(operating principles).

Course outcomes for Principles of Electrical Engineering:

1. Students able to demonstrate knowledge on fundamental concepts circuits, DC, AC Machines.
2. Students able to demonstrate knowledge on how to measure the electrical quantities using measuring instruments.
3. Students are able to apply electrical principles in their applications.
   Students are able to determine the RLC parameters using bridge principles.

Text Books

1. Network Analysis – A Sudhakar, Shyammohan S.Palli, 3 ed., 2009. TMH.
2. Introduction to Electrical Engineering – M.S.Naidu and S. Kamakshaiah, 2008, TMH.

References:

1. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.

BoS – chairman

II B.Tech – **I Sem**

15AEE01-ELECTRICAL ENGINEERING MATERIALS
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives for Electrical Engineering material:

1. To aquire knowledge on general properties of different conductors.
2. To learn the fundamental properties of dielectric materials and high resistivity materials.
3. To gain knowledge on different insulating materials.
4. To learn about different types of wiring and wiring materials.

UNIT-I Conducting Materials:
Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting resistivity of electrical materials –electrical/mechanical/thermal properties of copper, aluminum, iron, steel, lead, tin and their alloys – applications.

UNIT-II Dielectric Materials And High Resistivity Materials :
Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down– electrical and thermal effects ,Polarization – electric, ionic and dipolar polarization. Effect of temperature and Frequency on dielectric constant of polar dielectrics. High Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

UNIT-III Insulating Materials-I:
Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials, electrical, thermal and mechanical properties of, Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

UNIT-IV Insulating Materials-II:
Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – their Electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications .

V.Sesh
BOS- chairman

UNIT-V Domestic Wiring:

Wiring materials and accessories – Types of wiring – Types of Switches - Specification of Wiring – Stair case wiring - Fluorescent lamp wiring-Godown wiring – Basics of Earthing – single phase wiring layout for a residential building

Course outcomes for Electrical Engineering material:

1. Able to demonstrate the knowledge on different types of electrical materials.
2. Able to evaluate the leakage current, loss angle, permittivity, dielectric constant and loss constant of different dielectrics.
3. Able to understand the fundamentals of different insulating materials

Able to demonstrate knowledge on types of switches and wiring.

Text Books:

1. Electrical engineering materials by G.K. Mittal, Khanna publication 2nd edition.
2. A course in Electrical Engineering Materials by R.K .RAJPUT, Laxmi publications.
3. Electrical technology volume-I by B.L. Theraja, SChand publications.

Reference Books:

1. "An Introduction to electrical engineering materials" by C.S. Indulkar and S. Thiruvengadam, SChand & Company.
2. "Electrical engineering Materials" by T.T.T.I, Madras, Tata McGraw Hill
3. "A course in electrical engineering materials" by S.P. Seth, Dhanapatrai & Sons, New Delhi

V. [illegible]
BOS-chairman

II B.Tech – I Sem

15AEE09-ELECTRICAL MEASURING INSTRUMENTS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Objective:

Electrical measurements course introduces the basic principles of all measuring instruments. It also deals with the measurement of RLC parameters voltage, current Power factor, power, energy and magnetic measurements and Digital Meters

UNIT- I Measuring Instruments

Classification – Deflecting, Control and Damping Torques – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Type Instruments – Expression for the Deflecting Torque and Control Torque – Errors and Compensations, Extension of range using Shunt and Series Resistance. Cathode Ray Oscilloscope- Cathode Ray tube-Time base generator-Horizontal and Vertical Amplifiers – Application of CRO – Measurement of Phase , Frequency, Current & Voltage- Lissajous Patterns

UNIT – II Measurement Of Power And Energy

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Element Dynamometer Wattmeter, Expression for Deflecting and Control Torques. Types of P.F. Meters – Dynamometer and Moving Iron Type – 1-ph and 3-ph Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and Compensations. Three Phase Energy Meter.

UNIT – III Instrument Transformers And Potentiometers

CT and PT – Ratio and Phase Angle Errors – Design Considerations.

Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer – Standardization – Measurement of unknown Resistance, Current, Voltage.

A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

UNIT – IV D.C & A.C Bridges

Method of Measuring Low, Medium and High Resistance – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle - Desauty Bridge. Wien's Bridge – Schering Bridge.

BOS - chairman

UNIT – V Magnetic Measurements

Ballistic Galvanometer – Equation of Motion – Flux Meter – Constructional Details, Comparison with Ballistic Galvanometer. Determination of B-H Loop Methods of Reversals - Six Point Method – A.C. Testing – Iron Loss of Bar Samples.

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications.

Reference Books:

1. Electronic Instrumentation by H. S. Kalsi, Tata Grawhill Mc, 3rd Edition.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers
4. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co.

V. Sarl
BoS -chairman

II B.Tech – **I Sem**

15ACS04-DATA STRUCTURES
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

UNIT-I

Stacks & Queues: stacks, stacks using dynamic arrays, Queues, circular queues using dynamic arrays, amazing problem, evaluation of expressions.

Linked List: single linked list and chains, representing chains in C, Linked stacks and queues, polynomials, additional list operations, equivalence classes, sparse matrices, double linked list.

UNIT –II

Trees : Introduction, Binary tree, Binary tree traversals , Additional binary tree operations, Threaded binary trees, Heaps, Binary search trees, Selection trees, Forests, Representation of disjoint sets, Counting binary trees.

UNIT-III

Graphs: The graph abstract datatype, Elementary graph operations, Minimam cost spanning trees, Shortest paths and transitive closure.

Sorting: Motivation, Insertion sort, Quick sort, Merge sort , Heap sort, sorting on several keys, list and table sorts, external sorting.

UNIT –IV

Hashing: Introduction, Static hashing, dynamic hashing, Bloom Filters.

Priority Queues: Single ended and double ended priority queues, leftist trees, Binominal Heaps, Fibonacci Heaps, Pairing Heaps, Symmetric Min-Max Heaps, and Interval Heaps.

UNIT-V

Efficient binary search trees: Optimal binary search trees, AVL Trees, RED Black Trees, Splay Trees, M- Way search trees, B-Trees, B+ -Trees.

Text Books:

1. Fundamentals of Data structures in C 2nd edition HOROWITZ , SAHNI, ANDERSON-FREED.

II B.Tech I/Sem R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANATHAPURAMU
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REGULATION - R15

15ACS11– OBJECT ORIENTED PROGRAMMING (CBCC)

L	T	P	C
3	1	0	3

Learning Objectives:

- This subject will help to improve the analytical skills of object oriented programming
- Overall development of problem solving and critical analysis
- Formal introduction to Java programming language

Learning Outcomes: On successful completion of this course, the student should be able to:

- Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard
- Understand the basic principles of the object-oriented programming
- Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming.

Unit-I :

Introduction to Java : Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Unit-II :

Objects and Classes : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Unit-III :

Inheritance and Polymorphism : Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

Unit-IV :

Event and GUI programming : Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

Unit-V :

Multithreading in java : Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Text Books:

1 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.

2 Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

3 Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.

Reference Books:

4 Core Java Volume-I Fundamentals, Eight Edition, Horstmann& Cornell, Pearson Education.

5 The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.

6 Java Programming, D. S. Malik, Cengage Learning.

II B.Tech – **I Sem**

15ACS08-OPERATING SYSTEMS

L	T	P	C
3	1	0	3

Course Objective

- To make the students understand the basic operating system concepts such as processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection.
- To get acquaintance with the class of abstractions afford by general purpose operating systems that aid the development of user applications

Course Outcomes

- Understand what makes a computer system function and the primary PC components.
- Understand past and current trends in computer technology.
- Use basic software applications.
- Add functionality to the exiting operating systems
- Design new operating systems

UNIT I

Operating Systems Overview: Operating system functions, Operating system structure, operating systems Operations, protection and security, Kernel data Structures, Computing Environments, Open- Source Operating Systems

Operating System Structure: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

Processes: Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.

UNIT II

Threads: overview, Multicore Programming, Multithreading Models, Thread Libraries, Implicit threading, Threading Issues.

Process Synchronization: The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches.

CPU Scheduling: Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple- Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.

UNIT III

Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

Virtual memory: demand paging, page-replacement, Allocation of frames, Thrashing, Memory- Mapped Files, Allocating Kernel Memory

Deadlocks: System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

UNIT IV

Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

File system Interface: The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection.

File system Implementation: File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.

UNIT V

I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

Protection: Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability- Based systems, Language – Based Protection

Security: The Security problem, Program threats, System and Network threats, Cryptography as a security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition, 2009, Pearson Education.

Reference Books:

1. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.
4. Operating Systems, A.S.Godbole, Second Edition, TMH.
5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
6. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
7. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.

B.TECH - R15 REGULATIONS

CHOICE BASED CREDIT COURSES (INTER DEPARTMENT)

OFFERED

IN

III YEAR II SEMESTER

w.e.f.

2015 ADMITTED BATCH

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

PULIVENDULA – 516390, Y.S.R. (DIST), ANDHRA PRADESH, INDIA

ANNEXURE-II

Choice Based Credit Course of Inter Department
offered in

B.TECH III YEAR II SEMESTER

BRANCH	SUBJECT CODE	SUBJECT NAME
MATHEMATICS	15ABS18	FUZZY SETS AND APPLICATIONS
	15ABS19	OPTIMIZATION TECHNIQUES
CHEMISTRY	15ABS20	CHEMISTRY ENERGY MATERIALS
	15ABS21	CHEMISTRY OF LIFE
	15ABS22	CHEMISTRY OF POLYMERS AND THEIR APPLICATIONS
CE	15ACE35	REMOTE SENSING & GIS
	15ACE36	ENVIRONMENTAL IMPACT ASSESTMENT & MANAGEMENT
	15ACE37	FINITE ELEMENT METHODS
EEE	15AEE34	RENEWABLE ENERGY SOURCES
	15AEE19	POWER ELECTRONICS
	15AEE35	UTILIZATION OF ELECTRICAL ENERGY
ME	15AME35	OPTIMIZATION TECHNIQUES BY MATLAB
	15AME36	MECHATRONICS & MEMS
	15AME37	AUTOMOTIVE ELECTRONICS
ECE	15AEC34	FUNDAMENTALS OF COMMUNICATION SYSTEMS
	15AEC35	INDUSTRIAL ELECTRONICS
	15AEC36	NEURAL NETWORKS & FUZZY LOGIC
CSE	15ACS35	MOBILE COMPUTING
	15ACS36	OPTIMIZATION TECHNIQUES
	15ACS37	MACHINE LEARNING

III B.Tech II Semester

15ABS18-FUZZY SETS AND APPLICATIONS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *This course aims at providing the student with the basic concepts of Fuzzy sets, along with the properties and applications.*

UNIT – I

Fuzzy sets - basic definitions, α-level sets, convex fuzzy sets.

UNIT – II

Basic operations on fuzzy sets, types of fuzzy sets

UNIT – III

Cartesian products, algebraic products, bounded sum and difference, t-norms and t-conorms. Fuzzy sets in contrast of probability theory.

UNIT – IV

The extension principle - the Zadeh's extension principle, image and inverse image of fuzzy sets.

UNIT – V

Fuzzy numbers, elements of fuzzy arithmetic,Fuzzy relations and fuzzy graphs, composition of fuzzy relations, min-max composition and its properties, fuzzy equivalence relations, fuzzy relational equations, fuzzy graphs.

Course Outcomes: *The student will be able to analyze several real time problems effectively, under fuzziness.*

TEXT BOOKS:

1. Klir, G. J. and Yuan, B. Fuzzy Sets and Fuzzy Logic : Theory and Applications, (Prentice Hall of India, New Delhi, 1997)

REFERENCES:

1. Zimmermann, H. J. Fuzzy set theory and its Applications (Allied publishers Ltd., New Delhi, 1991).
2. M.Ganesh, Introduction to Fuzzy sets and Fuzzy Logic (PHI Publications,2001)

2.7.18

III B.Tech II Semester

15ABS19-OPTIMIZATION TECHNIQUES
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *This course aims at providing the student with the basic concepts and several methods of optimization .*

UNIT – I

Linear programming I : Simplex Method

Introduction , Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method.

UNIT – II

Linear programming II : Duality in Linear Programming

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method and Transportation Problem.

UNIT – III

Non-linear programming: Unconstrained optimization techniques

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods : Random Search Methods : Random jumping Method, Random Walk method. Grid Search Method

UNIT – IV

Non-linear programming: Constrained optimization techniques

Introduction , Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V

Geometric Programming

Unconstrained Minimization Problems : solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems :Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Course Outcomes: *The student will be able to analyze optimization problems in engineering and technology using various elegant optimization technique.*

2.7.18

TEXT BOOKS:

Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.

REFERENCES:

1. Chong, E.K.P.and Zak, S. H.. An Introduction to Optimization, John Wiley & Sons, N.Y.
2. Peressimi A.L., Sullivan F.E., Vhl, J.J..Mathematics of Non-linear Programming, Springer – Verlag.

2.7.18

III B.Tech II Semester

15ABS20-CHEMISTRY ENERGY MATERIALS
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.*
- *To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.*
- *To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method*
- *Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.*
- *To understand and apply the basics of calculations related to material and energy flow in the processes.*

UNIT-1: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries

UNIT-2: Fuel Cells: Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,.

UNIT-3: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

UNIT-4: Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

UNIT-5: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

Course Outcome:

- *Ability to perform simultaneous material and energy balances.*
- *Student learn about various electrochemical and energy systems*
- *Knowledge of solid, liquid and gaseous fuels*
- *To know the energy demand of world, nation and available resources to fulfill the demand*
- *To know about the conventional energy resources and their effective utilization*
- *To acquire the knowledge of modern energy conversion technologies*
- *To be able to understand and perform the various characterization techniques of fuels*
- *To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively*

References :

1. **Physical chemistry by** Ira N. Levine
2. **Essentials of Physical Chemistry,** Bahl and Bahl and Tuli.
3. **Inorganic Chemistry,** Silver and Atkins
4. **Fuel Cell Hand Book 7th Edition,** by US Department of Energy (EG&G technical services and corporation)
5. **Hand book of solar energy and applications** by Arvind Tiwari and Shyam.
6. **Solar energy fundamental, technology and systems** by Klaus Jagar et.al.
7. **Hydrogen storage** by Levine Klebonoff

III B.Tech II Semester

15ABS21-CHEMISTRY OF LIFE

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives:

- *To impart knowledge in chemistry to the students about Structure and function of bio-molecules such as protein & nucleic acid, metabolism, and regulation that are particularly relevant to the biological and life sciences.*

UNIT-1: Cell Chemistry:

Introduction to cell as the basic unit of Life; Types of cells; Procaryotes and Eucaryotes – examples; Characteristics of Plant & Animal cells; Structure of Cell and its Organelles and their functions;

A Chemical probe into the Cell: - Cell Walls composition - (G+) & (G-) Procaryotes, Plant and Animal cells i) Minerals ii) Carbohydrates iii) Proteins iv) Lipids v) Nucleic acids vi) Enzymes vii) Vitamins viii) Hormones, etc. their biological functions.

UNIT -2: Lipids and Membranes:

Introduction: Lipid Structure - Acyl glycerol, Phospho glycerides (Phospholipids), ether lipids and sphingolipids. Bio-synthesis of lipids. Biological membranes – their role, structural complexity and compositions; Plasma membrane, Membrane lipids, Membrane proteins; Lipid bilayers, Fluid Mosaic Model of biological membrane. Dyanamic nature of lipid bilayers and membrane. Protein and Glycoprotein components of membrane. Membrane transport pores and channels, active transport and passive transport.

UNIT -3: Enzyme, Catabolic and Anabolic processes:

Definition, classification and nomenclature; Factors affecting the enzyme catalysed reactions. Advantages and limitations of enzymes in organic synthesis – mechanistic aspects of enzyme catalysis – Lock and Key mechanism, Induced – Fit mechanism, Desolvation and Solvation – substitution theory, Three- point attachment rule. Factors affecting the enzyme catalysed reactions. Enzyme selectivity – chemo, regio, diastereo and enatio selectivity – illustration with suitable examples. Regulation of enzyme activity – Allosteric enzymes. Enzyme inhibition – reversible inhibition – competitive, non-competitive and uncompetitive inhibition of enzymes. Immobilised enzymes – immobilization by physical and chemical methods. Co-Enzymes involved in Oxidation-Reduction processes. Role of metal ions in biological processes, physiology of digestion.

Catabolic and Anabolic processes: Energy transfer processes, role and significance of ATP; The electron transport system - Oxidative phosphorylation; Photosynthesis and its mechanism (cyclic and non-cyclic).

UNIT -4: Bio-Chemistry of Carbohydrates, Respiration and Carbohydrate Metabolism:

Bio-Chemistry of Carbohydrates: Classification of Carbohydrates; Stereoisomerism; Optical isomerism; Optical activity projection and perspective formulas; D-glyceride as a reference compound; Cyanohydrin synthesis; Structure of glucose; monosaccharides, disaccharides and polysaccharides; Polysaccharides and Glycoproteins in cells.

Respiration and Carbohydrate Metabolism: Glycolysis and Kreb's Cycle; Physiology of respiration in mammals, respiratory exchange and transport of respiration at cellular level. Interconversion of glycogen and glucose in liver and the role of insulin.

UNIT -5: Chemistry and Bio-Chemistry of Amino Acids & Proteins:

General properties of Amino acids; Proteins - Classification and Function; Structure of Proteins – Primary, Secondary, Tertiary and Quaternary Structure of Proteins. Synthesis of Peptides and Poly Peptides. Determination of Structure of Poly Peptides -N-terminal and C- terminal residue analysis.

Bio-Chemistry of Nucleic Acids: Introduction; Hydrolysis of Nucleic acids; Structure, Physical and Chemical properties of Heterocyclic bases - Adenine, Guanine, Uracil and Thymine; Structure of DNA: Primary, Secondary, Tertiary structures of DNA. A,B,C and Z forms of DNA. Structure of RNA – types of RNA – mRNA, rRNA and tRNA.; Definition and explanation of Replication, Transcription, Translation. Genetic Code – Codons – Protein synthesis.

Course outcome:

Students will gain an understanding of:

- *the chemical basis for biological phenomena and cellular structure*
- *how physiological conditions (esp. the chemistry of water) influence the structures and reactivities of biomolecules*
- *the chemical properties of amino acids, cofactors, and sugar*
- *the basic principles of protein and polysaccharide structure*
- *enzyme kinetics and their application to the elucidation of catalytic mechanisms*
- *constructing reasonable electron-pushing mechanisms for enzyme-catalyzed reactions*
- *the chemical logic of metabolism*
- *nucleic acid structure – building blocks of both DNA and RNA, secondary structures, tertiary structures and higher order packaging of genomic DNA*
- *translation – process for translation of messenger RNA into polypeptides, interpreting the genetic code, mechanism of ribosomal action*

References:

1. **"*Outlines of Bio-Chemistry*"**, by E.E. Conn & Stumpf, John Wiley & Sons, New York, **(2000)**.
2. **"*Text Book of Bio-Chemistry*"**, by West, Todd et.al, Oxford and & BH Manohar Publishers & Distributers.
3. **"*Priciples of Bio-Chemistry*"** by White, Handler, Smith et.al.
4. **"*Bio-Chemistry*"**, by Lehninger, W.H. Freeman and Companies, USA.
5. **" *Bio-Chemistry*"** by L.Stryer and W.H.Freeman and Companies, USA..
6. **"*Organic Chemistry*"**, by R.T.Morison and R.N.Boyd, Allyn & Bacon Inc., (printed in Singapore) **(2001)**.

III B.Tech II Semester

15ABS22-CHEMISTRY OF POLYMERS AND THEIR APPLICATIONS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

The objectives of this course are:

- *To impart the students the knowledge of polymer materials, their formation mechanisms, properties and uses*
- *provides students with an opportunity to identify different types of polymers in our surrounding*
- *introduces hydrogels of polymer networks in drug delivery system and study of surface phenomenon.*
- *introduces students to the practical application of polymers*

UNIT – 1 : Polymers-Basics and Characterization

Basic concepts: monomers, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition and copolymerization, Mechanism of free radical, chain, ionic and coordination polymerization. Average molecular weight concepts: number, weight, viscosity average molecular weights, polydispersity and molecular weight distribution.

Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT – 2 : Synthetic Polymers

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation, properties and applications of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons,

Urea - formaldehyde, phenol - formaldehyde and melanine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, GPC and XRD.

UNIT – 3 : Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils, gums and proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; speciality plastics- PES, PAES, PEEK, PEAK.

UNIT -4: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Introduction to drug to drug delivery systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release. Applications of hydrogels in drug delivery.

UNIT – 5 : Surface phenomena

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

Course outcome:

Upon successful completion of this course, the students will be able to:

- *differentiate between natural and man-made polymers.*
- *explain polymerization methods*
- *understand polymerization kinetics*
- *understand drug and drug delivery systems and*
- *applications and uses of polymers.*

References :

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar
6. Physical Chemistry –S. Glasston & K.J Laidler
7. Drug Delivery- Ashim K. Misra

CBCC ANEXURE-II R-15

III B.Tech II Semester

15ACE35-REMOTE SENSING & GIS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives:

- *To Know the concept of photogrammetry.*
- *Analysis of RS and GIS data and interpreting the data for modelling applications.*
- *To educate of GIS in civil engineering field.*

UNIT I

INTRODUCTION TO PHOTOGRAMMETRY:

Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

UNIT II

REMOTE SENSING :

Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

UNIT III

GEOGRAPHIC INFORMATION SYSTEM:

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.

TYPES OF DATA REPRESENTATION:

Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

UNIT IV

GIS SPATIAL ANALYSIS:

Computational Analysis Methods(CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

UNIT V

WATER RESOURCES APPLICATIONS:

Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development and Watershed characteristics. Reservoir sedimentation, Fluvial Geomorphology, water resources management and monitoring, Ground Water Targeting, Identification of sites for artificial Recharge structures, Drainage Morphometry, Inland water quality survey and management, water depth estimation and bathymetry.

Course Outcomes:

On completion of the course the students will have knowledge on

- *Understanding the concept of photogrammetry.*
- *Analysis of RS and GIS data and interpreting the data for modelling applications.*
- *Understand Application of GIS in civil engineering field.*

TEXT BOOKS:

1. Remote Sensing and GIS by B.Bhatta, Oxford University Press,New Delhi.
2. Advanced surveying: Total station GIS and remote sensing – Satheesh Gopi – Pearson publication.

REFERENCE BOOKS:

1. Fundamentals of remote sensing by gorge Joseph , Universities press, Hyderabad.
2. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
3. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications.
4. Remote sensing and GIS by M.Anji reddy ,B.S.Pubiliications,New Delhi.
5. *Remote Sensing and its applications by LRA Narayana University Press 1999.*
6. *GIS by Kang – tsung chang, TMH Publications & Co.,*
7. *Principals of Geo physical Information Systems – Peter A Burragh and Rachael Mc Donnell,Oxford Publishers 2004*

III B.Tech II Semester

15ACE36-ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objectives:

- *To apply knowledge acquired to the process of environmental impact modeling and prediction as a design tool with application to a number of case studies.*
- *To adapt skills in GIS to environmental management systems*

UNIT I

INTRODUCTION:

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

UNIT II

EIA METHODOLOGIES:

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

UNIT III

IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE:

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT IV

ASSEMENT OF IMPACT ON VEGETATION AND WILDLIFE:

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

ENVIRONEMNTAL AUDIT:

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT V

ENVIRONEMENTAL ACTS (PROTECTION AND PREVENTION):

Post Audit activities, The Environmental protection Act, The water preventation Act, The Air (Prevention & Control of pollution Act.), Wild life Act.Case studies and preparation of Environmental Impact assessment statement for various Industries.

Course outcomes

- *an understanding of current EIA methods and the techniques and tools used.*
- *To develop an understanding of current assessment methods and legislation.*
- *To develop an understanding of current environmental monitoring systems.*

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers

Reference Books:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katari & Sons Publication.,New Delhi.
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

CBCC ANEXURE-II R-15

III B.Tech II Semester

15ACE37-FINITE ELEMENT METHODS (CBCC)

L	T	P	C
3	1	0	3

Course objectives:

- *To know FEM Principles to displacement*
- *Students will apply matrix in constructions*

UNIT –I

INTRODUCTION: Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh –Ritz method of functional approximation.

UNIT –II

PRINCIPLES OF ELASTICITY: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT –III

ONE DIMENSIONAL ELEMENTS: Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems. Different types of elements for plane stress and plane strain analysis – Displacement models –generalized coordinates – shape functions – convergent and compatibility requirements– Natural coordinate system

UNIT –IV

GENERATION OF ELEMENT : Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements. Concepts of, isoparametric elements for 2D analysis –formulation of CST element, 4 –Noded and 8-noded iso-parametric quadrilateral elements –Lagrangian and Serendipity elements.

UNIT-V

AXI-SYMMETRIC ANALYSIS: Basic principles-Formulation of 4-noded iso-parametric axi-symmetric element – Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Course Outcomes:

- *Students can ~~understand~~ FEM Principles*
- *Students can apply matrix in construction*

TEXT BOOK:

1. Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications.
2. Finite element analysis by S.S. Bhavakatti-New age internationalpublishers
3. Finite Element methods for Engineers by U.S.Dixit, Cengage Publishers, New Delhi.
4. Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
5. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers

REFERENCES:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E.Plesha. Jhon Wiley & Sons.
2. Finite element analysis by David V Hutton, Tata Mcgraw Hill, New Delhi
3. Applied Fem by Rammurthy, I.K.International Publishers PVt. Ltd., New Delhi.
4. Fem by J.N.Reddy, Mcjraw, TMH Publications, New Delhi.

III B.Tech II Semester

15AEE19-POWER ELECTRONICS
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *The basic power semiconductor switching devices and their principles of operation..*
- *This course covers characteristics of semi conductor devices, ac-dc, dc-dc, ac-ac and dc-ac converters.*
- *The importance of using pulse width modulated techniques to obtain high quality power supply is also discussed in detail in this course.*

UNIT – I POWER SEMI CONDUCTOR DEVICES

Power Semiconductor Diodes, Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power Transistor - Power MOSFET – Power IGBT - TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors – Basic Theory of Operation of SCR – Static Characteristics – Turn On and Turn Off Methods- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits – Series and Parallel Connections of SCR's – Snubber Circuits – Specifications and Ratings of SCR's, BJT, IGBT - Numerical Problems –Commutation Circuits.

UNIT – II PHASE CONTROLLED CONVERTERS

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL and RLE loads– Derivation of Average Load Voltage and Current – Line Commutated Inverters - Active and Reactive Power Inputs to the Converters without and with Free Wheeling Diode, Effect of Source Inductance – Numerical Problems.

Three Phase Line Commutated Converters – Three Pulse and Six Pulse Converters – Mid Point and Bridge Connections - Average Load Voltage with R and RL Loads – Effect of Source Inductance–Dual Converters (Both Single Phase and Three Phase) - Waveforms –Numerical Problems.

UNIT – III DC – DC CONVERTERS

Buck converters, boost converters and buck boost converters. Steady state analysis, voltage and current ripple, design of inductor and capacitor values.

UNIT – IV INVERTERS

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms –sine-triangle PWM, Three Phase VSI in 120^0 And 180^0 Modes of Conduction. unipolar, bipolar inverter PWM techniques selective harmonic elimination - Voltage Control Techniques for Inverters Pulse Width Modulation Techniques – Numerical Problems.

UNIT – V AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of Triac – Triac with R and RL Loads – Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems - Thyristor Controlled Reactors; Switched Capacitor Networks.

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BOS - chairman

Cyclo Converters – Single Phase Mid Point Cyclo Converters With R and RL loads (Principle of Operation only) – Bridge Configuration Of Single Phase Cyclo Converter with R and RL loads (Principle of Operation only) – Waveforms

Course Outcomes:

- *Basic operating principles of power semiconductor switching devices*
- *The operation of power electronic converters, choppers, inverters, AC voltage controllers, and cycloconverters, and their control.*
- *To understand the working of inverters and application of PWM techniques for voltage control and harmonic mitigation.*
- *How to apply the learnt principles and methods to practical applications.*

TEXT BOOKS:

1. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 1998.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998

REFERENCE BOOKS:

1. Power Electronics – by P. S. Bimbra, Khanna Publications.
2. Power electronics, Essentials and applications – L. Umanand Wiley Publications
3. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
4. Power Electronics - by V. R. Murthy , 1st edition -2005, OXFORD University Press
5. Power Electronics-by P. C. Sen, Tata Mc Graw-Hill Publishing.
6. The power electronics (hand book) : Timothy L. Skgarnina
7. Theory of Power Electronics- by KL Rao, Ch Sai Babu, S Chand Publications Revised Edition 2009

V. [signature]
Bos – chairman

III B.Tech II Semester

15AEE34-RENEWABLE ENERGY SOURCES

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

This course enables the students to

- *Identify the use of renewable energy sources for electrical power generation*
- *Know the environmental effects of energy conversation*
- *Analyze the different types of turbines for ocean energy conversations*
- *Understand the concept of fuel cells and preventive measurements on pollution*

UNIT-I:

Photo voltaic power generation ,spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT-II:

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology.

Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT-III:

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

UNIT-IV:

Miscellaneous energy conversion systems: coal gasification and liquifaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.

Global energy position and environmental effects: energy units, global energy position.

UNIT-V:

Types of fuel cells, H_2-O_2 Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures steam stations and pollution, pollution free energy systems.

V. Sarla
BOS-chairman

Course Outcomes:

The student will have the knowledge on the following concepts

- *Find different renewable energy sources to produce electrical power*
- *Solar radiation on earth surface and concept of photo voltaic cells.*
- *Find the various types of turbines and design of energy systems*
- *Estimate the global energy position on miscellaneous energy conversation systems.*

TEXT BOOKS:

1. "Energy conversion systems" by Rakosh das Begamudre, New age International publishers, New Delhi - 2000.
2. John twidell & wier, renewable energy sources, CRC press, 2009.
3. G. D. Rai – non conventional sources, Khanna Publishers.

References books:

1. D.P Kothari, Rakesh Ranjan, renewable energy sources and emerging technologies, PHI, 2009.
2. C.S Solaniki, solar Photo Voltaic- Fundamentals-Principals and applications, PHI 2009

V. Siva
BoS- chairman

III B.Tech II Semester

15AEE35-UTILIZATION OF ELECTRICAL ENERGY

Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

This course enables the students to

- *Understand different types of heating and welding techniques.*
- *Study the basic principles of illumination and its units of Illumination.*
- *Understand different lighting design schemes for various applications.*
- *Learn basic principles of traction system & speed time curves for different traction system.*
- *Understand the fundamentals of environmental aspects of hybrid electric vehicles.*
- *Study the concepts of economic aspects of utilizing electrical energy.*

UNIT–I ILLUMINATION:

Definition – Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems.

UNIT–II ELECTRIC HEATING & WELDING:

Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating.

Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.

Electrolysis - Faraday's Laws, Applications of Electrolysis, Power Supply for Electrolysis.

UNIT–III INTRODUCTION TO HYBRID ELECTRIC VEHICLES:

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT–IVELECTRIC TRACTION:

Introduction – Systems of Electric Traction. Comparison Between A. C And D. C Traction – Special Features of Traction Motors - Methods of Electric Braking – Plugging, Rheostatic and Regenarative Types. Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral, Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

V. Suda

BOS-Chairman

UNIT–V ECONOMIC ASPECTS OF UTILISING ELECTRICAL ENERGY:

Power Factor Improvement, Improvement of Load Factor, Off Peak Loads- Use of Exhaust Steam, Waste Heat Stations, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage, Cost of Renewals.

Course Outcomes:

The students will have knowledge on the following concepts to:

- *Identify most appropriate heating & welding techniques for suitable applications*
- *Design the levels of illumination based on the applications*
- *Determine speed-time curves, acceleration & retardation of different traction services.*
- *Estimate energy consumption levels at various modes of operation in traction systems*
- *Identify the economic aspects of utilizing electrical energy*

TEXT BOOKS:

1. Utilization of Electric Energy – by E. Openshaw Taylor and V. V. L. Rao, Universities Press.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Co.
3. Utilization of Electrical Energy & Traction – J.B.Gupta, Rajeev Manglik,Rohit Manglik – Published by S.K Kataria & Sons.

REFERENCE BOOKS:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Utilization of Electrical Power – by R. K. Rajput, Laxmi Publications
3. Generation, distribution and utilization of electrical energy by C.L Wadhwa,wiley Eastern Limited-1993
4. Electrical Power,S.L Uppal Khanna Publisher – 1988.

BOS-chairman

III B.Tech II Semester

15AME35-Optimization Techniques by MATLAB
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course objective:

To engage in learning of optimization principles, be able to effectively setup and solve real-world optimization problems, and develop technical and communication skills. The course also aims to teach how to use computer programs such as MATLAB to solve mathematical models.

UNIT I

Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

UNIT II

Introduction to Optimization: Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization with inequality constraints, Convex and Concave programming.

UNIT III

Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

UNIT IV

Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher- Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

UNIT V

Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

***Course Outcomes*:**

after completion of this course the student can be able to,

- Define and use optimization terminology and concepts, and understand how to classify an optimization problem.
- know the Application of Optimization Methods to Engineering Problems.
- implement basic optimization algorithms in a computational setting and apply existing optimization software packages (MATLAB) to solve engineering problems.

Text books:

1. "MATLAB An introduction with applications" Rao V.Dukkipati, New age international publications.
2. "Optimization in practice with MATLAB" Achille Messac, Cambridge University Press.
3. "Introduction to optimum design" Jasbir S Arora, Academic Press, Elsevier Publications.

References:

1. "MATLAB Optimization Techniques" Cesar Perez Lopez, Academic press, Springer publications.
2. "Applied Numerical Methods with MATLAB for Engineers and scientists" Steven C.Chapra. Mc,Graw Hill Publications.
3. "Nonlinear optimization" Benny Yakir, open source from net.

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JNTUA College of Engineering,
PULIVENDULA - 516 390.

III B.Tech II Semester

15AME36-MECHATRONICS AND MEMS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *To understand the technologies behind modern mechatronic systems.*
- *To provide methodological fundamentals for the development of fully automated system.*
- *To teach students how to develop a robotic or automated system project focusing on the hardware and software integration, and*
- *To apply the acquired knowledge for developing a mechatronic system.*

UNIT – I

Introduction: Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

UNIT – II

Sensors: Static characteristics of sensors, Displacement, Position and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

UNIT – III

Actuators: Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

UNIT – IV

Microprocessors, Microcontrollers and Programmable Logic Controllers: Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of -.

UNIT – V

Micro Electro Mechanical Systems (MEMS): History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

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Course Outcomes

Upon successful completion of this unit, the student will be able to:

- *Define the discipline of mechatronics.*
- *Identify examples of mechatronic systems that are encountered in real life.*
- *Identify the components of a typical mechatronic system.*

Text books:

1. Mechatronics, W.Bolton, Pearson Education
2. Mechatronic System Design, Devadas Shetty and Richard A Kolk, Cengage learning
3. Mechatronics an integrated approach, Clarence W. de Silva, CRC Press
4. Micro Electro Mechanical Systems Design, James J Allen, CRC Press Taylor & Francis group
5. Mechatronics, Ganesh S Hedge, Jones and Bartlett Publishers

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III B.Tech II Semester

15AME37-AUTOMOTIVE ELECTRONICS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

- *To understand the use of electronics in the automobile.*
- *To appreciate the various electronic and the instrumentation systems used in automobile.*

UNIT 1

Introduction to microcomputer: Microcomputer: Buses, memory, timing, CPU registers; Microprocessor architecture: Initialization, operation codes, program counter, branch and jump instructions, subroutine. Analog to digital converters and Digital to analog converters, sampling, polling and interrupts, digital filters, lookup table.

UNIT 2

Sensors and actuators: Speed sensors, Pressure sensors: Manifold Absolute Pressure sensor, knock sensor, Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays.

UNIT 3

Electronic engine management system: Electronic engine control: Input, output and control strategies, electronic fuel control system, fuel control modes: open loop and closed loop control at various modes, EGR control, Electronic ignition systems – Spark advance correction schemes, fuel injection timing control.

UNIT 4

Electronic vehicle management system: Cruise control system, Antilock braking system, electronic suspension system, electronic steering control, traction control system, Transmission control, Safety: Airbags, collision avoiding system, low tire pressure warning system.

UNIT 5

Automotive instrumentation system: Input and output signal conversion, multiplexing, fuel quantity measurement, coolant temperature and oil pressure measurement, display devices-LED, LCD, VFD and CRT, Onboard diagnostics(OBD), OBD-II, off board diagnostics.

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Course outcomes:

After completion of this course the student can be able to:

1. *Obtain an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today's automotive industry .*
2. *Interface automotive sensors and actuators with microcontrollers.*
3. *Know, the various display devices that are used in automobiles.*

Text Books:

1. Understanding Automotive Electronics, William B Ribbens, Newne Butterworth-Heinermann, 6^{th} edition 2003.
2. Crouse W H, Automobile Elctrical Equipment, McGraw Hill Book Co.Inc, Newyork 2005

References:

1. Bechhold "Understanding Automotive Electronics", SAE, 1998.
2. Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.
3. Tom Denton,"Automobile Electrical and Electronic Systems" 3^{rd} edition- Edward Arnold, London - 2004.
4. Eric Chowanietz - 'Automotive Electronics' - SAE International USA – 1995

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III B.Tech II Semester

15AEC34-FUNDEMENTALS OF COMMUNICATION SYSTEMS (QUALITATIVE TREATMENT ONLY)

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

1. *To study the fundamental concept of the analog communication systems.*
2. *To analyze various analog modulation and demodulation techniques.*
3. *To know the working of various transmitters and receivers.*
4. *To understand the influence of noise on the performance of analog communication systems, and to acquire the knowledge about information and capacity.*

UNIT- I

Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication, Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

UNIT- II

Angle Modulation & Demodulation: Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis, & De-emphasis, Illustrative Problems.

UNIT -III

Pulse Analog Modulation Techniques

Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation.

Multiple Access Techniques

Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications.

UNIT IV

Digital Communication (Qualitative Approach only)

Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M- PSK techniques

Unit-V

Modern Communication Trends (Qualitative Approach only)

Basics of Spectrum utilizations, Comparison of 2G, 3G, Types of Ethernet, Modems – Types of Modems, 100Mbps, 1Gbps modems, Role of IPV6 in Present trends.

Course Outcomes:

This course provides the foundational education in Analog Communication systems, and applications. The students are provided the learning experience through class room teaching and solving assignment & tutorial problems. At the end of course, students should be able to:

1. *Acquire knowledge on the basic concepts of Analog Communication Systems.*
2. *Analyze the analog modulated and demodulated systems.*
3. *Verify the effect of noise on the performance of communication systems.*
4. *Know the fundamental concepts of information and capacity.*

TEXT BOOKS:

1. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.
2. Wayne Tomasi, Electronic Communications System: Fundamentals Through Advanced, 2nd editions, PHI, 2001.

REFERENCES:

1. Simon Hakin, "Communication Systems," Wiley India Edition, 4th Edition, 2011.
2. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", 5th Edition, McGraw-Hill International Edition, 2010.

III B.Tech II Semester

15AEC35-INDUSTRIAL ELECTRONICS

(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objective:

1. *To get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.*
2. *To study the characteristics of AC to DC converters.*
3. *To know about the practical applications Electronics in industries.*

UNIT – I:

SEMICONDUCTOR DEVICES: Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open-circuited p-n junction, Diode resistance, Zener diode, Photoconductors and junction photo diodes, Photo voltaic effect, Light emitting diodes (LED)

UNIT – II:

JUNCTION TRANSISTORS: Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

UNIT – III:

AC TO DC CONVERTORS: AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

UNIT – IV: INDUSTRIAL APPLICATIONS – I

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding.

Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating

Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

UNIT – V: INDUSTRIAL APPLICATIONS - II

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasoni8c waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physico-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Course Outcome: *After completion of the course the students will be able to*

a. *Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.*
b. *Understand the characteristics of AC to DC converters.*
c. *Understand about the practical applications Electronics in industries.*

Text Books:

1. G. K. Mithal, "Industrial Electronics", Delhi, Khanna Publishers, 2000.
2. J.Gnanavadivel, R.Dhanasekaran, P.Maruthupandi, "Industrial Electronics", Anuradha Publications, 2011.

Reference Books:

1. F. D. Petruzulla, "Industrial Electronics", Singapore, McGraw Hill, 1996.
2. M. H. Rashid, "power Electronics Circuits, Devices and Application", 3rd edition, PHI, 2004.

III B.Tech II Semester

15AEC36-NEURAL NETWORKS & FUZZY LOGIC
(Choice Based Credit Courses (Inter-department))

L	T	P	C
3	1	0	3

Course Objectives:

1. To Know the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward and Feedback Networks
2. To understand the Applications of Neural Networks in pattern recognition, speech and decision making.
3. To study the basic concepts of Fuzzy Logic, Fuzzy sets and Fuzzy system design implementation.
4. To Know the Associate Memories , FAM neural networks and encoding Adaptive Resource theory- network for ART

UNIT-I

Neural Networks Characteristics: History of Development in neural networks, Artificial neural net terminology, model of a neuron, Topology, Types of learning. Supervised, Unsupervised learning. Basic Learning laws, Hebb's rule, Delta rule, widrow and Hoff LMS learning rule, correlation learning rule instar and ouster learning rules.

UNIT-II

Unsupervised Learning: Competitive learning, K-means clustering algorithm, Kohonen's feature maps. Radial Basis function neural networks- recurrent networks, Real time recurrent and learning algorithm. Introduction to Counter propagation Networks- CMAC Network, ART networks, Application of NN in pattern recognition, optimization, Control, Speech and decision making.

UNIT-III

Neural Network models: neural network models, layers in neural network and their connections. Instar, outstar, weights on connections, threshold function, application- Adaline and madaline. Back propagation: feed forward back propagation network- mapping, layout, training, BPN applications

UNIT-IV

Fuzzy Logic: Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, membership functions, operations of Fuzzy sets, Fuzzy if-then rules, Variables inference techniques, defuzzification techniques, basic Fuzzy interference algorithm, application of fuzzy logic , Fuzzy system design implementation , useful tools supporting design.

UNIT-V

Bidirectional Associative Memory (BAM), inputs and outputs, weights and training. FAM-fuzzy associative memory, association, FAM neural networks, encoding Adaptive Resource theory-network for ART, processing in ART

Course Outcomes: After completion of the course, the student can able to

a. Comprehend the concepts of feed forward neural networks
b. Analyze the various feedback networks
c. Understand the concept of fuzziness involved in various systems and fuzzy set theory.
d. Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
e. Analyze the application of fuzzy logic control to real time systems.

Text Books:

1. Berkin Riza C and Trubatch, "Fuzzy System design principles- Building Fuzzy IF-THEN rule bases", IEEE Press.
2. Yegna Narayanan, "Artificial Neural Networks". 8th Printing, PHI, 2003.

Reference Books:

1. Simon Haykin, "Neural Networks," Pearson Education.
2. Yen and Langari, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education.

III B.Tech II Semester

15ACS35- MOBILE COMPUTING

(Choice based credit course of inter department)

L	T	P	C
3	1	0	3

Course Objective:

- To make the students understand the basic information about mobile computing and its concepts such as Applications, Impediments, Architecture, New Data Services like GPRS, CSHSD, DECT,Mobile IP Networks, MANET's and Linux for Mobile devices.
- To get acquaintance with the class of abstractions offered by the mobile computing system that develops the User App applications

UNIT-I

Introduction: Mobile Communications, Mobile Computing–Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT–II

Medium Access Control in Wireless (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. MAC protocols for GSM, Wireless LAN (IEEE802.11), Collision Avoidance (MACA, MACAW) Protocols. **Mobile IP Network Layer:** IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization,DHCP.

UNIT–III

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.
Database Issues: Database Hoarding & Caching Techniques, C–S Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT–IV

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Methods, Digital Audio and Video Broadcasting (DAB & DVB). Data Synchronization –Introduction, Software, and Protocols

UNIT-V

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Mobile Agents, Service Discovery.
Protocols and Platforms for Mobile Computing: WAP, Bluetooth, XML, J2ME, Java Card, Palm OS, Windows CE, Symbian OS, Linux for Mobile Devices.

Course Outcome:

•Students able to use mobile computing more effectively

• Developing mobile application programs to exploit the mobile operating system

TEXTBOOKS:

1. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

REFERENCEBOOKS:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2004.
2. Stojmenovic and Cacute, "Handbook ofWireless Networks and Mobile Computing", Wiley, 2002, ISBN0471419028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press,Oct 2004,

III B.Tech II Semester

15ACS36- OPTIMIZATION TECHNIQUES
(Choice based credit course of inter department)

L	T	P	C
3	1	0	3

Course Objective:

• To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
• To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.
• To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

UNIT-I

Introduction to optimization: Requirements for the Application of Optimization Methods, Applications of Optimization in Engineering, Structure of Optimization Problems, Functions of a Single Variable: Properties of Single-Variable Functions, Optimality Criteria, Region Elimination Methods, Polynomial Approximation or Point Estimation Methods.

UNIT-II

Functions of a Several Variables: Optimality Criteria, Direct-Search Methods, Gradient Based Methods, Comparison of Methods and Numerical Results.2013-2014

UNIT-III

Linear Programming: Formulation of Linear Programming Models, Graphical Solution of Linear Programming in Two Variables, Linear Programming in Standard Form, Principles of the SimplexMethod,Applications.

UNIT-IV

Constrained Optimality Criteria: Equality-Constrained Problems, Lagrange Multipliers, Economic Interpretation of Lagrange Multipliers, Kuhn-Tucker Conditions, Kuhn-Tucker Theorems, Saddle point Conditions, Second-Order Optimality Conditions, Generalized Lagrange Multiplier Method, and Generalization of Convex Functions.

UNIT-V

Transformation Methods: Penalty Concept, Algorithms, Codes, and Other Contributions, Method of Multipliers, Constrained Direct Search: Problem Preparation, Adaptations of Unconstrained Search Methods, Random-Search Methods.

Course Outcomes: At the end of the course students will be able to:

• Use various optimization techniques such as Quadratic programming, Dynamic Programming and select the ones most suitable to the problem at hand.
• Subdivide a complex system in to smaller disciplinary models, manage their interfaces and reintegrate them in to an overall system model.
• Rationalize and quantify a system architecture or product design problem by selecting appropriate objective function, design variables, parameters and constraints.

- Interpret the mathematical conditions for optimality and give physical explanation.
- Make recommendations based on solutions, analysis and limitations of models.

TEXTBOOKS:

1. Engineering Optimization- Methods and Applications, A.Ravindran, K. M. Ragsdell, G.V. Reklaitis, Second Edition, Wiley India Edition.

2. Introductory Operation Research- Theory and Applications, H.S. Kasana, K.D. Kumar, Springer International Edition.

REFERENCES:

1. Optimization Methods in Operations Research and Systems Analysis, K.V. Mital and C. Mohan, New Age International (P)Limited, Publishers, Third Edition, 1996.
2. Operations Research, Dr. J.K.Sharma, Mc Millan.

3. Operations Research: An Introduction, H.A. Taha, PHI Pvt. Ltd.,

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III B.Tech II Semester

15ACS37-MACHINE LEARNING

(Choice based credit course of inter department)

L	T	P	C
3	1	0	3

Course Objectives:

1. Machine Learning is the discipline of designing algorithms that allow machines (e.g.,a computer)
2. To learn patterns and concepts from data without being explicitly programmed.
3. This course will be an introduction to the design (and some analysis) of Machine Learning Algorithms, with a modern outlook focusing on recent advances, and examples of real-world applications of Machine Learning algorithms.

UNIT I

Introduction- Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning.

Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm and Their Remarks,

UNIT II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems and issues for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning,

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm with their Remarks.

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT III

Bayesian learning – Introduction, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm.

Computational learning theory–introduction: probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training.Sample complexity for finite hypothesis spaces, kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution.

Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

UNIT V

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators.

Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming.

Course Outcomes:

1. Develop an appreciation for what is involved in learning from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to apply a variety of learning algorithms to data.
4. Understand how to perform evaluation of learning algorithms and model selection.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH.
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)
3. Bishop.C(2006)pattern recognition and machine learning .Berlin:Springer-Verlag.

REFERENCES:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Baldi.P and Brunak.S(2002) Bioinformatics : A Machine Learning Approach Cambridge:
5. HalDaumé III, A Course in Machine Learning, 2015

Jawaharlal Nehru Technological University Anantapur College of Engineering
Pulivendula –516 390 (A.P) India

B.Tech. in Mechanical Engineering
Course Structure and Syllabi
under R19 Regulations

MECHANICAL ENGINEERING

S.No	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

B.Tech I Year I Semester

Semester – 1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19ABS06	Linear Algebra and Calculus	BS	3-1-0	4
2	19ABS01	Engineering Physics	BS	3-0-0	3
3	19ACS01	Problem Solving and Programming	ES	3-1-0	4
4	19AME01	Engineering Graphics	ES	1-0-3	2.5
5	19AME02	Engineering Workshop	LC	0-0-3	1.5
6	19ABS02	Engineering Physics Lab	BS	0-0-3	1.5
7	19ACS02	Problem Solving and Programming Lab	ES	0-0-3	1.5
				Total	**18**

B.Tech I Year II Semester

Semester - 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19ABEE01	Basic Electrical and Electronics Engineering	ES	3-0-0	3
2	19ABS07	Differential Equations and Vector Calculus	BS	3-1-0	4
3	19ABS05	Engineering Chemistry	BS	3-0-0	3
4	19ACS05	Data Structures	ES	3-0-0	3
5	19AHS01	Communicative English -I	HS	2-0-0	2
6	19AHS02	Communicative English Lab-I	HS	0-0-2	1
7	19AME03	Mechanical Engineering Workshop	LC	0-0-2	1
8	19ABEE02	Basic Electrical & Electronics Engineering Lab	ES	0-0-3	1.5
9	19ABS08	Engineering Chemistry Lab	BS	0-0-3	1.5
10	19ACS06	Data Structures Lab	ES	0-0-3	1.5
				Total	**21.5**

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B.Tech II Year I Semester

Semester – 3					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19ABS11	Complex Variables, Transforms and Applications to PDE	BS	3-0-0	3
2	19AME04	Fluid Mechanics and Hydraulics Machinery	PC	3-0-0	3
3	19AME06	Thermodynamics	PC	3-0-0	3
4	19AME07	Engineering Mechanics	PC	3-0-0	3
5	19AME08	Material Science and Engineering	PC	3-0-0	3
6	19AME10	Manufacturing Processes - I	PC	3-0-0	3
7	19AHS03	Universal Human Values	HS	2-0-0	2
8	19AME05	Fluid Mechanics and Hydraulic Machinery Lab	PC	0-0-2	1
9	19AME09	Material Science and Engineering Lab	PC	0-0-2	1
10	19AME11	Manufacturing Processes - I Lab	PC	0-0-3	1.5
11	19ABS14	Environmental Science	MC	3-0-0	0
				Total	**23.5**

B.Tech II Year II Semester

Semester - 4					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19ABS15	Numerical Methods, Probability and Statistics	BS	3-0-0	3
2	19ACS18	Internet of Things	ES	2-0-0	2
3	19AME14	Design Thinking and Product Innovation	ES	2-0-0	2
4	19AME15	Mechanics of Materials	PC	3-0-0	3
5	19AME17	Theory of Machines	PC	3-0-0	3
6	19AME18	Manufacturing Processes – II	PC	3-0-0	3
7	19AME19	Computer Aided Machine Drawing	LC	0-0-3	1.5
8	19AME16	Mechanics of Materials Lab	PC	0-0-3	1.5
9	19ACS19	Internet of Things (IOT)Lab	ES	0-0-3	1.5
10	19AME20	Design Thinking & Product Innovation Lab	ES	0-0-2	1
11	19AHS04	Constitution of India	MC	3-0-0	0
				Total	**21.5**

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B.Tech III Year I Semester

Semester - 5					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19AME51	Thermal Engineering	PC	3-0-0	3
2	19AME52	Design of Machine Members	PC	3-0-0	3
3	19AME53	Automation and Robotics	PC	3-0-0	3
4	19AME54	Professional Elective I	PE	3-0-0	3
	19AME54a	Alternative Fuels and Emission Control in Automotives			
	19AME54b	Manufacturing Methods in Precision Engineering			
	19AME54c	Design for Manufacturing (DFM)			
	19AME54d	Power Plant Engineering			
	19AME54e	Non Destructive Testing (NDT)			
	19AME54f	Ergonomics and Human Factors in Engineering			
5	19AME55	Open Elective I (Inter Disciplinary) (ANNEXURE-I)	OE	3-0-0	3
6	19AHS14	Humanities Elective I	HS	3-0-0	3
	19AHS14a	MEFA			
	19AHS14b	Entrepreneurship & Innovation Management			
7	19AME56	Thermal Engineering Lab	PC	0-0-3	1.5
8	19AME57	Manufacturing Processes - II lab	PC	0-0-2	1
9	19AME59	Socially Relevant Projects (30 hours/sem)	PR	---------	1
10	19AHS16	Organizational Behaviors	MC	3-0-0	0
			Total :		**21.5**

B.Tech III Year II Semester

Semester - 6					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19AHS12	English Language Skills	HS	2-0-0	2
2	19AME61	Automobile Engineering	PC	2-0-0	2
3	19AME62	Heat Transfer	PC	3-0-0	3
4	19AME63	Operations Research	PC	3-0-0	3
5	19AME64	Professional Elective II	PE	3-0-0	3
	19AME64a	Hybrid and Electric Vehicles			
	19AME64b	Simulation and Modeling of Manufacturing Systems			
	19AME64c	Design of Transmission Systems			
	19AME64d	Solar and Wind Energy Systems			
	19AME64e	Mechanical Behavior of Materials			
	19AME64f	Total Quality Management (TQM)			
6	19AME65	Open Elective II (Inter Disciplinary)(ANNEXURE-II)	OE	3-0-0	3
7	19AHS15	Humanities Elective II	HS	3-0-0	3
	19AHS15a	Management Science			
	19AHS15b	Business Environment			
8	19AHS13	English Language Skills Lab	HS	0-0-3	1.5
9	19AME66	Heat Transfer Lab	PC	0-0-2	1
10	19AHS17	Research Methodology	MC	3-0-0	0
11	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions		PR	4 Weeks Summer Internship	
				Total	**21.5**

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B.Tech IV Year I Semester

Semester - 7					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19AME71	Metrology & Measurements	PC	2-0-0	2
2	19AME72	Introduction to CAD/CAM	PC	3-0-0	3
3	19AME73	Finite Element Analysis	PC	3-0-0	3
4	19AME74	Professional Elective III	PE	3-0-0	3
	19AME74a	Automotive Transmission			
	19AME74b	Additive Manufacturing			
	19AME74c	Mechanical Vibrations			
	19AME74d	Refrigeration & Air Conditioning			
	19AME74e	Material Characterization			
	19AME74f	Production and Operations Management			
5	19AME76	Professional Elective IV	PE	3-0-0	3
	19AME76a	Vehicle diagnosis and control			
	19AME76b	Mechatronics & MEMS			
	19AME76c	Design of Oil Hydraulics and Pneumatics			
	19AME76d	Computational Fluid Dynamics (CFD)			
	19AME76e	Geometric dimensioning and tolerances			
	19AME76f	Product Marketing			
6	19AME75	Open Elective 3	OE	2-0-0	2
		ANNEXURE-III			
7	19AME77	CADD and CAM Lab	PC	0-0-3	1.5
8	19AME70	Metrology and Measurements Lab	PC	0-0-2	1
9	19AME78	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	PR	-------	2
10	19AME79	Project Stage - I	PR	---------	2
				Total	**22.5**

B.Tech IV Year II Semester

Semester - 8 (Theory - 2, Lab - 1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credit**
1	19AME81	Professional Elective V (MOOC)	PE	3-0-0	3
2	19AME82	Open Elective IV (MOOC)	OE	3-0-0	3
3	19AME89	Project Stage - II	PR	---------	6
					12

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ANNEXURE – I

Open Elective I (Interdisciplinary)

Branch	Subject Code	Subject
Humanities	19AHS10	Campus Recruitment Training & Soft Skills
Mathematics	19ABS20	Mathematical Modeling
	19ABS21	Fuzzy Set Theory, Arithmetic and Logic
	19ABS22	Number Theory
Physics	19ABS31	Sensors and Actuators for Engineering Applications
	19ABS32	Physics of Electronic Materials
Chemistry	19ABS41	Chemistry of Energy Materials
	19ABS42	Advanced Polymers and Their Applications
	19ABS43	Marine Chemistry
CIVIL	19ACE55a	Air Pollution and Control
	19ACE55b	Green Buildings
	19ACE55c	Basics of Civil Engineering Materials and Construction Practice
EEE	19AEE55a	Basics of Non-Conventional Energy Sources
	19AEE55b	Electrical Measurements & Sensors
	19AEE55c	Electric Vehicle Engineering
ECE	19AEC55a	Fundamentals of Electronics and Communication Engineering
	19AEC55b	Transducers and Sensors
	19AEC55c	Principles of Communications
CSE	19ACS55a	Object Oriented Programming Concepts Through Java
	19ACS55b	Introduction to Internet Of Things
	19ACS55c	Introduction to Operating Systems

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ANNEXURE – II

Open Elective II (Interdisciplinary)

Branch	Subject Code	Subject Name
Humanities	19AHS11	Competitive &Spoken English
Mathematics	19ABS23	Integral Transforms And ITS Applications
	19ABS24	Numerical Analysis
	19ABS25	Optimization Techniques
Physics	19ABS33	Functional Nanomaterials For Engineers
	19ABS34	Materials Characterization Techniques
Chemistry	19ABS44	Green Chemistry and Catalysis for Sustainable Environment
	19ABS45	Chemistry of Nanomaterials and Applications
	19ABS46	Environmental Management and Audit
CIVIL	19ACE65a	Remote Sensing and GIS
	19ACE65b	Environmental Impact Assessment
	19ACE65c	Disaster Management and Mitigation
EEE	19AEE65a	Energy Conservation and Management
	19AEE65b	PLC & ITS Applications
	19AEE65c	System Reliability Concepts
ECE	19AEC65a	Introduction to Microcontrollers & Applications
	19AEC65b	Principles of Digital Signal Processing
	19AEC65c	Introduction to Image Processing
CSE	19ACS65a	Introduction to Machine Learning
	19ACS65b	Introduction to Computer Networks
	19ACS65c	Web Design and Management

ANNEXURE – III - Open Elective III

Branch	Subject Code	Subject Name
CIVIL	19ACE75a	Architecture and town planning
	19ACE75b	Experimental stress analysis
	19ACE75c	Finite element methods
EEE	19AEE75a	Electrical engineering materials
	19AEE75b	Digital signal processors and applications
	19AEE75c	IOT applications in electrical engineering
ME	19AME75a	Special types of vehicles
	19AME75b	Six sigma and lean manufacturing
	19AME75c	Reverse engineering
	19AME75d	Energy auditing
	19AME75e	Introduction to composite materials
	19AME75f	Customer relationship management
ECE	19AEC75a	Embedded systems & IOT
	19AEC75b	Electronic instrumentation
	19AEC75c	Basics of VLSI design
CSE	19ACS75a	Mobile application development
	19ACS75b	Real time operating systems and applications
	19ACS75c	Fundamentals of block chain and applications

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF MATHEMATICS
I B.TECH – I SEMESTER (Common to all Branches of Engineering)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Linear Algebra and Calculus	3	1	-	4

COURSE OBJECTIVES	
1	This course will illuminate the students in the concepts of calculus and linear algebra.
2	To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications

COURSE OUTCOMES	
CO1	develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO2	Utilize mean value theorems to real life problems
CO3	familiarize with functions of several variables which is useful in optimization
CO4	Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems
CO5	Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Unit I: Matrix Operations and Solving Systems of Linear Equations **10 hrs**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Unit II: Mean Value Theorems **06 hrs**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

Unit III: Multivariable calculus **08 hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers for three variables

Unit IV: Double Integrals **08 hrs**

Double integrals, change of order of integration, change of variables, areas enclosed by plane curves

Unit V: Multiple Integrals and Special Functions **08 hrs**

Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA
DEPARTMENT OF MATHEMATICS
I B.TECH – II SEMESTER (Common to all Branches of Engineering)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Differential Equations and Vector Calculus	3	1	-	4

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES	
CO1	solve the differential equations related to various engineering fields
CO2	Identify solution methods for partial differential equations that model physical processes
CO3	interpret the physical meaning of different operators such as gradient, curl and divergence
CO4	estimate the work done against a field, circulation and flux using vector calculus

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT II: Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

UNIT III: Partial Differential Equations **08 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT IV: Multivariable Calculus (Vector differentiation)

Scalar and vector point functions, gradient, divergent, curl and their properties (Identities and applications)

UNIT V: Multivariable Calculus (Vector integration)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF PHYSICS
I B.TECH – I SEMESTER (common to CIVIL & MECH)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Engineering Physics	3	0	-	3

COURSE OBJECTIVES	
1	Understand the basic concepts of mechanics and oscillations in correlation to engineering application.
2	To familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application.
3	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications.
4	To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
5	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their properties and applications in modern emerging technologies are to be elicited.

COURSE OUTCOMES	
CO1	**Identify** forces and moments in mechanical systems using scalar and vector techniques (L3). **Interpret** the equation of motion of a rigid rotating body (torque on a rigid body), Simple harmonic oscillators, Damped harmonic oscillator, Heavy, Forced oscillations , Resonance for consideration in designing technological applications. (L3)
CO2	**Explain** sound waves and its is propagation /interaction with construction material in design of buildings (L2). **Analyze** acoustic parameters of typically used materials in buildings (L4). **Recognize** sound level disruptors and their application in architectural acoustics (L2). **Identify** the use of ultrasonics in diversified fields of engineering (L3)
CO3	**Explain** the need of coherent sources and the conditions for sustained interference (L2). **Identify** engineering applications of interference including homodyne and heterodyne detection (L3). **Analyze** the differences between interference and diffraction with applications (L4). **Illustrate** the concept of polarization of light and its applications (L2). **Classify** ordinary polarized light and extraordinary polarized light (L2)The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics.
CO4	**Explain** various types of emission of radiation (L2). **Identify** the role of laser in engineering applications (L3). **Describe** the construction and working principles of various types of lasers (L1). **Explain** the working principle of optical fibers (L2). **Classify** optical fibers based on refractive index profile and mode of propagation (L2). **Identify** the applications of optical fibers in medical, communication and other fields (L2). **Apply** the fiber optic concepts in various fields (L3).
CO5	**Explain** the concept of dielectric constant and polarization in dielectric materials (L2). **Summarize** various types of polarization of dielectrics (L2). **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics (L2). **Classify** the magnetic

	materials based on susceptibility and their temperature dependence (L2). **Explain** the applications of dielectric and magnetic materials (L2). **Apply** the concept of magnetism to magnetic devices (L3) **Identify** the nano size dependent properties of nanomaterials (L2). **Illustrate** the methods for the synthesis and characterization of nanomaterials (L2). **Apply** the basic properties of nanomaterials in various Engineering branches (L3).

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS OF ENGINEERING PHYSICS

Unit-I: Introduction to Mechanics and Oscillations

Introduction to Mechanics and Oscillations-Basic laws of vectors and scalars-Rotational frames-Conservative forces – F = - grad V, torque and angular momentum – Simple harmonic oscillators-Damped harmonic oscillator-Heavy, critical and under damping- Energy decay in damped harmonic oscillator- Forced oscillations – Resonance.

Unit-II: Acoustics and Ultrasonics

Acoustics: Reverberation – Reverberation time– Sabine's formula (Qualitative) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies.

Ultrasonics: Properties and Production by magnetostriction & piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications

Unit-III: Wave Optics

Interference-Principle of superposition –Interference of light – Conditions for sustained interference-interference in thin films- Colors in thin films-Newton's Rings-Determination of wavelength and refractive index- Applications

Diffraction- Fresnel and Fraunhofer diffraction-Fraunhofer diffraction due to single slit and double slit – Diffraction grating- Grating spectra-Applications

Polarization-Polarization by double refraction-Nicol's Prism--Half wave and Quarter wave plates- Applications.

Unit-IV: Lasers and Fiber optics

Lasers: Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients – Population inversion – Pumping mechanisms – Nd:YAG laser – He-Ne laser – CO_2 Laser, Applications of lasers.

Fiber optics- Total Internal Reflection-Critical angle of propagation-Acceptance Angle-Numerical Aperture-Classification of fibers based on refractive index profile –Propagation of electromagnetic wave through optical fibers – Modes -Importance of V-number-Fiber optic sensors (Pressure/temperature/chemical change)

UNIT V: Engineering Materials

Dielectric Materials: Dielectric polarization- Dielectric constant- Types of polarizations: Electronic, Ionic and Orientation Polarizations (Qualitative) - Lorentz (Internal) field- Clausius-Mosotti equation-Applications of Dielectrics: Ferroelectricity and Piezoelectricity.

Magnetic Materials: Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-Hysteresis - Soft and hard magnetic materials-Applications.

Nanomaterials: Surface area and quantum confinement –Physical properties: electrical and magnetic properties- Synthesis of nanomaterials: Top-down: Ball Milling, Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Prescribed Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.

Reference Books:

1. Engineering Physics – K.Thyagarajan, MacGraw Hill Publishers, 2016
2. Introduction to modern optics – Grant R Fowles
3. A text book on Optics – Brijlal & Subramanyam
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Engineering Physics – M.R.Srinivasan, New Age Publications
7. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
8. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
9. Engineering Physics – M. Arumugam, Anuradha Publications

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Problem Solving and Programming

(Common to All Branches of Engineering)

B. Tech – I Semester **L-T-P-C**
3-1-0-4

Course Objectives:

1. Introduce the internal parts of a computer, and peripherals.
2. Introduce the Concept of Algorithm and use it to solve computational problems
3. Identify the computational and non-computational problems
4. Teach the syntax and semantics of a C Programming language
5. Demonstrate the use of Control structures of C Programming language
6. Illustrate the methodology for solving Computational problems

Outcomes:

Student should be able to

1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

Unit 1:

Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

Unit 2:

Introduction to problem solving: Introduction, the problem-solving aspect, Design and implementation of algorithms – Topdown design, Analysis of Algorithms, the efficiency of algorithms, the analysis of algorithms.

Fundamental algorithms: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

Learning Outcomes: Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)
3. Analyze the algorithms (L4)

Unit 3:

Types, Operators, and Expressions: Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Input and output: standard input and output, formatted output-Printf, formatted input-Scanf

Control Flow: Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Dowhile, break and continue, goto and labels.

Functions and Program Structure: Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.

Learning Outcomes: Student should be able to

1. Recognize the programming elements of C Programming language (L1)
2. Select the control structure for solving the problem (L4)
3. Apply modular approach for solving the problem (L3)

Unit 4:

Factoring methods: Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.

Pointers and arrays: Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

Array Techniques: Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the k^{th} smallest element.

Learning Outcomes: Student should be able to

1. Solve mathematical problems using C Programming language (L3)
2. Structure the individual data elements to simplify the solutions (L6)
3. Facilitate efficient memory utilization (L6)

Unit 5:

Sorting and Searching: Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

Structures: Basics of structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedef, unions, bit-fields.

Some other Features: Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

Learning Outcomes: Student should be able to

1. Select sorting algorithm based on the type of the data (L4)
2. Organize heterogeneous data (L6)
3. Design a sorting algorithm (L6)

Text Books:

1. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.

Reference Books:

1. RS Bichkar "Programming with C", 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage
3. Byron Gottfried and Jitender Kumar Chhabra, "Programming with C", 4th Edition, 2019, McGraw Hill Education.

Course Outcomes:

1. Construct his own computer using parts (L6).
2. Recognize the importance of programming language independent constructs (L2)
3. Solve computational problems (L3)
4. Select the features of C language appropriate for solving a problem (L4)
5. Design computer programs for real world problems (L6)
6. Organize the data which is more appropriated for solving a problem (L6)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

DEPARTMENT OF MECHANICAL ENGINEERING

(Common to all branches)

Subject Code	Title of the Subject	L	T	P	C
19A03102	Engineering Graphics	1	0	3	2.5

	COURSE OBJECTIVES
1	To bring awareness that Engineering Drawing is the Language of Engineers.
2	To familiarize how industry communicates technical information.
3	To teach the practices for accuracy and clarity in presenting the technical information.
4	To develop the engineering imagination essential for successful design.
5	To instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
6	To train the usage of 2D and 3D modeling.
7	To instruct graphical representation of machine components.

COURSE OUTCOMES	
CO1	**Draw** various curves applied in engineering.
CO2	**Show** projections of Lines, planes and solids..
CO3	**Draw** the sections of solids and development of surfaces of solids.
CO4	**Use** computers as a drafting tool.
CO5	**Draw** isometric and orthographic drawings.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	1						1	1
CO2	3	3	1	3	1						1	1
CO3	3	3	1	3	1						1	1
CO4	3	3	1	3	1						1	1
CO5	3	2	1	3	1						1	1

UNIT – I:

Introduction to Engineering Graphics: Principles of Engineering Graphics and their significance – Conventions in drawing – Lettering – BIS conventions.

a) Conic sections including the rectangular hyperbola – general method only.
b) Cycloids, Epicycloids and Hypocycloids.
c) Involutes **(2L + 6P hrs)**

1. V. veeru prasad
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5. K. Jaya chandra [illegible]

6 –
7 –
8 A. Dinesh Reddy
9 [illegible]

UNIT – II:

Projection of Points, Lines and Planes: Projection of points in any quadrant, Lines inclined to one and both planes, Finding true lengths, Angle made by line. Projections of regular plane surfaces.

(2L + 6P hrs)

UNIT – III:

Projections of Solids: Projections of regular solids inclined to one and both planes by rotational and auxiliary views method.

Sections of Solids: Section planes and sectional view of right regular solids – Prism, Cylinder, Pyramid and Cone. True shapes of the sections. **(2L + 6P hrs)**

UNIT – V:

Development of Surfaces: Development of surfaces of right regular solids – Prism, Cylinder, Pyramid, Cone and their sectional parts. **(1L + 6P hrs)**

UNIT – V:

Orthographic Projections: Systems of projections, Conventions and Application to Orthographic Projections.

Isometric Projections: Principles of Isometric Projection – Isometric scale, Isometric views – Lines, Planes, Figures, Simple and Compound Solids. **(5L + 15P hrs)**

Text Books:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

I YEAR I SEMESTER

ENGINEERING WORKSHOP (19AME02)
(Common to CE, MECH & CSE)

L	T	P	C
0	0	3	1.5

Course Objectives:

- To bring awareness about workshop practices for Engineers.
- To familiarize how wood working operations can be performed.
- To teach the practices for sheet metal operations.
- To develop the technical skills related to fitting and electrical wiring.

Section 1 : Wood Working

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint

Section 2 : Sheet Metal Working

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Section 3 : Fitting

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tyre

Section 4 : Electrical Wiring

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two way switch c) Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

Text Books:

1. K.Venkata Reddy., Workshop Practice Manual, 6/e BS Publications.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2/e, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2/e, PHI 2010.

Course Outcomes:

At the end of this Course the student will be able to

- Apply wood working skills in real world applications. (L6)
- Apply fitting operations in various applications. (L6)
- Build different parts with metal sheets in real world applications. (L5)
- Demonstrate soldering and brazing. (L4)
- Apply basic electrical engineering knowledge for house wiring practice. (L6)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

Engineering Physics Laboratory

(Common to I B.Tech I Semester CIVIL & MECH)

L	T	P	C
0	0	3	1.5

Course Objectives:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

EXP No.1: Determination of the thickness of thin object using wedge shape method

Learning Outcomes:

At the end of this experiment, the student will be able to

• **Operates** optical instrument like travelling microscope	**L2**
• **Estimate** the thickness of the wire using wedge shape method	**L2**
• **Identifies** the formation of interference fringes due to reflected light from non-uniform thin film.	**L2**

EXP No. 2 : Determination of the radius of curvature of the lens by Newton's rings

Learning Outcomes:

At the end of this experiment, the student will be able to

• **Operates** optical instrument like travelling microscope.	**L2**
• **Estimate** the radius of curvature of the lens	**L2**
• **Identifies** the formation of interference fringes due to reflected light from non-uniform thin film.	**L2**
• **Plots** the square of the diameter of a ring with no. of rings	**L3**

EXP No. 3: Determination of wavelengths of various spectral lines of mercury source using diffraction grating in normal incidence method

Learning Outcomes:

At the end of this unit, the student will be able to

• **Operates** optical instrument like spectrometer.	**L2**
• **Estimate** the wavelength of the given source	**L2**
• **Identifies** the formation of grating spectrum due diffraction.	**L2**

EXP No. 4: Determination of dispersive power of grating.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Operates** optical instrument like spectrometer.	**L2**
• **Estimate** the refractive index and dispersive power of the given prism	**L2**
• **Identifies** the formation of spectrum due to dispersion.	**L2**

EXP No. 5: Determination of wavelength using diffraction grating by laser source.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instrument	**L2**
• **Estimate** the wavelength of laser source	**L2**
• **Identifies** the formation of grating spectrum due diffraction.	**L2**
EXP No. 6: Determination of particle size by laser source	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instrument	**L2**
• **Estimate** the Particles size using laser	**L2**
• **Identifies** the application of laser	**L2**
EXP No. 7: Determination of numerical aperture and acceptance angle of an optical fiber	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instruments and connect them as per the circuit.	**L2**
• **Estimate** the numerical aperture and acceptance angle of a given optical fiber.	**L2**
• **Identifies** the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications	**L2**
EXP No. 8: Study of variation of Magnetic field along the axis of a current carrying coil – Stewart-Gee's Method.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instruments and connect them as per the circuit.	**L2**
• **Estimate** the magnetic field along the axis of a circular coil carrying current.	**L2**
• **Plots** the intensity of the magnetic field of circular coil carrying current with distance	**L3**
EXP No. 9: Study of B-H curve of Ferromagnetic material.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instruments and connect them as per the circuit.	**L2**
• **Estimate** the hysteresis loss, coercivity and retentivity of the ferromagnetic material	**L2**
• **Classifies** the soft and hard magnetic material based on B-H curve.	**L2**
• **Plots** the magnetic field H and flux density B	**L3**
EXP No. 10: Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Operates** various instruments	**L2**
• **Estimate** the rigidity modulus of the given material	**L2**

• **Identifies** the applications of Torsional pendulum	**L2**
Reference Books:	
1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017	
2. R. Padma Suvarna, K. Thyagarajan “Engineering Physics Practicals” – NU Age Publishing House.	
Course Outcomes:	
At the end of this Course the student will be able to	
➢ **Operate** optical instruments like microscope and spectrometer	**L2**
➢ **Determine** thickness of a hair/paper with the concept of interference	**L2**
➢ **Estimate** the wavelength of different colors using diffraction grating and resolving power	**L2**
➢ **Plot** the intensity of the magnetic field of circular coil carrying current with distance	**L3**
➢ **Evaluate** the acceptance angle of an optical fiber and numerical aperture	**L3**

Problem Solving and Programming Laboratory

(Common to All Branches of Engineering)

B.Tech – I Semester **L-T-P-C**
0-0-3-1.5

Laboratory Experiments #

1. Assemble and disassemble parts of a Computer
2. Design a C program which reverses the number
3. Design a C program which finds the second maximum number among the given list of numbers.
4. Construct a program which finds the k^{th} smallest number among the given list of numbers.
5. Design an algorithm and implement using C language the following exchanges
   $a \leftarrow b \leftarrow c \leftarrow d$
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.
7. Implement the C program which computes the sum of the first n terms of the series
   Sum = 1 – 3 + 5 -7 + 9
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.
9. Design an algorithm and implement using a C program which finds the sum of the Infinite series $1 - x^2/2! + x^4/4! - x^6/6! + ...$
10 Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1.
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa.
12. Develop an algorithm which computes the all the factors between 1 to 100 for a given number and implement it using C.
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n.
14. Design a C program which reverses the elements of the array.
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The starts for each number should be printed horizontally.
16. Implement the sorting algorithms
    a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort.
17. Illustrate the use of auto, static, register and external variables.
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list.
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers.
20. Design a C program which sorts the strings using array of pointers.

The above list is not exhaustive. Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

Proposed

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA
YSR (KADAPA) Dist 516 390, (A.P) INDIA

B.Tech – II Sem **L T P C**

3 0 0 3

Basic Electrical & Electronics Engineering
Part A: Basic Electrical Engineering
(Civil, Mechanical, CSE), ECE

Course Objectives:

1. To introduce basics of electric circuits.
2. To teach DC and AC electrical circuit analysis.
3. To explain working principles of transformers and electrical machines.
4. To impart knowledge on low voltage electrical installations

Unit 1 DC & AC Circuits:
Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

Unit Outcomes: Able to
- Recall Kirchoff laws (L1)
- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations(L4)

Unit 2 DC & AC Machines:
Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only]

Unit Outcomes: Able to
- Explain principle and operation of DC Generator & Motor.
- Perform speed control of DC Motor (L2)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor ~~- DC motor~~

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Unit 3 Electrical Installations:

Components of LT. Switchgear: Switch fuse unit (SFU),MCB,ELCB,MCCB,Tpes of wires and cables,Earthing. Types of batteries,important Characteristics for Batteries. Elementary Calculations for energy consumption,power factor improvement and battery backup

Unit Outcomes: Able to

- Explain principle and operation of protecting equipments.
- Come to know different types of batteries and their usage.

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I B.Tech II Sem

COURSE NO. - Basic Electrical & Electronics Engineering

(Common to Civil, Mechanical, CSE)

L	T	P	C
3	1	0	4

Part B: Basic Electronics Engineering

Course Objectives:

- To provide comprehensive idea about working principle, operation and applications of PN junction & zener diodes, BJT, FET, MOSFET and operational amplifier
- To introduce fundamentals of digital electronics
- To educate on principles of various communication systems
- To teach efficacy of electronic principles which are pervasive in engineering applications

UNIT I ANALOG ELECTRONICS

Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED.

BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications.

Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

Unit Outcomes:

- Describe operation and characteristics of diodes and transistors
- Make use of diodes and transistors in simple, typical circuit applications
- Understand operation of basic op-amp circuits

UNIT II DIGITAL ELECTRONICS

Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems, combinational circuits - adders, multiplexers, decoders; introduction to sequential circuits, flip flops, shift register, binary counter.

Unit Outcomes:

- Explain different logic gates using truth table
- Distinguish combinational and sequential circuits
- Analyze various combinational circuits such as adders, multiplexers and decoders
- Understand functionality of flip-flops, shift registers and counters

UNIT III COMMUNICATION SYSTEMS

Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).

Unit Outcomes:

- Describe basic elements of a communication system
- Explain need for modulation and different modulation techniques
- Understand functioning of various communication systems

TEXT BOOKS:

1.D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited

2.S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

REFERENCES:

1.R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education, Reprint 2012.

2.David Bell, Electronic Devices and Circuits: Oxford University Press, 5th EDn., 2008.

Head of Electronics
Communication Engineering Dept.
JNTU College of Engineering
PULIVENDULA - 516 390

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA
DEPARTMENT OF MATHEMATICS
I B.TECH – II SEMESTER (Common to all Branches of Engineering)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Differential Equations and Vector Calculus	3	1	-	4

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES	
CO1	solve the differential equations related to various engineering fields
CO2	Identify solution methods for partial differential equations that model physical processes
CO3	interpret the physical meaning of different operators such as gradient, curl and divergence
CO4	estimate the work done against a field, circulation and flux using vector calculus

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT II: Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

UNIT III: Partial Differential Equations **08 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT IV: Multivariable Calculus (Vector differentiation)

Scalar and vector point functions, gradient, divergent, curl and their properties (Identities and applications)

UNIT V: Multivariable Calculus (Vector integration)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF CHEMISTRY
I B.TECH – I SEMESTER (common to CE , ME & CHEMICAL)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
19A53101	Engineering Chemistry	3	0	-	3

COURSE OBJECTIVES	
1	To familiarize engineering chemistry and its applications
2	To impart the concept of soft and hard waters, softening methods of hard water
3	To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

COURSE OUTCOMES	
CO1	**list** the differences between temporary and permanent hardness of water, **explain** the principles of reverse osmosis and electrodialysis. **compare** quality of drinking water with BIS and WHO standards. **illustrate** problems associated with hard water - scale and sludge. **explain** the working principles of different Industrial water treatment processes
CO2	**apply** Nernst equation for calculating electrode and cell potentials, **apply** Pilling Bedworth rule for corrosion and corrosion prevention, **demonstrate** the corrosion prevention methods and factors affecting corrosion, **compare** different batteries and their applications
CO3	**explain** different types of polymers and their applications, **Solve the numerical problems based on Calorific value, select** suitable fuels for IC engines, **explain** calorific values, octane number, refining of petroleum and cracking of oils
CO4	explain the constituents of Composites and its classification Identify the factors affecting the refractory material, Illustrate the functions and properties of lubricants, demonstrate the phases and reactivity of concrete formation, identify the constituents of Portland cement, enumerate the reactions at setting and hardening of the cement
CO5	**summarize** the applications of SEM, TEM and X-ray diffraction in surface characterization, **explain** the synthesis of colloids with examples, **outline** the preparation of nanomaterials and metal oxides **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Unit 1: Water Technology (8 hrs)

Introduction –Causes and types of hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles , Industrial water treatment (Ion exchange process, Internal treatment of water) specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Unit 2: Electrochemistry and Applications(10 hrs)

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zn-MnO_2 (Leclanche cell), Li Battery. Secondary cells – lead acid and lithium ion batteries- working of the batteries including cell reactions.

Fuel cells- Basic Principles and Working Principles of hydrogen-oxygen, methanol -oxygen fuel cells, Applications of Fuel cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry corrosion, Pilling Bedworth rule and uses, Factors affecting corrosion, Corrosion Control -cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Unit 3: Polymers and Fuel Chemistry:(12 hrs)

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization,

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of PVC and Bakelite, Biodegradable polymers

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane numbers, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT-4 Basic Engineering Materials(8Hrs)

(i)Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

(ii)Refractories- Classification, Properties, Factors affecting the refractory materials and Applications

(iii)Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils and Applications

(iv)Building materials- Portland Cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

Unit 5: Surface Chemistry and Applications (10 hrs)

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid-gas interface, solid-liquid interface, adsorption isotherm, applications of colloids and nanomaterials – catalysis, medicine, sensors.

Text Books:

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
2. A Text Book of Engineering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1. 1. A Text book of Engineering Chemistry by K. Sesha Maheswaramma and Mridula Chugh, Pearson's Publications Pvt. Ltd., (PAN India Title)
2. A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi
3. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
4. A Text book of Engineering Chemistry by Prasanta Rath, B. Rama Devi, Ch.Venkata Ramana Reddy and Subhendu Chakroborty, Cengage learning India Pvt.Ltd.
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

Data Structures

(Common to All Branches of Engineering)

B. Tech – II Semester **L-T-P-C**

3-0-0-3

Course Objectives:

1. To teach the representation of solution to the problem using algorithm
2. To explain the approach to algorithm analysis
3. To introduce different data structures for solving the problems
4. To demonstrate modeling of the given problem as a graph
5. To elucidate the existing hashing techniques

Unit – 1: Introduction

Algorithm Specification, Performance analysis, Performance Measurement, Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions, Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort

Learning Outcomes:

Student should be able to

1. Analyze the given algorithm to find the time and space complexities (L4)
2. Select appropriate sorting algorithm (L4)
3. Design a sorting algorithm (L6)

Unit – 2: Stack, Queue and Linked lists

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

Learning outcomes: Student should be able to

1. Evaluate expressions (L5)
2. Develop the applications using stacks and queues (L3)
3. Construct the linked lists for various applications (L6)

Unit – 3: Trees

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, **Counting Binary Trees,** Optimal Binary search Trees, AVL Trees. B-Trees: BTrees, B + Trees.

Learning outcomes

1. Explain the concept of a tree (L2)
2. Compare different tree structures (L4)
3. Apply trees for indexing (L3)

Unit – 4: Graphs and Hashing

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure.

Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

Learning outcomes:

Student should be able to

1. Recognize the importance of Graphs in solving real world problems (L2)
2. Apply various graph traversal methods to applications (L3)
3. Design a minimum cost solution for a problem using spanning trees (L6)
4. Select the appropriate hashing technique for a given application (L5)
5. Design a hashing technique (L6)

Unit – 5: Files and Advanced Sorting & Searching

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization.

Advanced sorting and searching: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

Learning outcomes: Student should be able to

1. Organize data in the form of Files (L6)
2. Apply sorting on large amount of data (L3)

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2007.
2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.

Reference Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education.
2. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
3. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2016
4. Richard F.Gilberg, Behrouz A.Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

Course Outcomes:

Students should be able to

1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyze the Algorithms (L4)
5. Develop Algorithm for sorting large files of data (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA - 516390, A.P, INDIA.
HUMANITIES & SOCIAL SCIENCES DEPARTMENT

COMMUNICATIVE ENGLISH - 1

Subject Code	Title of the Subject	L	T	P	C
	Communicative English - 1	2	0	0	2

COURSE OBJECTIVES	
1	Facilitates effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
2	Helps to improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
3	Imparts effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
4	Provides knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

COURSE OUTCOMES	
CO1	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
CO2	Apply grammatical structures to formulate sentences and correct word forms
CO3	Analyze discourse markers to speak clearly on a specific topic in informal discussions
CO4	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
CO5	Create a coherent paragraph interpreting a figure/graph/chart/table

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

Unit 1

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :**Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 2

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

Unit 3

Lesson: The Death Trap: Saki

Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

Unit4

Lesson: Inspiration: Chindu Yellamma

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Learning Outcomes

At the end of the module, the learners will be able to

- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

Unit 5

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Learning Outcomes

At the end of the module, the learners will be able to

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

Prescribed Text:

1. English All Round: Communication Skills for Undegurdation Learners Vol. I, Orient BlackSwan Publisers, First Edition 2019, Authored by Y.Prabhavathi, M.Lalitha Sridevi and Ruth Z Hauzel.

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

DEPARTMENT OF MECHANICAL ENGINEERING

I B.TECH – II SEMESTER

Subject Code	Title of the Subject	L	T	P	C
	Mechanical Engineering Workshop	0	0	3	1.5

	COURSE OBJECTIVES
1	To familiarize moulding and casting skills.
2	To train on different types welding joints.
3	To develop assemble or disassembly skills.
4	To make plastic components.
5	To familiarize with use of power tools.

	COURSE OUTCOMES
CO1	Make moulds for sand casting. (L3)
CO2	Develop different weld joints. (L3)
CO3	Assemble or disassemble of machine components. (L3)
CO4	Make plastic components. (L3)
CO5	Use power tools for different applications. (L3)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

1. Foundry Practice: (2 Sessions).

i. a) Determination of average grain size for sand sample using sieve shaker.
   b) Preparation of a green sand mould using single piece pattern.

ii. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

2. Welding Practice: (2 Sessions).

i. Lap joint, butt joint and T joint using arc welding.

ii. a) Lap joint using resistance spot welding.
    b) Lap and butt joints using gas welding.

3. Assembling/Disassembling Practice: (3 Sessions).

2. — 3. 4. 5. 6 — 7 — 8 9

i. Bicycle.
ii. Clutch and carburetor.
iii. Two wheeler engine.

4. Manufacture of a Plastic Component (2 Sessions).

i. Use of injection moulding machine.
ii. FRP composite using hand layup method.
iii. Joining of plastic components.

5. Design and manufacture any two domestic utility products with any material (2 Sessions).

6. Use of Power Tools (2 Sessions).

I B.Tech II Sem

COURSE NO. - **Basic Electrical & Electronics Engineering Lab**

(Common to Civil, Mechanical, CSE)

L	T	P	C
0	0	3	1.5

PART A: ELECTRICAL ENGINEERING LAB

Course Objectives:

- To Verify Kirchoff's laws
- To verify Superposition theorem.
- To learn performance characteristics of DC Machines.
- To perform open circuit & Short Circuit test on 1- Phase Transformer.
- To Study the I – V Characteristics of Solar PV Cell

List of experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Open circuit characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Brake test on 3 - Phase Induction Motor.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

Course Outcomes: Able to

- Verify Kirchoff's Laws & Superposition theorem.
- Perform testing on AC and DC Machines.
- Study I – V Characteristics of PV Cell

PART B: ELECTRONICS ENGINEERING LAB

Course outcomes:

- Describe construction, working and characteristics of diodes, transistors and operational amplifiers
- Demonstrate how electronic devices are used for applications such as rectification, switching and amplification
- Build different building blocks in digital electronics using logic gates
- Explain functionality of flip-flops, shift registers and counters for data processing applications

- Explain functioning of various communication systems

LIST OF EXPERIMENTS:

1. Draw and study the characteristics of Semi-conductor diode and Zener Diode
2. Draw and study the input and output characteristics of Transistor in Common Emitter configuration
3. Draw and study the static and transfer characteristics of FET in Common Source Configuration
4. Construct half wave and full wave rectifier circuits. Find ripple factor and plot their output waveforms with and without filters
5. Study the application of Op-amp as an Inverting amplifier, Non-inverting amplifier, Voltage follower, Summer and Subtractor
6. Realization of logic gates, AND, OR, NOT, NAND, NOR, XOR
7. Realization of Adders, Multiplexers and Decoders using logic gates.
8. Realization of flip-flops using logic gates.
9. Conduct an experiment on AM & FM modulation & demodulation, Plot the corresponding modulated and demodulated signals

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF CHEMISTRY
I B.TECH – I SEMESTER (common to CE, ME & CHEMICAL)
(ENGINEERING CHEMISTRY LAB)

Subject Code	Title of the Lab	L	T	P	C
19A53103	Engineering Chemistry lab	-	-	4	2

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

COURSE OUTCOMES	
CO1	**determine** the cell constant and conductance of solutions (L3)
CO2	**prepare** advanced polymer materials (L2)
CO3	**determine** the physical properties like surface tension, adsorption and viscosity (L3)
CO4	**estimate** the Iron and Calcium in cement (L3)
CO5	**calculate** the hardness of water (L4)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

LIST OF EXPERIMENTS

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of percentage of Iron in Cement sample by colorimetry
8. Estimation of Calcium in port land Cement
9. Adsorption of acetic acid by charcoal
10. Determination of percentage Moisture content in a coal sample
11. Determination of Viscosity of lubricating oil by Red Wood Viscometer 1
12. Determination of Flash and Fire points of fuels
13. Determination of Calorific value of gases by Junker's gas Calorimeter

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera

Data Structures Lab

(Common to All Branches of Engineering)

B. Tech – II Semester **L-T-P-C**

0-0-3-1.5

Course Objectives:

1. To introduce to the different data structures
2. To elucidate how the data structure selection influences the algorithm complexity
3. To explain the different operations that can be performed on different data structures
4. To introduce to the different search and sorting algorithms.

Laboratory Experiments:

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue.
   While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table.

The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table.
User may like to remove row/column. Create table data type and support different operations on it.

Course Outcomes:

At the end of the course students should be able to

1. Select the data structure appropriate for solving the problem (L5)
2. Implement searching and sorting algorithms (L3)
3. Design new data types (L6)
4. Illustrate the working of stack and queue (L4)
5. Organize the data in the form of files (L6)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA

B.Tech – II-I SEM (R19)

L	T	P	C
3	0	0	3

COMPLEX VARIABLES, TRANSFORMS & APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS

(Common to MECH & CIVIL)

Course Objective:
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The aim is to analyze the solutions of partial differential equations.

Unit-I: Complex Variables – Differentiation:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations in Cartesian and Polar coordinates (without proof), analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

Properties of elementary functions of exponential, trigonometric, hyperbolic, and logarithm. Conformal mappings-standard and special transformations (z^2, sin z, cos z, e^z, lnz) Mobius transformations (bilinear) and their properties.

Unit Outcomes:
Students will be able to

- Understand functions of Complex variable and its properties.
- Find derivatives of complex functions.
- Understand the analyticity of complex functions.
- Understand the conformal mappings of complex functions.

Unit-II: Complex Variables – Integration:

Line integral-Contour integration, Cauchy's integral theorem (with proof), Cauchy Integral formula, generalized Cauchy Integral formula (All theorems without Proof).

Power series expansions: Taylor's series and Laurent's series (without proof); zeros of analytic functions, singularities.

Residues: Evaluation of residue by formula and by Laurent's series, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi-circle with f(z) not having poles on real axis).

Chairman BOS(C.Maths).

Unit Outcomes:

Students will be able to

- Understand the integration of complex functions.
- Apply Cauchy's integral theorem and Cauchy's integral formula.
- Understand singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.

Unit-III: Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Unit Outcomes:

Students will be able to

- Understand the concept of Laplace transforms and finds the Laplace transforms of elementary functions.
- Find the Laplace transforms of general functions using its properties.
- Understand Laplace transforms of special functions (Unit step function, Unit Impulse & Periodic).
- Apply Laplace transforms to solve Differential Equations.

Unit-IV: Fourier series &Fourier transforms

Fourier Series : Fourier coefficients (Euler's formulae) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.

Fourier Integrals & Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem – Finite Fourier Sine and Cosine transforms.

Unit Outcomes:

Students will be able to

- Understand finding Fourier series expression of the given function.
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function.
- Expand the given function in Fourier series given in Half range interval.
- Find Fourier Sine and cosine integrals.
- Understand Fourier transforms.
- Apply properties of Fourier transforms.

Unit-V: Partial Differential Equations & Applications

Solution of PDEs by Method of separation of variables –Solutions of one dimensional wave equation, one dimensional heat equation and Laplace equation in two dimensions under initial and boundary conditions.

Unit Outcomes:

Students will be able to

- Understand the method of separation of variables.
- Solve applications of Partial Differential Equations.

Course Outcomes:

After the completion of course, students will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of Laplace Transforms.
- Evaluate the Fourier series expansion of periodic functions.
- Formulate/solve/classify the solutions of Partial differential equations and also find the solution of one dimensional wave equation and heat equation.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", McGraw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

Fluid Mechanics and Hydraulic Machinery

L	T	P	C
3	0	2	4

Course Objectives

- To impart the knowledge of fluid properties and their behavior in static and dynamic states.
- To acquaint mathematical techniques to fluid flow problems.
- To familiarize solution methods in one dimensional viscous flow of different cases.
- To introduce the concepts of boundary layer.
- To teach working principle of hydraulic machinery.

UNIT I: **8 hours**

Definition of fluid: Continuum, velocity field, stress field, Newton's law of viscosity, Properties - compressibility, surface tension, vapour pressure, manometry.

Fluid Kinematics: Methods of Analysis – Systemand control volume, differential and integral, Kinematics – streamtube, stream function, potential function, vortex motion, free and forced vortices, continuity equation, Classification of flows – steadyand unsteady, uniform and nonuniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, internal and external flows.

Learning outcomes:

After completion of this unit, students will be able to

- Interpret the properties of fluid and their application. (L2)
- Select appropriate method for analyzing fluid flow problems. (L1)
- Understand principles of continuity in fluid motions. (L2)

UNIT II: **10 hours**

Fluid Dynamics: Momentum equation and Bernoulli's equation, Measurement of flow –Venturimeter, orifice meter and pitot tube, stagnation properties, Exact flow solution – Couetteand Poisuielle flow, concept of boundary layer, measures of controlling boundary layer thickness, Turbulence – Reynolds stresses.

Darcy Weisbach equation – frictionfactor, minor losses, Moody's diagram.

Learning outcomes:

After completion of this unit, students will be able to

- Convert conservation laws into flow governing equations. (L3)
- Apply Bernoulli's principle for determining flow in measuring devices. (L3)
- Solve governing equations for solutions of simple fluid flow problems. (L3)

- identify importance of boundary layer and advantages of control (L3)
- judge factors influencing laminar and turbulent flow (L4)

UNIT III: **8 hours**

Dimensional analysis: Fundamental and derived dimensions, Rayleigh method, Buckingham theorem, dimensionless groups, application of dimensional groups, model testing and similitude, types of similarity - geometric, kinematic and dynamic, model testing methods.

Learning outcomes:

After completion of this unit, students will be able to

- Compute major and minor losses in pipe flows. (L3)
- Solve for forces exerted by the fluid through impulse momentum equation. (L3)
- Employ suitable scaling laws for converting model to prototype. (L3)
- Use similitude principle to test prototypes of machines. (L3)

UNIT IV: **8 hours**

Impact of Jets: Impulse momentum equation, Hydrodynamic force of jet striking stationary and moving vanes, flat and curved vanes, centrally and tangentially, series of vanes, radial vanes, velocity triangles, work done and efficiency

Hydraulic Turbines: Classification of hydraulic turbines – Impulseand Reaction turbines, Pelton, Francis and Kaplan turbines, working principles, Unit and specific quantities, performance curves.

Learning outcomes:

After completion of this unit, students will be able to

- Estimate forces exerted by jet on blades. (L4)
- Classify turbines based on principle of operation. (L2)
- Calculate various efficiencies of turbines. (L2)
- Select suitable turbine for operating conditions. (L3)

UNIT V: **8 hours**

Rotodynamic Pumps: Classification – mixed, axial, construction, principle and application. Centrifugal Pumps: working principle, work done by impeller, performance curves – Cavitation.

Positive displacement Pumps: Working –gearpump, vane pump, rotary piston pump, and Reciprocating pump – Working, Slip, Indicator diagrams, Airvessels.

Learning outcomes:

After completion of this unit, students will be able to

- Explain construction and operation of different pumps. (L2)

- Classify pumps based on principle of operation. (L2)
- Calculate efficiencies of pumps. (L3)
- Identify pump suitable for an application. (L3)

TextBooks:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. S K Som, Gautam Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017.

References:

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
2. YunusCengel, John Cimbala, Fluid Mechanics, McGraw Hill Education, 2017.
3. Jagdish Lal, Hydraulic Machines Including Fluidics, Metropolitan Book Co. Pvt. Ltd., 2016.

Course Outcomes

At the end of the course, student will be able to

- Interpret the behavior under static and dynamic conditions. (L2)
- Analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows. (L4)
- Apply boundary layer flows for laminar and turbulent regimes. (L3)
- Explain Reynolds stresses and its application. (L3)
- Compare working of different fluid machinery and their design parameters. (L2)
- Explain different types of pumps and their application. (L2)

Thermodynamics

L	T	P	C
3	0	0	3

Course Objectives

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Familiarize steam properties to understand working of steam power plants.
- Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines.

UNIT I: **10 hours**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

First law of Thermodynamics: Joule's experiment – firstlaw of thermodynamics, corollaries – perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics.

Learning outcomes

At the end of this Unit, the student will be able to

- Identify thermodynamic systems, properties and their importance in solving engineering problems. (L3)
- Explain energy balance for closed systems and open systems. (L4)
- Solve simple thermodynamics problems. (L3)

UNIT II: **8 hours**

Second Law of Thermodynamics: Kelvin –Planckstatement and Clausius statement and their equivalence, corollaries –perpetualmotion machines of second kind – reversibilityand irreversibility, cause of irreversibility – Carnotcycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Learning outcomes

At the end of this Unit, the student will be able to

- Apply second law of thermodynamics in design of heat engine, refrigerator and heat pump. (L3)

- Explainthe efficiencyof thermodynamic systems.(L2)
- Enumerate the causes for poor performance of thermodynamic systems. (L3)

UNIT III: **8 hours**

Entropy: Clausius inequality –Conceptof Entropy – entropyequation for different processes and systems

Availability and Irreversibility: Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

Learning outcomes

At the end of this Unit, the student will be able to

- Apply entropy affects to estimate the performance of systems. (L3)
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process. (L4)
- Explain thermo-economics.(L3)

UNIT IV: **8 hours**

Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry.

Learning outcomes

At the end of this Unit, the student will be able to

- Apply properties of steam to design steam systems. (L3)
- Examine steam systems using conservation equations. (L4)
- Evaluate the performance of steam systems. (L4)

UNIT V: **8 hours**

Thermodynamic Relations: Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation.

Air Standard Cycles: Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles.

Vapour Power Cycles: Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output ofRankine cycle.

Learning outcomes

At the end of this Unit, the student will be able to

- Explain the importance of T-ds equations. (L3)
- Relate specific heats, internal energy, enthalpy and Joule-Thomson coefficient in standard form.

(L3)

- Examine the importance of compression ratio. (L4)
- Explain the cycles on which internal combustion engines work. (L3)

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

References

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009
4. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

Course Outcomes

After completing the course, the student will be able to

- Explain the importance of thermodynamic propertiesrelated to conversion of heat energy into work. (L3)
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. (L3)
- Utilize steam properties to design steam based components. (L4)
- Compare thermodynamic relations and air standard cycles. (L4)

Engineering Mechanics

L	T	P	C
3	0	0	3

Course Objectives:

- Explain the effect of force and moment in the different engineering applications.
- Teach center of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Analysis of rigid bodies under dynamic conditions.

UNIT I: **08 hours**

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Learning Outcomes:

At the end of this unit, the student will be able to

- Resolve the forces in mechanical systems. (L2)
- Identify the moments and forces. (L3)
- Draw free body diagram. (L3)

UNIT II: **10 hours**

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different types of trusses. (L2)
- Analyze the plane trusses by method of joints and the method of sections. (L4)
- Demonstrate equilibrium of ideal system. (L2)
- Estimate the work done by a force and work done by a couple. (L3)

UNIT III: **10 hours**

Properties of Surfaces and Volumes: Centroid and centre of gravity, derivation of centroids from first moment of area, centroids of composite sections, centre of gravity of common volumes – cylinder, cone, sphere, theorem of Pappus – guidinus.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes – thinplates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the centre of gravity of composite sections. (L3)
- Determine the centre of gravity of common solids. (L3)
- Determine moment of inertia for composite volumes. (L3)

UNIT IV: **10 hours**

Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, and motion under gravity – projectilemotion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

Learning Outcomes:

At the end of this unit, the student will be able to

- Write equations of motion for rigid bodies. (L3)
- Find velocity and acceleration in rectilinear and curvilinear motions. (L4)
- Trace the path of projectile. (L3)

UNIT V: **08 hours**

Kinetics: Principles of dynamics - Newton'sLaws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy and applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- ApplyD'Alembert's principle in rectilinear translation. (L3)
- Relate principle of work and energy in dynamic systems. (L3)
- Make use of principle of momentum and impulse to dynamic bodies. (L4)

Text books:

1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S SBhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Reference Books:

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G.K.M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.
3. K.L. Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

Course Outcomes:

Upon successful completion of the course, the students will be able to

- Resolve forces and couples in mechanical systems. (L3)
- Identify the frictional forces and its influence on equilibrium. (L3)
- Find the centre of gravity and moment of inertia for various geometric shapes. (L3)
- Develop equations for different motions. (L4)
- Determine the displacement, velocity and acceleration relations in dynamic systems. (L4)
- Relate the impulse and momentum. (L4)

Material Science and Engineering

L	T	P	C
3	0	2	4

Course Objectives

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
- Explain the methods to change the properties of materials through heat treatment processes.
- Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

UNIT I: **10 Hours**

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbidediagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Distinguish metals and alloys. (L4)
- Make use of the principles of construction of binary phase diagrams. (L3)
- Identify various invariant reactions in binary phase diagrams. (L3)
- Explain the concept of metallography in studying the microstructures of metals and alloys. (L2)

UNIT II: **8 Hours**

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe_3Calloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the importance of steel and iron - iron carbide phase diagram. (L2)
- Explain the influence of heat treatment in modification of properties of steels. (L2)
- Develop a heat treatment cycle based on properties required. (L3)
- Explain the principles of surface hardening methods. (L2)

UNIT III: **8 Hours**

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Micro structure, properties and applications of alloy steels-stainless steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

Learning Outcomes:

At the end of this unit the student will be able to

- Classify various types of steels, their properties and applications. (L2)
- Identify various types of cast irons, their properties and applications. (L3)
- Compare steels and cast irons and their limitations in applications. (L3)

UNIT IV: **8 Hours**

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the importance of non-ferrous metals and alloys in engineering applications. (L2)
- Demonstrate various properties and applications of non-ferrous alloys. (L4)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

UNIT V: **8 Hours**

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterial's.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the properties of ceramics and their applications. (L2)
- Summarize the properties of polymers and composites and their use. (L2)
- Interpret the properties of Nano materials and their applications. (L2)
- Identify the difference between the micro and Nano scale materials and their uses. (L3)

Course Outcomes:

After completing the course, the student will be able to

- Explain the principles of binary phases. (L2)
- Apply heat treatment to different applications. (L3)
- Selectsteels and cast irons for a given application. (L3)
- Utilize nonferrous metals and alloys in engineering. (L3)
- Choose composites for various applications. (L3)
- Assess the properties of Nano-scale materials and their applications. (L2)

TextBook:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr.Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.

References:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Manufacturing Processes– I

L	T	P	C
3	0	3	4.5

Course Objectives:

- Working principle of different metal casting processes and gating system.
- Classification of the welding processes, working of different types of welding processes and welding defects.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

UNIT I: 8 Hours

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

Learning Outcomes:
At the end of this unit, the student will be able to

- Selection of suitable manufacturing process for a given product. (L3)
- Understand the steps involved in metal casting, pattern making. (L2)
- Apply the knowledge of designing gating systems, risers. (L3)
- Compare the working of various metal casting processes. (L4)
- Identify the various casting defects. (L3)

UNIT II: 10 Hours

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects.

Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Compare cold working and hot working processes. (L4)
- Explain the working of rolling mills. (L2)
- Evaluate the forces and power in rolling and extrusion processes. (L5)
- Summarize the working of various extrusion processes. (L2)
- Identify the principles of forging, tools and dies. (L3)
- Summarize the various operations of Sheet metal forming. (L2)

UNIT III: **8 Hours**

Metal Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding,Oxy Acetylene Gas Welding, Resistance Welding, Thermit Welding, applications, advantages, and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

At the end of this unit, the student will be able to

- Classify the working of various welding processes. (L2)
- Compare V-I characteristics of different welding processes. (L4)
- Summarize the applications, advantages of various welding processes. (L2)
- Identify the defects in welding. (L3)

UNIT IV: **8 Hours**

Plastics: Types, properties and their applications, processing of plastics: extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts. (L2)
- Explain the steps in making ceramics parts. (L2)
- Explain the steps in manufacturing of powder metallurgy parts. (L2)
- Demonstrate the application of plastic, ceramics and power metallurgy. (L2)

UNIT V: **10 Hours**

Unconventional Machining Processes: Principles and process parameters of Abrasive jet machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM),and Electrical discharge machining (EDM).

Principle and processes parameters of Electro – chemical machining (ECM), Laser beam machining (LBM), Plasma arc machining (PAM) and Electron beam machining (EBM).

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different unconventional machining processes. (L3)
- Evaluate process parameters of EDM, ECM, LBM, PAM and AJM.(L5)
- Apply various unconventional machining processes. (L3)

Text Books:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Hajra Choudhury S.K, Elements of Workshop Technology Vol 1: Manufacturing Processes, 15/e, Media Promoters and Publishers Pvt. Ltd., 2013.

Course Outcomes:

At the end of the course, the student will be able to

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING PULIVENDULA(AUTONOMOUS) -PIN: 516390(A.P.)

L	T	P	C
2	0	0	2

UNIVERSAL HUMAN VALUES

OBJECTIVES

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of Others

Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Self interest - Spirituality, Moral dilemmas- Consensus and controversy.

Unit II: PERSONALITY DEVELOPMENT

Concept of personality, types of personalities, Knowing of self(SWOT), improving personality – techniques, interpersonal skills, intrapersonal skills, building right attitude, developing the spirit of universal human goodness.

Unit III: ENGINEERING AS SOCIAL EXPERIMENTATION AND

Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer- Designing for the safety.

UNIT IV: UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY.

Understanding Harmony in the family – the basic unit of human interaction, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family.

UINIT V: GLOBAL ISSUES

Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics and Research – Analyzing Ethical Problems in research – Intellectual property Rights(IPR).

Outcomes:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
- Identify the multiple ethical interests at stake in a real-world situation or practice.
- Articulate what makes a particular course of action ethically defensible.
- Assess their own ethical values and the social context of problems.
- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects.
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Text Books

1. "**Engineering Ethics**" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
2. **Engineering Ethics includes Human Values**" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
3. "**Ethics in Engineering**" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
4. "**Professional Ethics and Morals**" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
5. "**Professional Ethics and Human Values**" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
6. "**Indian Culture, Values and Professional Ethics**" by PSR Murthy-BS Publication.

7. **"Professional Ethics and Human Values"** by Prof.D.R.Kiran.

Fluid Mechanics and Hydraulic Machinery Lab

Course Objectives:

- Explain the application of Bernoulli's equation in internal flows.
- Familiarize with the performance of turbines and pumps.
- Develop skill for measurement of pressure in external flows.

LIST OF EXPERIMENTS

1. Free and Forced vortex apparatus.
2. Calibration of Venturimeter / Orifice meter.
3. Resistance characteristics of pipes – friction factor.
4. Minor losses in pipes – sudden contraction/bends/valves.
5. Impact of a jet on flat and curved plates.
6. Performance characteristics of single and multi – stagecentrifugal pump.
7. Performance characteristics of reciprocating pump.
8. Performance characteristics of Pelton wheel turbine.
9. Performance characteristics of Francis turbine.
10. Performance characteristics of Kaplan turbine.

Course Outcomes

Upon the successful completion of course, students will be able to

- Explain the devices used for measuring flow.
- Compute major losses in pipes.
- Illustrate the operating parameters of turbines.
- Explain the working of different types of pumps.

Material Science & Engineering Lab

Course Objectives:

1. To understand microstructure of engineering materials.
2. To explain grain boundary layers and grains size of different engineering materials.

List of Experiments:

1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.
9. Study of microstructure of super alloy and Nanomaterial's.
10. Find the harness of ceramics, super alloys, Nanomaterial's and polymeric materials (one sample on each)

Course Outcomes:

The student is able to

- Identify various microstructures of steels and cast irons. (L3)
- Visualize grains and grain boundaries. (L3)
- Evaluate hardness of treated and untreated steels. (L4)
- Summarize the importance of hardening of steels. (L2)

Manufacturing Processes - I Lab

Course Objectives:

- Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   c) Molding, Melting and Casting for ferrous/ non ferrous materials.

2. **WELDING**
   a) TIG Welding.
   b) MIG Welding.
   c) Friction stir welding
   d) Any other Special Welding Processes.

3. **MECHANICAL PRESS WORKING**
   a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
   b) Closed die forging, Deep Drawing and Extrusion operations.

4. **UN CONVENTIONAL MANUFACTUNRING PROCESSES**
   a) Electro Discharge Machining (EDM)/ Wire cut EDM.
   b) Plasma arc cutting / Abrasive jet machining (AJM).
   c) Additive manufacturing with reverse engineering.

Course Outcomes:

At the end of the lab, the student will be able to

- Fabricate different types of components using various manufacturing techniques. (L6)
- Adapt unconventional manufacturing methods. (L6)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF CHEMISTRY
II B.TECH – I/II SEMESTER Mandate Course (MC)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Environmental Science	3	0	-	0

COURSE OBJECTIVES	
1	To make the student understand multi disciplinary nature of environment and its components.
2	To investigate the relationship between human life and environment from scientific prospective.
3	To impart knowledge to the students about fundamental concepts of Ecosystem and Biodiversity
4	Necessasity of analyzing regional, national and global environmental problems
5	To understand and apply the fundamentals of Environmental science to important local, regional, national and global environmental problems and potential issues

COURSE OUTCOMES	
CO1	Able to solve the environmental problems based fundamental concepts of Environmental Science.
CO2	Enable the students to understand the structure and function of significant environmental systems
CO3	Knowledge of concepts makes them differentiate Natural and Polluted environment..
CO4	Enable to apply the Pyramid of number, mass and Energy, understand about Renweable energy resources. Illustrate the Forest ecosystem, Discuss about Grass and Net biomass productivity
CO5	Differentiate between Forest and desert Ecosystems, Critically evaluate arguments regarding environmental issues. Illustrate the Food chain and food web, Identify the applications of rain water harvesting, Interpret advantages of In-situ and Ex-situ conservation of biodiversity

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT-I:

i) Multidisciplinary nature of environmental studies

The **Multidisciplinary** nature of environmental studies Definition; Scope and importance, Need for public awareness.

ii) Natural Resources:

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and Over-exploitation, deforestation, case studies. Dams, benefits and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water

c) Earth: Geomorphology, Weathering, Structure of Earth - inner core, outer core, mantle and the crust, magma.

d) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

e) Food resources: World food problems, changes caused by agriculture, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT-II:

i) Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids.

Types of some ecosystems: -

a. Forest ecosystem b. Desert ecosystem

d. Aquatic ecosystems (ponds, rivers, oceans, estuaries).

ii) Biodiversity and its Conservation

Introduction-Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation.

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III:

Environmental Pollution and Disaster management:

Definition - Causes, effects and control measures of:

a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution

e. Noise pollution f. Thermal pollution g. Nuclear hazards

Ouy

Disaster management: floods, earthquake, cyclone and landslides.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

UNIT-IV:

Social Issues and the Environment

From Unsustainable to Sustainable development. Water conservation, rain water harvesting, watershed management.

Resettlement and rehabilitation of people; its problems and concerns. Case studies.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.

Issues involved in enforcement of environmental legislation. Public awareness.

UNIT-V:

i) Human Population and the Environment

Population growth, variation among nations. Population explosion-Family welfare Programme. Environment and human health, Women and Child Welfare, Role of information Technology in Environment and human health, Case Studies.

ii) Field Work

- Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Text Books:

1. Shashi Chawla, A Text Book of Environmental Studies, Mc Graw Hill Education, 4th edition, 2014

2. De A.K., Environmental Chemistry, Wiley Eastern Ltd , 2012

Reference Books

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).

2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

3. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA

B.Tech – II-II Sem (R19)

L T P C
3 0 0 3

Numerical Methods, Probability and Statistics
(Common to CIVIL, ME, EEE& CSE)

Course Objectives:

1) To familiarize the students with numerical methods of solving the non-linear equations, interpolation, differentiation, integration, and ordinary differential equations.
2) To impart knowledge in basic concepts and few techniques in probability and statistics in various applications in engineering.

Unit I: Solution to algebraic and transcendental equations& Interpolation

Solution of algebraic and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Learning Outcomes:

After completion of this unit student able to

- find approximate roots of the an equation by using different numerical methods
- explain various discrete operators and find the relation among operators
- apply Newton forward and backward formulas for equal and unequal intervals

Unit II: Numerical differentiation, integration & Solution of Initial Value Problems to Ordinary Differential Equations of first order.

Numerical Differentiation and Numerical integration: Numerical differentiation using Newton's forward & backward interpolation formulae; Numerical Integration by trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Numerical Solutions of Ordinary differential equation: Solution by Taylor's series, Picard's method of successive approximations, Euler's method, modified Euler's method and Runge-Kutta method of fourth order.

Learning Outcomes:

After completion of this unit student able to

- find integration of a function by different numerical methods
- solve ordinary differential equations using different numerical schemes

Unit III: Probability & Random Variables

Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem.

Random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties. (All concepts without proofs)

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the terms sample space, random variable, expected value
- apply probability theory via Baye's theorem
- identify the notations of discrete and continuous distribution functions
- evaluate Binomial and Poisson distributions
- explain the properties of normal distribution

Unit IV: Testing of hypothesis

Formulation of hypothesis, critical region, level of significance. Large sample tests: test for single proportion, difference of two proportions, test for single mean and difference of two means.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of testing of hypothesis
- apply the concept of hypothesis testing for large samples

Unit V: Small Sample Tests

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for independence of attributes and goodness of fit.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply the concept of testing hypothesis for small samples
- estimate the goodness of fit

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008
3. S.S.Sastry, "Introductory methods of Numerical Analysis", 5th edition, PHI, 2012.

References:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons publications, 2012.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. P. Kandasamy, K. Thilagavathy, S. Gunavathy, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

Course Outcomes:

Students will be able to

- apply different methods to find roots of the equations
- find approximate the solutions of ordinary differential equations
- apply the Laplace transform for solving differential equations
- explain the concepts of probability and their applications
- apply discrete and continuous probability distributions in practical problems
- use the statistical inferential methods based on small and large sampling tests

Internet of Things (IoT)

(ME)

B. Tech – IV Semester (R19) **L-T-P-C**

2-0-0-2

Course objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario..

Course Outcomes:

Upon completion of this course, students will acquire knowledge about:

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices.
- Deploy an IoT application by using all resources.
- Analyze applications of IoT in real time scenario.

UNIT I: Fundamentals of IoT

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.

UNIT II: IoT and M2M

M2M, IoTvs M2M, SDN and NFV for IoT, IOT system Management with NETCONF-YANG.

UNIT III: IoT Design Methodology

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

UNIT IV: Sensors and Connectivity

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols

UNIT V: IoT Applications

IOT application for industry-Future factory concepts, Brownfield IoT, Smart objects, Smart applications, Study of existing IoT platforms/middleware, IoT- A, Hydra etc.

TEXT BOOKS:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.

REFERENCES:

1. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
3. *Simon Monk, "Programming the Raspberry Pi: Getting Started with Python"*, McGraw-Hill, *2013.*
4. CharalamposDoukas,"Building Internet of Things With the Arduino", Second Edition, 2012.
5. Dr.John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.

Design Thinking and Product Innovation

L	T	P	C
2	0	2	3

Design is a realization of a concept or idea into a configuration, drawing or a product. Design thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end user. This course introduces the design thinking in product innovation.

Course Objectives:

- To bring awareness on innovative design and new product development.
- To explain the basics of design thinking.
- To familiarize the role of reverse engineering in product development.
- To train how to identify the needs of society and convert into demand.
- To introduce product planning and product development process.

UNIT I:

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.
Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, and electrical induction in engineering products.

Learning Outcomes:

After completion of this Unit, the student will be able to

- Relate the principles of science to engineering. (L2)
- Explain simple mechanics motion and force transmission. (L2)
- Identify the laws of physics applied to engineering products. (L3)

UNIT II:

Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.

Learning Outcomes:

After completion of this Unit, the student will be able to

- Identify innovation in early mechanical designs. (L2)
- Explain development of electrical equipment. (L2)
- List out the developments in computing machines. (L4)
- Summarize innovations in communication systems. (L2)

UNIT III:

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

Learning Outcomes:

After completion of this Unit, the student will be able to

- Explain the steps in the design process. (L2)
- Apply systematic approach in design. (L3)
- Develop strategies for new product development. (L3)

UNIT IV:

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, and study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

Learning Outcomes:

After completion of this Unit, the student will be able to

- Understand reverse engineering methods in product development. (L2)
- Use new materials to improve the product. (L2)
- Apply electronic controls to improve the product acceptability. (L3)
- Summarize the safety and environmental factors in new product design. (L2)
- Understand 3D printing in manufacturing. (L2)

UNIT V:

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, and smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Learning Outcomes:

After completion of this Unit, the student will be able to

- Identify the needs for new product development in agriculture. (L3)
- Develop simple electrical gadgets. (L3)
- Explain the principles in design electrical vehicles and drones. (L2)

Reference Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010.

3. An AVA Book, "Design Thinking", AVA Publishing, 2010.
4. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
5. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Course Outcomes

After completion of this course, the student will be able to

- Summarize the importance of basic sciences in product development. (L2)
- Explain the historical developments in mechanical, electrical, communications and computational engineering. (L3)
- Apply systematic approach to innovative designs. (L3)
- Identify new materials and manufacturing methods in design. (L3)

Mechanics of Materials

L	T	P	C
3	0	2	4

Course Objectives:

- Introduce the concepts of different stresses, strains and their relationships.
- Discuss the principal stresses and components of stress on different planes under different loads.
- Explain maximum shear force and bending moment of different beams under different loading conditions.
- Demonstrate bending stress and shear stress distribution of various cross section of beams and to predict the maximum slope deflection of beams.
- Impart strain energy due to axial, bending, and torsion loading, and to solve statically indeterminate problems using Castigliano's theorem.
- Focus on the stresses and deformations of the springs.
- Familiarize the Euler's concept of buckling in columns & struts.

UNIT I:

10 Hours

Stresses and Strains: Types of stresses and strains, stress-strain relations, stress-strain diagram for ductile and other materials, axial loaded bars of uniform and varying cross section, compound bars, relation between three elastic moduli, thermal stresses.

Principal stresses and strains: Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

Learning outcomes:

After completing this unit, the student will be able to

- Determine stresses and deformations due to axial loads in simple members. (L3)
- Analyze stresses compound bars due to temperature raise. (L4)
- Correlate the elastic constants of materials.(L3)
- Construct the Mohr's circle for calculating principal stresses.(L3)
- Analyze principal stresses in biaxial state of loading. (L4)

UNIT II:

10 Hours

Analysis of Beams: Types of beams and loads, shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of loadings, point of contra flexure, relation between shearing force and bending moment.

Deflection of Beams: Differential equations of the deflection curve, Slope and deflection: using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams.

Learning outcomes:

After completing this unit, the student will be able to

- Draw shear force and bending moment diagrams in beams subject to bending loading.(L3)
- Determine bending stresses in beams under different loading. (L4)
- Evaluate the maximum shear force and bending moment and their location in beams. (L4)
- Demonstrate the shear stress and bending moment distribution in different cross sections of beams.(L4)

UNIT III: **8 Hours**

Bending Stresses: Flexural equation, bending stress distribution and efficiency of various cross sections of beams. **Shear Stresses**: Shear stress distribution for different cross sections of beams.

Energy Methods: Strain energy, resilience. Deflection under single and several loads, Castigliano's theorem.

Learning outcomes:

After completing this unit, the student will be able to

- Compute the slope and deflection in beam under different loading.(L3)
- Distinguish various approaches for calculating slope and deflection. (L4)
- Explain the difference between strain energy, resilience, elastic strain energy and modulus of toughness. (L2)
- Apply the Castigliano's theorem for beams. (L3)

UNIT IV: **8 Hours**

Torsion of Circular Shafts: Theory of pure torsion, transmission of power in solid and hollow circular shafts, comparison of strengths of solid and hollow shafts, shafts in series and parallel, combined bending and torsion.

Springs: Deflection of closed and open coil helical springs under axial force and axial couple, Leaf springs.

Learning outcomes:

After completing this unit, the student will be able to

- Analyze circular shafts subjected to twisting couple. (L4)
- Determine stresses in shafts subjected to combined loads.(L4)
- Determine angle of twist in shafts. (L4)
- Determine stresses and deformations in helical and leaf springs. (L5)

UNIT V: **8 Hours**

Buckling of Columns: Analysis of columns to evaluate buckling loads with different boundary conditions, Euler's formula and its limitations, Rankine's formula, columns under eccentric load, columns under initial curvature.

Thin Cylinders: hoop and stresses, longitudinal, cylindrical and spherical shells subjected to internal pressure calculation of volumetric strain.

Learning outcomes:

After completing this unit, the student will be able to

- Determine buckling load in compressive members. (L4)
- Apply concepts of elastic stability of columns. (L3)
- Assess hoop and longitudinal stresses in thin cylinders. (L3)
- Calculate volumetric strain. (L3)

Text Books:

1. F.P. Beer, E.R. Johnston, Jr&John.T. DeWolf, Mechanics of Materials, 7/e, Tata McGraw-Hill, 2016.
2. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.

References:

1. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Course Outcomes:

After successful completion of this course student will be able to

- Apply the concepts of stress and strain to machine numbers. (L3)
- Determine, shear forces, and bending moments in beams. (L4)
- Find the slope and deflection in beams.(L4)
- Estimate the stress in machine members such as shafts and springs.(L4)
- ApplyCastigliano's theorem to determine displacements in beams. (L3)
- Analyze columns for buckling loads.(L4)
- Estimate the stresses in thin cylinders due to internal pressure.(L3)

Theory of Machines

L	T	P	C
3	0	0	3

Course Objectives:

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

UNIT I: **10 Hours**

Simple Mechanisms:

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – UniversalJoint – Rocker mechanisms.

Learning outcomes:

After completion of this unit, students will be able to

- Contrast the difference between machine and structure. (L2)
- Identify different types of kinematic pairs, kinematic chains. (L3)
- Find degrees of freedom for different mechanisms. (L1)
- Identify the inversions of four bar mechanism. (L3)
- Explain the difference between Davis and Ackerman steering gear mechanisms. (L2)

UNIT II: **12 Hours**

Plane and motion analysis:

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematicanalysis of simple mechanisms – slidercrank mechanism dynamics – Coincidentpoints – Corioliscomponent of acceleration.

Learning outcomes:

After completion of this unit, students will be able to

- Calculate the velocities and acceleration of various links in a mechanism. (L4)
- Determine instantaneous centers for a given mechanism. (L4)

UNIT III: **10 Hours**

Gyroscope:

Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

Gear Profile:

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

Learning outcomes:

After completion of this unit, students will be able to

- Explain the concept of gyroscopic couple. (L2)
- Analyze the effects of gyroscopic couple on an aeroplane, ship and road vehicles. (L4)
- Explain the different gear profiles and parameters. (L2)
- Identifydifferent types of gears and application. (L3)

UNIT IV: **12 Hours**

Balancing of Rotating masses:

Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams:

Classification of cams and followers- Terminology and definitions – Displacementdiagrams – Uniformvelocity, parabolic, simple harmonic and cycloidal motions – derivativesof follower motions-specified contour cams- circular and tangent cams –pressureangle and undercutting.

Learning outcomes:

After completion of this unit, students will be able to

- Explain the importance of balancing. (L2)
- Analyze balancing problems in rotating engines. (L4)
- Explain the working of cams and followers. (L2)
- Analyze the different motions in cam and followers. (L4)

UNIT V: **12 Hours**

Vibrations:

Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

Learning outcomes:

After completion of this unit, students will be able to

- Formulate equations of motion and solve for single degree of freedom system with damping. (L6)
- Estimate natural frequency of vibratory systems. (L5)
- Explain concept of vibration isolation and transmissibility. (L2)

Text Book(s)

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

References

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

Course Outcomes:

At the end of the course the students will be able to

- Understand different mechanisms and their inversions. (L2)
- Calculate velocity and acceleration of different links in a mechanism. (L4)
- Apply the effects of gyroscopic couple in ships, aero planes and road vehicles. (L3)
- Evaluate unbalance mass in rotating machines. (L5)
- Analyze free and forced vibrations of single degree freedom systems. (L4)

Manufacturing Processes - II

L	T	P	C
3	0	2	4

Course Objectives:

- Explain parameters in the metal cutting operation.
- Relate tool wear and tool life and the variables that control them.
- Calculate machining times for different machining processes.
- Teach various metal cutting processes. (Lathe, drilling, boring shaping, slotting, milling and grinding).
- Familiarize the principles of jigs and fixtures and types of clamping and work holding devices.

UNIT I: **8 Hours**

Material Removal Processes:

Metal Cutting: Single and multi-point cutting, orthogonal cutting, various force components, chip formation, tool wear and tool life, surface finish and integrity, machinability, cutting tool materials, cutting fluids, coatings.

Learning Outcomes:

At the end of the this unit, the student will be able to

- Describe cutting processes and variables. (L2)
- Classify various types of chips, cutting tool materials and cutting fluids. (L4)
- Calculate cutting force, speed and feed finding techniques during machining. (L5)

UNIT II: **10 Hours**

Machining processes for round shapes:

Lathe and Lathe Operations: Principles of working, specifications, types of lathes, operations performed, work holders and tool holders. Taper turning, thread turning attachments for lathes. Machining time calculations. Turret and capstan lathes – Principleof working, collect chucks, other work holders – toolholding devices.

Boring and Boring Machines- Principles of working, specifications, types, and operations performed – toolholding devices –nomenclature of boring tools

Drilling and Drilling Machines: Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof twist drill.

Reaming and Reamers: Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof reamers.

Taping and Taps: Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof taps.

Learning Outcomes:

At the end of this unit, the student will be able to

- List the specifications for various types of lathes. (L1)
- Determine cutting speeds for different machining operations. (L5)
- Identify parts of drilling, boring, reaming machines. (L3)

UNIT III: **8 Hours**

Machining processes for other shapes:

Milling operations and Milling machines: Principles of working, specifications, classifications of milling machines, machining operations, types and geometry of milling cutters, methods of indexing, and accessories to milling machines, machining time calculations, gear hobing.

Shaping, Slotting and planning machines: Principles of working – principalparts, specification, classification, and operations performed, machining time calculations.

Gear Manufacturing:

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize the parts of milling, shaping, slotting and planning machine. (L3)
- Compare tool geometry for milling, shaping, slotting and planning operations. (L3)
- Calculate machining times. (L5)

UNIT IV: **8 Hours**

Abrasive Machining:

Grinding and Grinding Machines: Grinding process, types of grinding machines, grinding process parameters, honing, lapping, other finishing processes.

Learning Outcomes:

- At the end of this unit, the student will be able to
- Understand the basic principles of abrasive processes. (L2)
- Explain the designation of the grinding wheel and the significance of the various codes. (L2)
- Classify different types of grinding machines and their applications. (L4)
- Assess the grinding process and variables that effect the operation. (L5)
- Estimate the time and power required for the grinding operation. (L5)
- Explain various types of abrasive processes such as honing and lapping for final finishing operation. (L2)

UNIT V: **8Hours**

Jigs and Fixtures Principles of design of Jigs and fixtures and uses, 3-2-1 principle of location and clamping, classification of Jigs & Fixtures, types of clamping and work holding devices, typical examples of jigs and fixtures.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various types of jigs and fixtures. (L4)
- Identify various types of work and tool holding devices. (L3)
- Explain the design principles of jigs and fixtures. (L2)
- Design a jig and fixture for a given application. (L6)

Text books:

1. P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e,Tata McGraw-Hill Education, 2013
2. R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012.

Reference books:

1. Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.
2. Milton C.Shaw, Metal Cutting Principles, 2/e, Oxford, 2012.
3. Hindustan Machine Tools, Production Technology, TMH, 2001.
4. V.K.Jain, Advanced Machining Process, 12/e, Allied Publications, 2010.
5. AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017.
6. Halmi A Yousuf& Hassan, Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008.

Course Outcomes:

At the end of the course, the student will be able to

- Choose cutting processes and variables. (L3)
- Relate tool wear and tool life. (L1)
- Calculate the machining parameters for different machining processes. (L5)
- Identify methods to generate different types of surfaces. (L3)
- Explain work-holding requirements. (L2)
- Design jigs and fixtures. (L6)

Computer Aided Machine Drawing

L	T	P	C
0	0	3	1.5

Course Objectives:

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.
- Familiarize with limits, fits and tolerances in mating components.

The following contents are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling, bushed pin-type flange coupling, universal joint, Oldhams' coupling.

The following contents to be done by any 3D software package

Sectional views: Creating solid models of complex machine parts and create sectional views.

Assembly drawings: (Any four of the following using solid model software)

Piston, Connecting rod, Eccentric, Screw jack, Plumber block, Axle bearing, Pipe vice, Clamping device, Geneva cam, Lathe Single tool post, Clapper Box, Tail stock, Machine vice, Air Cock, Carburetor.

Manufacturing drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Books:

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.

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Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
4. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Course Outcomes:

After completion of this lab student will be able to

- Demonstrate the conventional representations of materials and machine components.
- Model riveted, welded and key joints using CAD system.
- Create solid models and sectional views of machine components.
- Generate solid models of machine parts and assemble them.
- Translate 3D assemblies into 2D drawings.
- Create manufacturing drawing with dimensional and geometric tolerances.

Mechanics of Materials Laboratory

Course Objectives:

- To conduct uni-axial tension test on Steel, Aluminium, Copper and Brass.
- To perform compression test on spring and wood.
- To determine elastic constants of materials using flexural and torsion tests.
- To find hardness of given metals.

List of Experiments:

1. Study the stress – strain relations of (a) Mild Steel and (b) Tor Steel by conducting tension/compression test on U.T.M.
2. Study the stress – strain relation of (a) Copper and (b) Aluminium (c) other materials by conducting tension /compression test.
3. Find the compressive and shear strength of wood and shear strength of GI sheet by conducting relevant tests.
4. Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper.
5. Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel and aluminium.
6. Find the spring index and modulus of rigidity of the material of a spring by conducting compression and tensile tests.
7. Determine the Young's modulus of the material by conducting deflection test on a simply supported, propped cantilever and continuous beams.
8. Find impact strength of a given material by conducting a) Charpy test and b) Izod test.
9. Determine buckling load in a compressive member made with steel and aluminium.
10. Determine the deflection in leaf spring with a single leaf and multiple leafs.
11. Measure the increase in diameter in cylindrical and spherical shells subjected to internal hydraulic pressure.

Course Outcomes:

On completion of this lab student will be able to

- Understand the stress-strain behavior of different materials.
- Identify the difference between compression and tension testing.
- Evaluate the hardness of different materials.
- Correlate the elastic constants of the materials.
- Explain the relation between elastic constants and hardness of materials.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA				
II YEAR II SEMESTER				
DESIGN THINKING AND PRODUCT INNOVATION LAB (19AME20) (MECH)				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objectives:

- Acquire practical knowledge on 3D Printing technology.
- Design the various measuring instruments like temperature, humidity, smart lighting system etc,.

List of Experiments

1. 3D Printing
    a. To develop a CAD model and simulate in CAE environment.
    b. To develop tooling and make a physical prototype.
2. To design a device for measurement of Temperature.
3. To design a device for measurement of Humidity.
4. To design a device for Water Level Indicator.
5. To design a Smart Lighting system.
6. To design Automatic Car Wiper.
7. Design of simple pneumatic and hydraulic circuits using basic components.
8. Design of pneumatic circuit for speed control of double acting cylinders.
9. Design a hydraulic circuit by using Flow Control Valves for simple application.
10. Design and Simulation of a Hydraulic Shaper.
11. Design and Simulation of a Hydro Electric Circuit for simple application.

Course Outcomes:

At the end of this Course the student will be able to

- Fabricate different types of components using 3D Printing technology. (L6)
- Design various measuring instruments like temperature, humidity, smart lighting system etc,. (L6).

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L	T	P	C
3	0	0	0

Constitution of India

Course Objectives:

1. To enable the student to understand the importance of constitution.
2. To understand philosophy of fundamental rights and duties.
3. To understand the structure of executive, legislature and judiciary.
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the concept of Indian constitution.
2. Apply the knowledge on directive principle of state policy.
3. Analyze the History, features of Indian constitution.
4. Evaluate Preamble Fundamental Rights and Duties.

UNIT-II

Democratic forms of Constitution, Union Government and its Administration Structure of the Indian Union: Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the structure of Indian government.
2. Differentiate between the state and central government.
3. Explain the role of President and Prime Minister.
4. Know the Structure of supreme court and High court.

UNIT-III

Federalism, Political relations, Financial relations of State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the structure of state government.
2. Analyze the role Governor and Chief Minister.
3. Explain the role of state Secretariat.
4. Differentiate between structure and functions of state secrateriate.

UNIT-IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the local Administration.
2. Compare and contrast district administration role and importance.
3. Analyze the role of Myer and elected representatives of Municipalities.
4. Evaluate Zilla panchayat block level Organisation.

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate , State Election Commission, Supreme Court, High Court.

Learning Outcomes:

At the end of this unit students will be able to:

1. Know the role of Election Commission apply knowledge.
2. Contrast and compare the role of Chief Election commissioner and Commissiononerate.
3. Analyze role of state election commission.
4. Evaluate various commissions of viz SC/ST/OBC and women.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government & Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication.
6. J.C. Johari, Indian Government and Politics Hans.

Course Outcomes:

1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
3. Understand the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
6. Know the sources, features and principles of Indian Constitution.
7. Learn about Union Government, State government and its administration.
8. Get acquainted with Local administration and Pachayati Raj.
9. Be aware of basic concepts and developments of Human Rights.
10. Gain knowledge on roles and functioning of Election Commission.

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME51 – THERMAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To familiarize the developments in IC engines.
- To teach combustion process in SI and CI engines.
- To introduce different types of compressors.
- To familiarize concepts of thermodynamics cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

UNIT – 1: IC Engines **10 Hrs**

IC Engines: Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.

Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking, pre-ignition. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking. Fuel requirements and fuel rating.

Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of IC Engines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand working of IC engines on the basis of thermodynamic cycles. **L2**
- Estimate engine performance. **L5**
- Identify the effects of abnormal combustion in IC engines. **L3**

UNIT – II: Classification of Air compressors **8 Hrs**

Reciprocating Compressor: Single stage reciprocating compressors, work done, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.

Rotary Compressor: Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify different types of air compressors. **L2**
- Compare the performance of different types of air compressors **L2**

UNIT – III: Vapour Power Cycles & Gas power Cycle **8 Hrs**

Vapour Power Cycles: Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output of Rankine cycle

Gas power Cycle: Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for maximum pressure ratio and optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating. Introduction to jet propulsion: working principle of ramjet, turbojet, turbofan, turboprop and pulse jet engines,

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Learning Outcomes:

At the end of this unit, the student will be able to

- Explain concepts of vapour power cycle used in steam power plant. **L2**
- Evaluate the cycles used in gas turbine **L5**
- Outline the jet propulsion system. **L2**

UNIT – IV: Nozzles & Steam Turbines **10 Hrs**

Nozzles: Type of nozzles - air and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - nozzle efficiency.

Steam Turbines: Classification of steam turbines -impulse turbine and reaction turbine - compounding in turbines - velocity diagrams in impulse and reaction turbines, efficiency, degree of reaction - governing of turbines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare the performance of nozzles, used in turbines. **L2**
- Classify steam turbines and applications. **L4**
- Analyze the performance of steam turbines under different operating conditions. **L5**

UNIT – V: Refrigeration **8 Hrs**

Refrigeration: Bell-Coleman cycle - vapour compression cycle, effect of vapour condition on COP of VCR, - vapour absorption cycle, properties of common refrigerants

Principles of Psychrometry and Air Conditioning: Psychometric terms, psychometric processes and air conditioning systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline the operation of refrigerators. **L2**
- Identify different refrigerants and applications. **L3**
- Use properties of moist air in calculations for air-conditioning system. **L3**

Text Books:

1. Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017.
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014.
3. K.K.Ramalingam, Thermal Engineering, 2/e, Scitech Publications (India) Pvt Ltd,2011

Reference Books:

1. Cengal Y.A and Boles M.A, Thermodynamics: An Engineering Approach, 5/e, McGraw Hill, 2006.
2. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010.
3. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008.
4. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014.
5. P.L.Ballaney, Thermal Engineering, 2/e, Khanna, 2005.

Course Outcomes:

At the end of this Course the student will be able to

- Explain working of IC engines with combustion process. **L2**
- Select compressors for different applications. **L1**
- Use T-s diagram in vapour power and gas power cycles. **L3**
- Explain the basic principles of steam turbines. **L2**
- Explain the basic principles of steam turbines. **L2**
- Select appropriate refrigerant for different applications **L1**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME52 – DESIGN OF MACHINE MEMBERS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

UNIT – I: Mechanical Engineering Design **10 Hrs**

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify materials suitable for machine elements. **L1**
- Apply codes and standards in design. **L3**
- Contrast the difference between static and dynamic loads. **L2**
- Apply failures theories in designing components subjected to static and dynamic loads **L3**

UNIT – II: Design of Bolted and Bolted joints **10 Hrs**

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different types of joints. **L1**
- Analyze stresses induced in joints subjected to different loads. **L4**
- Design different joints subjected to combined loading. **L6**

UNIT – III: Power Transmission Shafts & Couplings **8 Hrs**

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of flange and bushed pin couplings, universal coupling.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the functions of different keys. **L2**
- Design shafts subjected to fluctuating loads. **L6**
- Select coupling for a given application and outline the design procedure. **L3**
- Explain construction and design procedure for helical and leaf springs. **L2**

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UNIT – IV: Friction Clutches, Brakes & Springs **8 Hrs**

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression, tension, torsion and leaf springs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the difference between brake and clutch. **L2**
- Calculate the torque transmitting capacity in clutches.
- Compare different types of brakes and their applications.
- Explain the concepts of self-energizing and self-locking brakes.
- Discuss procedures to design different types of brakes. **L2**

UNIT – V: Design of Sliding Contact Bearings **10 Hrs**

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

Learning Outcomes:

At the end of this unit, the student will be able to

- Contrast the difference between sliding and rolling contact bearings. **L2**
- Explain the mechanics of lubrication in sliding contact bearings **L2**
- Identify failures in bearings. **L3**
- Evaluate static and dynamic load capacity of rolling contact bearings. **L5**
- Explain the procedure to select bearings from manufacturer's catalogue **L3**

Text Books:

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya & Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.

Course Outcomes:

At the end of this Course the student will be able to

- Estimate safety factors of machine members subjected to static and dynamic loads. **L5**
- Design fasteners subjected to variety of loads. **L6**
- Select of standard machine elements such as keys, shafts, couplings. **L1**
- Design clutches brakes and spur gears. **L6**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME53 – AUTOMATION AND ROBOTICS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems.
- Illustrate adaptive control systems and automated inspection methods.

UNIT – 1: Introduction **10 Hrs**

Introduction: Automation in production system, need, types, Principles and Strategies of automation, levels of automation, basic elements of an automated system, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Automated flow lines & transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define the automation in production system. **L1**
- Describing the concept of automated flow lines. **L2**
- Classify the types of hardware components of automation and control system. **L3**
- Compare various types of part transfer mechanisms. **L4**

UNIT – II: Assembly Line Balancing **10 Hrs**

Assembly Line Balancing: Assembly process and systems assembly line, line balancing algorithms, ways of improving line balance, flexible assembly lines.

Material handling and Identification Technologies: Overview of automatic material handling systems, principles and design consideration, material transport systems, storage systems, overview of automatic identification methods.

Automated Manufacturing Systems: Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describing the concept of assembly line balancing. **L2**
- Identify the components of automated manufacturing system **L1**
- Understand the concept of GT, FMS, cellular manufacturing and material handling system **L1**
- Classify the types of automated manufacturing system. **L2**
- Design a simple material handling system for low cost manufacturing **L6**

UNIT – III: Introduction Robotics **8 Hrs**

Introduction: Brief history of robots, classification of robot, functional line diagram, degrees of freedom. Elements of robot - types and its functions, factors to be considered in the design of grippers.

Robot Actuators And Feedback Components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design a simple gripper for robot. **L6**
- Compare the types of actuators used in robot manipulator. **L4**

- List out the various types of robots and feedback components. **L1**
- Define the degree of freedom for robot. **L1**

UNIT – IV: Manipulator Kinematics & Dynamics **12 Hrs**

Manipulator Kinematics: Homogenous transformations as applicable to translation, rotations- D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate D-H notations for simple robot manipulator **L4**
- Identify the path and position of robot gripper within work volume **L1**
- Use the Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipulator dynamic problems **L6**
- Explain the concepts of manipulator kinematics and dynamics **L3**

UNIT – V: Robot Programming & Applications **8 Hrs**

Robot Programming: Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion, joint integrated motion, straight line motion; avoidance of obstacles.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading; Process - spot and continuous arc welding & spray painting; Assembly and Inspection.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the requirements and features of robot programming **L1**
- Demonstrate the various applications of robots in manufacturing. **L6**
- List the various methods of robot programming. **L1**
- Use various software packages to write the robot programming **L4**

Text Books:

1. Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing- Pearson Education.5/e, 2009.
2. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey , Industrial Robotics – – Mc Graw Hill, 1986.

Reference Books:

1. S. R. Deb & Sankha Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill Education.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
4. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

At the end of this Course the student will be able to

- Explain the principles and Strategies of automation. **L2**
- Select type of automatic material handling system **L1**
- Use D-H parameters for determining the position of the end effecter. **L3**
- Explain the manipulator kinematics and dynamics **L2**
- Write the program for robot **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54a - ALTERNATIVE FUELS AND EMISSION CONTROL IN AUTOMOTIVES

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain various alcohol and gaseous fuels and their use in SI and CI engines.
- Explain various vegetable oils and their use in CI engines.
- Determine the formation of various emissions from SI engine and control techniques.
- Identify various emission measuring instruments and test procedures.

UNIT – I **12 Hours**

Alcohol fuels and gaseous fuels: Properties of alcohols, alcohol – gasoline blends, fuel flexible vehicle, methanol reformed gas engine, dual fuel system, Spark assisted diesel engine, surface ignition engine, ignition accelerators, performance, combustion and emission characteristics in SI and CI engines, Properties of hydrogen, production and storage methods, safety precautions, biogas production and its properties, properties of LPG and CNG, Performance, combustion and emission characteristics of hydrogen, biogas, LPG and CNG in SI and CI engines

Learning Outcomes:

At the end of this unit, the student will be able to

- Assets the properties of alcohols and alcohol gasoline blends **L5**
- Explain the principles of spark assisted diesel engine and surface ignition engine. **L3**
- Identify the performance, combustion and emission characteristics in SI and CI engines. **L3**
- Explain production, storage methods and emission characteristics of hydrogen. **L3**

UNIT – II **10 Hours**

Vegetable oils: Various vegetable oils for diesel engines, structure and properties, problems in using vegetable oils in diesel engines, Methods to improve the engine performance using vegetable oils – preheating, Esterification , blending with good secondary fuels, Semi-adiabatic engine, surface ignition engine, ignition accelerators dual fuelling with gaseous and liquid fuels coils, Performance, combustion and emission characteristics of biodiesel fuelled diesel engines.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various vegetable oils and its properties used for diesel engines. **L1**
- Identify the problems in using vegetable oils in diesel engines. **L3**
- Explain the methods to improve the engine performance using vegetable oils. **L3**
- Explain the method of blending with good secondary fuels. **L3**
- Determine the performance, combustion and emission characteristics of biodiesel fuelled diesel engine. **L3**

UNIT – III **10 Hrs**

Emissions from SI engines and their control: Emission formation in SI engines (CO, HC and NOx), Effect of design and operating variables on emission formation, Control techniques – Thermal reactor, exhaust gas recirculation, Three way catalytic convertor and Charcoal canister control for evaporative emission, Positive crank case ventilation for blow by gas control.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Explain emission formation in SI engines. **L3**
- Practice the effect of design and operating variables on emission formation in SI engine. **L5**
- Classify various control techniques on SI engine emission formation. **L2**
- Choose a control technique for a given application **L1**
- Explain on positive crank case ventilation for blow by gas control. **L3**

UNIT – IV **08 Hrs**

Emissions from CI engines and their control: Emission formation in CI engines (HC, CO, NOx, Aldehydes, smoke and particulates), Effect of design and operating variables on emission formation, Control techniques – Exhaust gas recirculation, NOx selective catalytic reduction, Diesel oxidation catalytic convertor, Diesel particulate filter, NOx versus particulates – Trade off

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain emission formation in CI engines **L3**
- Appraise the effect of design and operating variables on emission formation in CI engine. **L5**
- Explain various control techniques on CI engine emission formation. **L3**
- Choose a control technique for a given application **L1**

UNIT – V **08 Hrs**

Emission measuring instruments and test procedures: Principle of operation of emission measuring instruments used in SI and CI engines, Measurement of CO_2 and CO by NDIR, Hydrocarbon emission by FID, Chemiluminescent analyser for NOx, Liquid and Gas chromatograph Spot sampling and continuous indication type smoke meters (Bosch, AVL and Hartridge smoke meters) emission test procedures – FTP, Euro and Bharat norms

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various emission measuring instruments for SI and CI engines **L2**
- Apply the principle of operation of emission measuring instruments used in SI and CI engines **L3**
- Explain the method of measurement of CO_2 and CO by NHIR **L3**
- Identify the emission of hydrocarbons using FID **L3**

Text Books:

1. Ganesan V, Internal combustion engines, 4^{th} Edition, Tata McGraw Hill Education, 2012
2. Thipse.S.S, Alternative Fuels: Concepts, Technologies and Developments, Jaico Publishing House, 2010.

Reference Books:

1. Michael F. Hordeski, Alternative Fuels: The Future of Hydrogen, The Fairmont Press, 2008
2. R.K.Rajput, A textbook of Internal Combustion Engines, 2^{nd} Edition, Laxmi Publications, 2007
3. "Society of Automotive Engineers", Alternative Fuels: Fuel Cells and Natural Gas, Society of Automotive Engineers, Incorporated, 2000

Course Outcomes:

At the end of this Course the student will be able to

- Identify various emissions from SI and CI engines. **L3**
- Explain the properties of alcohol fuels and gaseous fuels. **L3**
- Predict the problems by using vegetable oils in diesel engines. **L6**
- Choose the use of various emission measuring instruments. **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54b – MANUFACTURING METHODS IN PRECISION ENGINEERING

(Professional Elective – I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize with surface treatments and their industrial applications.
- Explain powder metal production sintering techniques for metal powders, glass, ceramics and plastics.
- Explain wafer preparation, optical lithography including current best practice and perceived limits and equipment required for micro-device packaging processes.
- Demonstrate plastics processing.
- Train different liquefied, solidified and particulate methods for different MMC, CMC, Polymer matrix composites.

UNIT – I **10 Hrs**

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the phenomenon related to different surface modification by physical and chemical treatments: **L2**
- Develop the basics of CVD (Chemical Vapour Deposition) and PVD (Physical Vapour Deposition) technologies for surface coating deposition, description of thermal spraying technology for surface coating applications. **L2**
- Explain properties and characteristics of different surface coatings and their applications. **L3**

UNIT – II **10 Hrs**

Processing of Powder metals, Glass and Superconductors: Introduction, production of metal powders, compaction of metal powders, sintering, secondary and finishing operations, design considerations for powder metallurgy, Process capabilities, economics of powder metallurgy, forming and shaping of Glass, techniques for strengthening and treating Glass, design considerations for Glass, processing of superconductors.

Processing of ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain powder metallurgy and ceramics applications. **L2**
- Demonstrate processing of powders and sintering techniques. **L2**
- Outline mechanism of sintering properties and characteristics of powder metals, glass and superconductors. **L3**

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UNIT – III **10 Hrs**

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, and micro machining, High speed Machining.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate wafer preparation, optical lithography. **L1**
- Explain the basic packaging and its levels, different IC chip mounting and interconnect methods. **L2**
- Summarize mechanisms like E-Manufacturing, nanotechnology, and micromachining, high speed machining. **L3**

UNIT – IV **10 Hrs**

Processing Of Plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction - concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, stereo holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process.

Learning Outcomes:

At the end of this unit, the student will be able to

- Build basic knowledge of manufacturing of plastics. **L1**
- Explain the rapid prototyping methods in plastic processing. **L2**

UNIT – V **08 Hrs**

Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use of fibre-reinforced composites in engineering applications. **L1**
- Summarize the use of composite materials, micromechanics of layered composites. **L2**
- Explain different liquefied, solidified and particulate methods for MMC, CMC, Polymer matrix composites. **L3**

Text Books:

1. Schmid and Kalpakjin, Manufacturing Engineering and Technology, 7/e, Pearson Education India, 2001
2. P.N. Rao, Manufacturing Technology, Foundry forming and welding, Vol I, 2/e, Tata McGraw-Hill, 2001
3. Rafiq Noorani, Rapid Prototyping Principles and Applications, Illustrated edition, Wiley, 2006

Reference Books:

1. R.K. Jain, Production Technology, 17/e, Khanna Publishers, 2012
2. Roy A. Lindberg, Process and materials of manufacturing, 2/e, Allyn and Bacon, 1978.

Course Outcomes:

At the end of this Course the student will be able to

- Classify different surface treatment methods. **L2**
- Explain processing of powder metals, glass and super conductors. **L2**
- Develop fabrication of microelectronic devices. **L2**
- Process plastics and composites. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54c – DESIGN FOR MANUFACTURING

(Professional Elective – I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain the product development cycle and manufacturing issues to be considered in design.
- Familiarize manufacturing consideration in cast, forged, and weld components.
- Describe the manufacture of sheet metal components.
- Impart knowledge plastics as substitution to metallic parts

UNIT – I **12 Hrs**

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Implement various steps in design process. **L6**
- Apply economical considerations at design stage. **L2**
- Develop creativity attitude in designing. **L5**
- Use Ashby charts for material selection. **L3**
- Apply process selection charts. **L2**

UNIT II **10 Hours**

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall various machining processes. **L1**
- Assign dimensional tolerances and surface roughness values. **L4**
- Identify the necessity of redesigning of the components. **L3**
- Summarize the design rules for machining. **L2**
- Assign recommendations for machining of components. **L4**

UNIT III **10 Hours**

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various casting processes. **L1**
- Assign tolerances for various casting processes. **L5**
- Simulate sand casting design. **L4**
- Prescribe pre and post treatment of welds. **L5**
- Discuss the effects of thermal stresses in weld joints and brazed joints. **L2**

UNIT IV **8 hours**

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the difference between open and closed die forging. **L2**
- Identify the problems in parting lines of dies. **L3**
- Apply the design guidelines the extruded sections. **L2**
- Apply the design principles for various sheet metal operations. **L2**
- Utilize sheet metal effectively for blanking operations. **L3**

UNIT V **8 Hours**

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain visco elastic and creep behavior in plastics. **L2**
- Discuss various plastic molding processes. **L6**
- Apply the design considerations for injection molding. **L2**
- Use the design guidelines in machining of plastics. **L3**

Text Books:

1. George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015)
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011)
3. David M Anderson, Design for Manufacturability, CRC Press (2013)

Reference Books:

1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004).
2. Dr.P.C.Sharma, Production Technology, S.Chand & Company (2009).

Course Outcomes:

At the end of this Course the student will be able to

- Design mechanical components with economical consideration. **L6**
- Select materials and machining processes. **L6**
- Identify the necessity for redesigning components out of manufacturing considerations. **L3**
- Consider the manufacturing considerations while designing cast, forged weld and sheet metal components. **L3**
- Design plastic parts with manufacturing considerations. **L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54d – POWER PLANT ENGINEERING

(Professional Elective – I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.

UNIT I **12 Hours**

Introduction to the Sources Of Energy - Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline sources of energy, compare and selection of types of power plants. L2
- Explain cost factors, load and power distribution factors. L2
- Select tariff based on load and demand factors. L3
- Summarize the impact of power plant on the environment, pollution mitigation and regulations. L2

UNIT II **10 Hours**

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

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Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate latest high pressure boilers, power plant cycles and their improvements. **L2**
- Explain various types of coals, coal handling operations and associated systems. **L2**
- Outline and compare types of feeders, stokers, combustion systems. **L2**
- Illustrate draught, dust collector, furnace, cooling tower and heat rejection systems. **L2**
- Evaluate pollution levels from power plants, pollution control methods, and application of pollution recorders. **L4**

UNIT III **8 Hours**

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

GAS TURBINE PLANT: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain working principle, and compare types of diesel power plant. **L2**
- Outline the diesel power plant layout with its supporting equipment. **L2**
- Illustrate the working principle of open cycle and closed cycle gas turbine. **L2**
- Demonstrate combined cycle power plants with benefits and shortcomings. **L2**

UNIT IV **8 hours**

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects And Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain hydrological cycle, infer flow measurements from hydrographs. **L2**
- Summarize working principle of hydro electric power plant. **L2**
- Illustrate typical layout of hydro electric power plant, and its auxiliary equipments. **L2**

UNIT V **8 Hours**

Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types Of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Learning Outcomes:
At the end of this unit, the student will be able to

- Demonstrate working principle of power generation from non-conventional energy sources. **L2**
- Explain working principle of Nuclear power plants, nuclear fuels, and reactor operations. **L2**
- Outline the various types of nuclear reactors, their applications and limitations. **L2**
- Summarize the hazards of nuclear reactors and significance of nuclear waste disposal. **L2**

Text Books:

1. P.K. Nag, Power Plant Engineering, 3/e, TMH, 2013.
2. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai & Co (P) Ltd, 2014

Reference Books:

1. Rajput, A Text Book of Power Plant Engineering, 4/e, Laxmi Publications, 2012.
2. Ramalingam, Power plant Engineering, Scietech Publishers, 2013
3. P.C. Sharma, Power Plant Engineering, S.K. Kataria Publications, 2012.

Course Outcomes:
At the end of this Course the student will be able to

- Outline sources of energy, power plant economics, and environmental aspects. **L2**
- Explain power plant economics and environmental considerations. **L2**
- Describe working components of a steam power plant. **L2**
- Illustrate the working mechanism of Diesel and Gas turbine power plants. **L2**
- Summarize types of renewable energy sources and their working principle. **L4**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54e – NON-DESTRUCTIVE TESTING

(Professional Elective - I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

UNIT I **10 Hours**

Introduction to non-destructive testing: Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain non destructive testing techniques **L2**
- Summarize the basic concepts of Radiographic test **L2**
- Outline the concepts of sources of X and Gamma Rays **L2**
- Explain the radiographic techniques **L2**
- Discuss the safety aspects of industrial radiography. **L4**

UNIT II **10 Hours**

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principle of ultrasonic test. **L2**
- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. **L4**
- Discuss the characteristics of ultrasonic transducers. **L4**
- Outline the limitations of ultrasonic testing. **L2**

UNIT III **10 Hours**

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

Learning Outcomes:

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At the end of this unit, the student will be able to

- Illustrate the procedure of Liquid Penetrant, eddy current and magnetic particle test. **L2**
- Outline the limitations of Penetrant, eddy current and magnetic particle tests. **L2**
- Explain the effectiveness of Penetrant, eddy current and magnetic particle tests **L2**
- Apply the applications of Magnetic particle test. **L3**

UNIT IV **8 hours**

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers —thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings – Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials– IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures– Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss the fundamentals of thermal testing. **L6**
- Explain the techniques of liquid crystals, active and passive. **L2**
- Illustrate thermal inspection methods. **L2**
- Outline the limitations of thermal testing. **L2**
- Explain the applications of honey comb and sandwich structures. **L2**

UNIT V **8 Hours**

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate applications of NDE. **L2**
- Explain the applications of Railways, Nuclear and chemical industries. **L2**
- Outline the limitations and disadvantages of NDE. **L2**
- Explain the applications of NDA of pressure vessels, casting and welding constructions **L2**

Text Books:

1. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys

Course Outcomes:

At the end of this Course the student will be able to

- Explain various methods of non-destructive testing. **L3**
- Apply relevant non-destructive testing method different applications. **L3**
- Explain the applications of Railways, Nuclear and chemical industries. **L2**
- Outline the limitations and disadvantages of NDE. **L2**
- Explain the applications of NDA of pressure vessels, casting and welding constructions **L2**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME54f – ERGONOMICS AND HUMAN FACTORS IN ENGINEERING

(Professional Elective – I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the fundamentals of human factors in engineering.
- Explain principles Hours Anthropometry, Ergonomics and product design.
- Describe the Improvement of human work place through controls.
- Evaluate the sources of vibration and performance effect of vibration in machine tools.
- Know the Special purpose lighting for illumination and quality control.

UNIT I **12 Hours**

Fundamentals of Human Factors Engineering: Human Biological, Ergonomic and psychological capabilities and limitations, Concepts of human factors engineering and ergonomics, Man-Machine system and Design philosophy.

Physical work and energy expenditure: Manual lifting, Work posture, Repetitive motion, Provision of energy for muscular work, Heat stress, Role of oxygen physical exertion, Measurement of energy expenditure, Respiration, Pulse rate and blood pressure during physical work, Physical work capacity and its evaluation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define the fundamentals concepts of human factors in engineering. L1
- Discuss the Human biological, Ergonomic and psychological capabilities in engineering. L6
- Evaluate physical work capacity and energy expenditure. L4
- Measure the energy expenditure, respiration, pulse rate and blood pressure during physical exertion. **L4**

UNIT II **10 Hours**

Anthropometry: Physical dimensions of the human body as a working machine, Motion size relationships, Static and dynamic anthropometry, Anthropometric design principles, Using anthropometric measures for industrial design.

Ergonomics and product design: Ergonomics in automated systems, Expert systems for ergonomic design, Anthropometric data and its application in ergonomic design, Limitations of anthropometric data, Use of computerized database.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of hours anthropometry. **L2**
- Illustrate the physical dimensions of the human body as a working machine. **L2**
- Discuss anthropometric data and its application in ergonomic design. **L6**
- State the limitations of anthropometric data in ergonomic design. **L4**

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UNIT III **10 Hours**

Machine controls: Improvement of human work place through controls, Displays and Controls, Shapes and sizes of various controls and displays, Multiple display and control situations, Design of major controls in automobiles and machine tools, Principles of hand tool design.

Work place and seating design: Design of office furniture, Redesign of instruments, Work process: Duration of rest periods, Design of visual displays, Design for shift work.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the concept of improvement of human work place through controls. **L2**
- Explain the principles of hand tool design. **L2**
- Illustrate the design of major controls in automobiles and machine tools. **L2**
- Design the work place and seating plane in machine controls. **L6**

UNIT IV **8 hours**

Color and light: Color and the eye, Color consistency, Color terms, Reactions to color and color continuation, Color on engineering equipments.

Temperature-Humidity-Illumination and Contrast: Use of Photometers, Recommended illumination levels, The ageing eye, Use of indirect (Reflected) lighting, Cost efficiency of illumination, Special purpose lighting for illumination and quality control.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the terms color consistency, reactions to color and color continuation. **L2**
- Describe effects of color on engineering equipments. **L2**
- Indentify recommended illumination levels. **L3**
- Explain about special purpose lighting for illumination and quality control. **L2**

UNIT V **8 Hours**

Measurement of sound: Noise exposure and hearing loss, Hearing protectors, Analysis and reduction of noise, Effects of noise, Performance annoyance of noise and interface with communication, Sources of vibration and performance effect of vibration, Vibrations in machine tools.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the sources of vibration and performance effect of vibrations in machine tools. **L6**
- Illustrate the effects of noise on machine tool operation. **L2**
- Explain the terms noise exposure, hearing loss and hearing protectors. **L2**
- Explain the terms analysis and reduction of noise in machine tools. **L2**

Text Books:

- M. S. Sanders and E. J. McCormick, Human Factors in Engineering Design, 7/e, McGraw-Hill International, 1993.

Reference Books:

1. P. V. Karpovich and W. E. Sinning, Physiology of Muscular Activity, 7/e, Saunders (W.B.) Co Ltd., 1971.
2. Applied Ergonomics Handbook, I.P.C. Science and Technology Press Limited, 1974.
3. M. Helander, A Guide to the Ergonomics of Manufacturing, 2/e, CRC Press, 1997.
4. K. H. E. Kroemer, H. B. Kroemer and K. E. Kroemer Elbert, Ergonomics: How to design for ease and efficiency, 2/e, Pearson Publications, 2001.

Course Outcomes:

At the end of this Course the student will be able to

• Describe the sources of vibration and performance effect of vibrations in machine tools.	**L6**
• Indentify recommended illumination levels.	**L3**
• Illustrate the design of major controls in automobiles and machine tools.	**L2**
• State the limitations of anthropometric data in ergonomic design.	**L4**
• Measure the energy expenditure, respiration, pulse rate and blood pressure during physical exertion.	**L4**

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B.Tech III Year I semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS10-CAMPUS RECRUITMENT TRAINING & SOFT SKILLS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

UNIT – 1: SOFT SKILLS: INTRODUCTIUON

Soft Skills: Definition-Meaning--Importance- Why skill gap -Analysis—Personality Developments. Soft Skills- Learning Methods.

Learning Outcomes:

At the end of this unit, the student will be able to

- Developing self-motivation, raised aspirations and belief in one's own abilities, defining and committing to achieving one's goals. **L1**
- Learning to keep going when things don't go according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict **L2**

UNIT – II: PERSONAL SKILLS

Intra-Personal: Definition-Meaning-Importance-SWOT analysis- Goal Setting- Emotional Intelligence- Right thinking- Problem Solving-Time management.

Inter-Personal: Definition-Meaning-Importance-Communications skills- Team Work-Negotiation Skills-Leadership skills.

Learning Outcomes:

At the end of this unit, the student will be able to

- A commitment to ethics and integrity in academic and professional relationships, within the community and the environment. **L1**
- Describe how good communication with other can influence our working relationships **L2**

UNIT – III:VERBAL AND NON VERBAL SKILLS

Verbal Skills: Definition and Meaning-Importance-Improving Tips for Listening, Speaking, Reading-Writing Skills.

Non Verbal Skills: Definition and Meaning-Importance- Dress Code- Facial Expressions- Eye Contact- Proxemics - Haptics-Posture-Kinetics- Para Language.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compares verbal and nonverbal communication **L1**
- Understand the functions of nonverbal communication **L2**

UNIT – IV: FINISHING SCHOOL

Before Interview: Bridging between Campus and Corporate-Preparation of Resume-Cover Letter-Statement of Purpose-E-mail writing-Corporate Etiquettes.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learner will be able to prepare his/ her own Resume and Cover letter. **L1**
- Learner will understand the importance of etiquettes and learn the nuances of expected behaviour within a group, a social class and society at general **L2**

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UNIT – V: DURING INTERVIEW

Interview Skills: Importance-Purpose- Types of interviews –Preparation for interviews - Top Questions- Body Language in Interview Room-Do's and Don't s of interview.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learner will be able to face interview questions and effectively present his /her. skills **L1**
- Learner will manage how to plan and organize personal and professional life. **L2**

Reference Books:

1. Sherfield, M. Robert at al **CornerstoneDeveloping Soft Skills**, 4th ed. Pearson Publication,New Delhi, 2014.
2. Alka Wadkar, **Life Skills for Success**, Sage Publications India Private Limited; First edition (1 May 2016)
3. Sambaiah.M. **Technical English**, Wiley publishers India. New Delhi. 2014.
4. GANGADHAR JOSHI, **From Campus to Corporate**, SAGE TEXT.
5. Alex.K, **Soft Skills,** 3rd ed. S. Chand Publication, New Delhi, 2014.
6. Meenakshi Raman and Sangita Sharma, **Technical Communication: Principle and Practice**, Oxford University Press. 2009.
7. Shalini Varma, **Body Language for Your Success Mantra**, 4th ed, S. Chand Publication, New Delhi, 2014.
8. Stephen Covey, **Seven Habits of Highly Effective People**, JMD Book, 2013.

Course Outcomes:

At the end of this Course the student will be able to

- The students will be able to assimilate and understood the meaning and importance of soft skills and learn how to develop them. **L1**
- The students will understand the significance of soft skills in the working environment for professional excellence. **L2**
- The students will be prepared to undergo the placement process with confidence and clarity. **L3**
- The students will be ready to face any situation in life and equip themselves to handle them effectively. **L4**
- The students will understand and learn the importance of etiquettes in both professional and personal life **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS20-MATHEMATICAL MODELING

(Open Elective -I)

L	T	P	C
3	0	0	3

Course Objectives:

- To provide the basic knowledge to understand a Mathematical model.
- To formulate a Mathematical model related to a real world problems of engineering, biological science etc.

UNIT – 1: Mathematical Modeling & Mathematical modeling Through Ordinary differential equations of First Order : **9 Hrs**

Mathematical Modeling : Need, Techniques, Classifications and Simple illustrations,

Mathematical modeling Through Ordinary differential equations of First Order :
Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order.

Learning Outcomes:
At the end of this unit, the student will be able to

- Learn various mathematical techniques in modeling a problem. **L2**
- Learn modeling in dynamics through ordinary differential equations of first order. **L3**

UNIT – II: Mathematical modeling Through System of Ordinary differential equations of First Order:
Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order.

Learning Outcomes:
At the end of this unit, the student will be able to

- Develop a modeling of Epidemics through system of ordinary differential equations of first order. **L4**
- Analyze a modeling in dynamics through systems of ordinary differential equations of first order. **L3**

UNIT – III: Mathematical modeling Through Ordinary differential equations of Second Order:
Mathematical modeling of Planetary motion; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order.

Learning Outcomes:
At the end of this unit, the student will be able to

- Evaluate a mathematical modeling of planetary motion. **L5**
- Analyze a mathematical modeling of Circular motion and motion of satellites **L3**

UNIT – IV: Mathematical modeling Through Difference equations :
Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in Probability theory.

Learning Outcomes:
At the end of this unit, the student will be able to

- Analyze mathematical modeling through difference equations in population dynamics and genetics. **L4**
- Analyze mathematical modeling through difference equations in probability theory. **L4**

UNIT – V: Mathematical modeling Through Functional, Integral, Delay- Differential and Differential-Difference Equations :
Mathematical modeling Through Functional equations; Mathematical modeling Through Integral equations; Mathematical modeling Through Delay- Differential and Differential-Difference Equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze a mathematical modeling through functional equations and integral equations. **L4**
- Analyze a mathematical modeling Through Delay- Differential and Differential-Difference Equations **L4**

Text Books:

1. J. N. Kapoor. Mathematical Modeling , New Age International Publishers.

Reference Books:

1. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts in mathematical modeling. **L1**
- Have better insight of the real word problems through mathematical modeling. **L2**
- Apply various concepts of mathematics in modeling. **L3**
- Analyze the real word problems through the techniques of modeling. **L4**
- Evaluate the real word problems through mathematical modeling. **L5**

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B.Tech III year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS21-FUZZY SET THEORY, ARITHMETIC AND LOGIC

(Open Elective -I)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing

- the basic knowledge to understand Fuzzy set theory and Arithmetic. and
- Logic, related to a real word problems of engineering, Science etc.

UNIT – 1: Classical (Crisp) Sets To Fuzzy Sets & Fuzzy Sets Versus Crisp Sets **9 Hrs**

Classical (Crisp) Sets To Fuzzy Sets:

Introduction: Crisp Sets: An Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Characteristics and Significance of the Paradigm Shift.

Fuzzy Sets Versus Crisp Sets:

Alpha -Cuts :Additional Properties of alpha -Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets

Learning Outcomes:

At the end of this unit, the student will be able to

- The basic concepts of Sets and Fuzzy sets **L2**
- Analyze the Fuzzy Sets Versus Crisp Sets **L3**

UNIT – II: Operations On Fuzzy Sets:

Types of Operations, Fuzzy Complements, Fuzzy Intersections: t-Norms Fuzzy Unions: t- Conorms, Combinations of Operations, Aggregation Operations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Do some operations on Fuzzy sets **L2**
- Assess t-Norms Fuzzy Unions **L3**

UNIT – III: Fuzzy Arithmetic & Fuzzy Relations:

Fuzzy Arithmetic :

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals, Arithmetic Operations on Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Relations:

Crisp versus Fuzzy Relations, Projections and Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on a Single Set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations, Fuzzy Ordering Relations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Perform arithmetic operations on Fuzzy numbers and equations. **L2**
- Analyze Fuzzy Relations, Projections and Cylindric Extensions etc. **L3**

UNIT – IV: Fuzzy Relation Equations & Possibility Theory

Fuzzy Relation Equations:

General Discussion ,Problem Partitioning , Solution Method , Fuzzy Relation Equations Based on Sup-i Compositions , Fuzzy Relation Equations Based on Inf- ω_i Compositions

Possibility Theory:

Fuzzy Measures, Evidence Theory, Possibility Theory, Fuzzy Sets and Possibility Theory, Possibility Theory versus Probability Theory.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve Fuzzy relation equations. **L3**
- Analyze Possibility Theory **L4**

UNIT – V: Fuzzy logic

Classical Logic: An Overview, Multivalued Logics, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Inference from Conditional and Qualified Propositions, Inference from Quantified Propositions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Fuzzy logic. **L1**
- Analyze the Inferences from Conditional, Qualified, and Quantified Propositions. **L4**

Text Books:

1. Fuzzy Sets and Fuzzy Logic, Geoge J. Klir and Bo Yuan

Reference Books:

1. Fuzzy Mathematical Models in Engineering and Management Science, A. Kaufmann and M.M. Gupta
2. Fuzzy Logic, Timothy J. Ross
3. Fuzzy Set Theory, H.J. Zimmermann
4. Introduction to Fuzzy Logic and Fuzzy Sets, J.J. Buckley and E. Eslami

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts of Fuzzy sets and logic. **L1**
- Do some operations of Fuzzy sets. **L2**
- Solve Fuzzy relation equations. **L3**
- Analyze the Inferences from Conditional, Qualified, and Quantified Propositions. **L4**
- Analyze the real word problem through the technique of Fuzzy set theory and logic to have better insight of the real word problems. **L5**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS22-NUMBER THEORY

(Open Elective -I)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing the basic knowledge

- To understand basic concepts of Number theory and
- To analyze the applications of Riemann Zeta Function and Dirichlet L Function of Number theory related to real word problems of engineering, biological science etc.

UNIT – 1: Divisibility and Primes & Congruences **9 Hrs**

Divisibility and Primes:

Division algorithm, Euclid's algorithm for the greatest common divisor- Linear Diophantine equations - Prime numbers, fundamental theorem of arithmetic, infinitude of primes- Distribution of primes, twin primes, Goldbach conjecture - Fermat and Mersenne primes - Primality testing and factorization.

Congruences:

Modular arithmetic- Linear congruences- Simultaneous linear congruences, Chinese Remainder Theorem- An extension of Chinese Remainder Theorem (with non-coprime moduli).

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn Division algorithm, Euclid's algorithm etc. **L2**
- Analyze linear congruences- Simultaneous linear congruences, and Chinese Remainder Theorem. **L3**

UNIT – II: Congruences with a Prime-Power Modulus, Euler's Function and RSA Cryptosystem, and Units Modulo an Integer

Congruences with a Prime-Power Modulus:

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem - Pseudo-primes and Carmichael numbers- Solving congruences modulo prime powers.

Euler's Function and RSA Cryptosystem:

Definition of Euler function, examples and properties - Multiplicative property of Euler's function - RSA cryptography.

Units Modulo an Integer:

The group of units modulo an integer, primitive roots- Existence of primitive roots.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the Congruences with a Prime-Power Modulus **L3**
- Analyze the Euler's Function, RSA Cryptosystem and Units Modulo an Integer **L4**

UNIT – III: Quadratic Residues and Quadratic Forms

Quadratic residues, Legendre symbol, Euler's criterion- Gauss lemma, law of quadratic reciprocity- Quadratic residues for prime-power moduli and arbitrary moduli- Binary quadratic forms, equivalent forms- Discriminant, principal forms, positive definite forms, indefinite forms- Representation of a number by a form, examples- Reduction of positive definite forms, reduced forms- Number of proper representations, automorph, class number.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the Quadratic residues **L3**
- Analyze the Quadratic Forms **L4**

UNIT – IV: Sum of Powers, Continued Fractions and Pell's Equation

Sum of Powers:

Sum of two squares, sum of three squares, Waring's problem- Sum of four squares-Fermat's Last Theorem.

Continued Fractions and Pell's Equation:

Finite continued fractions, recurrence relation, Euler's rule- Convergents, infinite continued fractions, representation of irrational numbers- Periodic continued fractions and quadratic irrationals- Solution of Pell's equation by continued fractions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compute sum of powers and learn Fermat's last theorem. **L3**
- Solve Pell's equation by continued fractions **L4**

UNIT – V: Arithmetic Functions, The Riemann Zeta Function and Dirichlet L Function

Arithmetic Functions:

Definition and examples, multiplicative functions and their properties- Perfect numbers, Mobius function and its properties- Mobius inversion formula- Convolution of arithmetic functions.

The Riemann Zeta Function and Dirichlet L Function:

Historical background for the Riemann Zeta function, Euler product formula, convergence. - Applications to prime numbers- Dirichlet L-functions, Products of two Dirichlet L functions, Euler product formula.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the arithmetic functions **L3**
- Analyze the Riemann Zeta function and its Applications to prime numbers **L4**

Text Books:

1. G. A. Jones & J.M. Jones, Elementary Number Theory, Springer UTM, 2007.
2. Niven, H. S. Zuckerman & H.L. Montgomery, Introduction to the Theory of Numbers, Wiley, 2000.
3. D. Burton; Elementary Number Theory, McGraw-Hill, 2005

Reference Books:

1. Tom M. Apostol, Introduction to Analytical Number theory, Narosa Publishing house, 1998.
2. Elementary number theory and its applications, BEL laboratories.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts such as Learn Division algorithm, Euclid's algorithm etc. **L1**
- Analyze the Congruences with a Prime-Power Modulus and RSA Cryptosystem. **L2**
- Analyze the Quadratic residues and Quadratic forms. **L3**
- Solve Pell's equation by continued fractions **L4**
- Analyze the real word problem through the technique of Number theory. **L5**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS31-SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To provide exposure to various kinds of sensors, actuators and their Engineering applications.
- Capable of understanding the principles and physics of various kinds of sensors from macro to micro/nano level.

UNIT – 1: Introduction to sensors **9 Hrs**

Content of the Unit – I

Sensors, Sensor systems, Nanosensors, -Types of sensors(based on Functions, temperature, pressure, strain, ranging and motion, time- active and passive sensors). Materials used and their fabrication process (Deposition, Pattern and Etching), General characteristics of sensors. Actuators, Functional diagram of actuators, Design of Actuators, Types of actuators (Hydraulic, Pneumatic, Mechanical, Electromagnetic, EAP and EM actuators). Applications of Actuators.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify different types of Sensors, Actuators and their characteristics
- Identifies the applications of Actuators in different fields
- Explain about different fabrication process of Sensors
- Illustrate functional diagram of Actuators

UNIT – II: Mechanical sensors **9 Hrs**

Content of the Unit – II

Principles of mechanical sensors (piezoresistivity, piezoelectricity, capacitive, inductive and resonant techniques), Displacement sensors, velocity sensors, Torque sensors, flow sensors, Micro and nanosensors, Multimodal nanosensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize various types of Mechanical sensors
- Explain the working principle of different types mechanical sensors
- Identifies the applications of Mechanical sensors in different environmental conditions
- Understand the basic concepts of micro and nano sensors

UNIT – III: Thermal sensors and Magnetic sensors **9 Hrs**

Content of the Unit – III

Introduction – Principles of Thermal sensors, Thermocouples, Types of thermocouples, Bi-metallic thermometer, Resistance Temperature Detectors (RTD), Advantages and Applications of these temperature sensors.

Introduction, Difference between conventional and magnetic sensors, Types of magnetic sensors (Low field, Earth field and BIAS magnetic field sensors), Working of variable reluctance sensors, Inductive sensors (LVDT), Eddy current sensors, Hall effect sensors, Applications of magnetic sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyse the difference between conventional sensors and magnetic sensors
- Explain the working principle of different magnetic sensors
- Identifies the applications of Thermal and Magnetic sensors
- Summarize various types of thermal and magnetic sensors

UNIT – IV: Electronic and Optical Sensors-I · **9 Hrs**

Content of the Unit – IV

Introduction, Block diagram of electronic sensor system, Microelectronic sensors, semiconductor strain gauge, Gas sensors – Basic principle and working, Applications of electronic sensors – Electronic nose. Optical system components, Solid state optical systems, Optical radiation sources.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the working and principle of various electronic and optical sensors
- Explain the block diagram of electronic sensor system
- Identifies the applications Electronic sensors in various fields
- Identify the various optical, solid state system components

UNIT – V: Electronic and Optical Sensors –II **9 Hrs**

Content of the Unit – V

Optical system components, Solid state optical systems, Optical transmitter and filters type (Geometrical optics, Fiber optics, optical Filters), Solid state photoelectric sensors, Photoconductive cells, Photo junction sensors, photon couplers, Example: MEMS transducers, Sensors calibration and compensation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the optical system components and solid state optical systems
- Classify different types of Optical filters
- Explain the solid state photoelectric sensors, photo junction sensors and photoconductive cells
- Understand basics of MEMS transducers, sensors calibration and compensation

Text Books:

1. Sensors and Signal Conditioning Wiley-Blackwell, 2008 Jacob Fraden,
2. Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer,2018Senturia S. D.

Reference Books:

1. Doebelin, "Measurement Systems: Application and Design", McGraw Hill Kogakusha Ltd.
2. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim "Microsensors, MEMS and Smart Devices", New York: Wiley, 2001.
3. Henry Bolte, "Sensors – A Comprehensive Sensors", John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Microsystem Design, Kluwer Academic Publisher, 2001 J.D. Plummer, M.D. Deal, P.G. Griffin

Course Outcomes:

At the end of this Course the student will be able to

- recognize the need of sensors
- types of sensors which they will able to utilize for the concerned engineering application

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS32-PHYSICS OF ELECTRONIC MATERIALS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- Be able to explain the fundamentals of materials.
- Be able to explain the kinds of semiconductor materials, their physical properties, and their applications.
- Be able to explain the kinds of magnetic materials, their physical properties, advances and their applications.
- Be able to explain the kinds of dielectric materials, their physical properties, advances and their applications.

UNIT – 1: Fundamentals of Materials **9 Hrs**

Content of the Unit – I

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Elementary idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic concepts of Phase and Phase diagram
- Understand the straight forward information of Nucleation and Growth
- Explain the preparation and deposition of Thin film using various methods
- Illustrate the methods of Crystal growth
- Summarize the different defects in crystal growth

UNIT – II: Semiconductors **9 Hrs**

Content of the Unit – II

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, diffusion length, diffusion and recombination. The Fermi level & Fermi dirac distribution, Temperature dependence of carrier concentration, Invariance of the Fermi level at equilibrium. Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Transistors, MOSFETs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics concepts regarding drift, diffusion, diffusion length and recombination.
- Classifies the energy bands of a Semiconductors
- Analyse how the position of the fermi level changes with carrier concentration and temperature.
- Explain the concepts regarding PN junctions, Transistors and MOSFETs.

UNIT – III: Optoelectronics **9 Hrs**

Content of the Unit – III

Introduction, Optoelectronic concepts, Hetrostructure p-n junction, Schottky junction and Ohmic contacts, Light emission and absorption, amplification and modulation in semiconductors, Semiconductor Light sources [Light emitting diodes (LEDs) , LASER, vertical cavity surface emitting laser (VCSEL), Quantum well laser {device structure – characteristics – Materials and applications}] and semiconductor Photo detectors [General Characteristics, Responsivity and Impulse response, photoconductors, semiconductor photodiodes].

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic concepts of PN junction and Schottky junction

- Explain about absorption, emission, amplification and modulation
- Illustrate various semiconductor light sources and their structure
- Identifies the characteristics and applications of optoelectronic devices
- Elucidate semiconductor photodetectors

UNIT – IV: Dielectric Materials and their applications **9 Hrs**

Content of the Unit – IV

Introduction, Dielectric properties, Electronic polarisability and susceptibility, dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of dielectric constant, polarisability, susceptibility
- Describe how the polarisation of the dielectric constant depends on the frequecy
- Explain about dielectric strength and dielectric loss
- Comprehend dielectric and piezoelectric properties

UNIT – V: Magnetic Materials and their applications **9 Hrs**

Content of the Unit – V

Introduction, Magnetism & various contributions to para and dia magnetism, Fero and Ferri magnetism and ferrites, concepts of Spin waves and Magnons, antiferromagnetism, domains and domain walls, coercive force, hysteresis, Nanomagnetism, Superparamagnetism – Properties and applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate different types of magnetic materials depending upon their properties
- Understand the concepts of Spin waves and Magnons
- Interpret the concepts of domains and domain walls
- Explain about the properties of Nanomagnetism, Super paramagnetism
- Identify the applications of magnetic materials

Text Books:

1. S.O. Kasap Principles of Electronic Materials and Devices, 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
2. Electrical Engineering Materials",by A.J. Dekker, PHI Pub.
3. "Electronic Components and Materials" Grover and Jamwal, DhanpatRai and Co.

Reference Books:

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th edition, PHI Learning,
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005
3. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd., 2011
4. W D Callister, Materials Science and Engineering – An Introduction, Jr., John Willey and Sons, Inc, New York, 7th edition, 2007.
5. "A First Course In Material Science" by Raghvan, McGraw Hill Pub.
6. "Solid State Physics" by S.O.Pillai,New Age Publication.
7. 'The Science and Engineering of materials' by Donald R.Askeland,Chapman& Hall Pub.

Course Outcomes:

At the end of this Course the student will be able to

- Recognize the need of semiconductors
- Dielectric and magnetic materials which they will able to utilize for the concerned engineering application

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS41-CHEMISTRY OF ENERGY MATERIALS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, EMF and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquefaction method
- Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

UNIT – 1: Electrochemical Systems **9 Hrs**

Galvanic cell, standard electrode potential, application of EMF, Electrode mechanism, polarization, Batteries-Lead-acid and Lithium ion batteries.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve the problems based on electrode potential L3
- Describe the Galvanic Cell L2
- Differentiate between Lead acid and Lithium ion batteries L2
- Illustrate the electrical double layer L2

UNIT – II: : Fuel Cells

Basic design of fuel cell, Fuel cell working principle, Fuel cell efficiency Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), and their applications

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the working Principle of Fuel cell L2
- Explain the efficiency of the fuel cell L2
- Discuss about the Basic design of fuel cells L3
- Classify the fuel cell L2

UNIT – III: Hydrogen Storage

Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures (Carbon nano tubes, fullerenes), metal oxide porous structures, hydrogen storage by high pressure methods. Liquefaction method

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate Chemical and Physical methods of hydrogen storage L2
- Discuss the metal organic frame work L3
- Illustrate the carbon and metal oxide porous structures L2
- Describe the liquification methods L2

UNIT – IV: Solar Energy

Solar energy introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar Fuels – Hydrogen: Ammonia& Hydrazine, Solar cells (Si-Te& Cd-Te), advantages and disadvantages.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the photo voltaic technology L3
- Demonstrate about solar energy and prospects L2
- Illustrate the Solar cells L2
- Discuss about concentrated solar power L3

UNIT – V: Photo and Photoelectrochemical Conversions

Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate between Photo and Photo electrochemical Conversions L2
- Illustrate the photochemical cells L2
- Identify the applications of photochemical reactions L3
- Interpret advantages of photoelectron catalytic conversion L2

Text Books:

1. Bahl and Bahl and Tuli, Essentials of Physical Chemistry, S. Chand Publications, New Delhi, 28th Edition, 2020.
2. US Department of Energy (EG&G technical services and corporation), Fuel Cell Hand Book 7th Edition, 2004.

Reference Books:

1. Ira N. Levine, Physical chemistry 6th Edition, McGraw Hills Education, New Delhi, 2009.
2. Silver and Atkins, Inorganic Chemistry, , 7th Edition, Oxford University Press, 2018.
3. Michael Hirscher, Hand book of Hydrogen Storage: New materials for future energy, storage, Wiley-VCH Verlag GmbH & Co. KGaA, 2010
4. Klaus Jagar et.al., Solar energy fundamental, technology and systems, UIT-Cambridge publishers, 2016

Course Outcomes:

At the end of this Course the student will be able to

- Understand to perform simultaneous material and energy balances **L1**
- Lists about various electrochemical and energy systems **L1**
- Classify solid, liquid and gaseous fuels **L3**
- Analyze the energy demand of world, nation and available resources to fulfill the demand **L3**
- Evaluate the conventional energy resources and their effective utilization **L3**
- To be able to understand and perform the various characterization techniques of fuels **L1**
- Explain knowledge of modern energy conversion technologies **L2**
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively **L1**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS42-ADVANCED POLYMERS AND THEIR APPLICATIONS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

UNIT – 1: Polymers-Basics and Characterization **9 Hrs**

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization mechanisms: condensation, addition, radical chain, ionic and coordination copolymerization, Zeigler-Natta and Ring opening metathesis polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers, Characterization of polymers by XRD, DSC.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the polymers L3
- Explain polymerization mechanism L2
- Differentiate addition, condensation polymerizations L2
- Describe measurement of molecular weight of polymer L2

UNIT – II: : Synthetic Polymers

Polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate Bulk, solution, Suspension and emulsion polymerization L2
- Describe fibers and elastomers L2
- Identify the thermosetting and thermo polymers L3

UNIT – III: Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the properties and applications of polymers L2

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- Interpret the properties of cellulose, lignin, starch, rosin, latex etc., **L2**
- Discuss the special plastics of PES, PAES, PEEK etc., **L3**
- Explain modified cellulosics **L2**

UNIT – IV: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, **Applications** of hydrogels in drug delivery. Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify types of polymer networks **L3**
- Describe methods involve in hydrogel preparation **L2**
- Explain applications of hydrogels in drug delivery **L2**
- Demonstrate the advanced drug delivery systems and controlled release **L2**

UNIT – V: Surface phenomena

Surface tension, adsorption on solids, electrical phenomena at interfaces including electro-kinetics, micelles, reverse micelles, solubilization. XPS principle-application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate electrical phenomena at interfaces including electrokinetics, miselles, reverse micelles etc., **L3**
- Explain photoelectron spectroscopy **L2**
- Discuss ESCA and Auger spectroscopy to the study of surfaces **L3**
- Differentiate micelles and reverse micelles **L2**

Text Books:

1. Fred W.Billmayer, A Text book of Polymer science, 3rd Edition, Wiley India, 2007.
2. K.J.Saunders, Organic polymer Chemistry, Chapman and Hall, 1973.

Reference Books:

1. B.Miller, Advanced Organic Chemistry, Prentice Hall, 2nd Edn, 2003.
2. Ambikanandan Misra, Aliasgar Shahiwala, Applications of polymers in Drug delivery system, Elsevier Pub., 2020.
3. Gowarikar, Polymer Chemistry –New Age International Publications, 2019.
4. Physical Chemistry , Samel Galsstone, Lan Caster Press, 1970.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the state of art synthesis of Polymeric materials **L1**
- Understand the hydro gels preparation, properties and applications in drug delivery system. **L2**
- Characterize polymers materials using XPS. **L2**
- Analyze surface phenomenon of micelles and characterize using photoelectron spectroscopy, ESCA and Auger spectroscopy. **L3**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS43-Marine Chemistry

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To classify the different dissolved gases in sea water.
- To predict the role of biological processes in affecting oceanic carbonate system.
- To describe chemical and pharmacological properties of bioactive substances in marine organisms.
- To determine micro-nutrient elements (N, P, Si) in seawater.
- To identify dissolved elements in the estuary.

UNIT – 1: Dissolved gases in seawater **9 Hrs**

Dissolution of gases in seawater and their solubility; classification of dissolved gases and factors affecting their concentration in seawater; distribution of dissolved oxygen in seawater and affecting factors, Apparent Oxygen Utilization (AOU) and oxygen minimum zone formation in the ocean, origin and consequences of ocean hypoxia, Methane hydrate, clathrates

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the factors affecting on the dissolution of gases **L1**
- Understand apparent oxygen utilization and ozygen minimum zone formation in ocean. **L1**
- Compare the distribution of dissolved gaseous in sea water **L4**
- Analyze origin and consequences of ocean hypoxia, methane hydrate and clathrates **L3**

UNIT – II: : Carbonate systems in the ocean

Acid base equilibria in seawater, carbon dioxide system – absorption of carbon dioxide, carbon cycle; parameters of carbonate systems and their distribution in the ocean; role of biological processes in affecting oceanic carbonate system; precipitation and dissolution of calcium carbonate in seawater, lysocline and carbonate compensation depth; Ocean acidification

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic principle of acid-base equibria in sea water **L1**
- Explain the concept of carbon cycle **L1**
- Lists the various biological process in affecting oceanic carbonate, pptn and dissolution **L1**
- Analyze the parameters of carbonate system in oceanic water **L3**

UNIT – III: Chemistry of marine natural products

Biomedical aspects; chemical and pharmacological properties of bioactive substances in marine organisms, carbohydrates and their derivatives in red and brown algae, aliphatic acids and their derivatives in marine organisms, steroids and their use as biomarkers, nitrogenous compounds in invertebrates, nucleosides from sponges, biopolymer

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the chemical and pharmacological properties of bioactive substances in marine organism **L1**
- Explain the steroids and their use as biomarkers **L2**
- List the chemical properties in nitrogenous compounds in invertebrates **L1**

UNIT – IV: Micronutrients in seawater

Micro-nutrient elements (N, P, Si) in seawater, their forms, distribution and seasonal variation in the ocean. Stoichiometry of uptake and regeneration of nutrients elements and Apparent Oxygen Utilization (AOU)

Learning Outcomes:

At the end of this unit, the student will be able to

- List the micro-nutrients in sea water **L1**
- Understand the stoichiometry of uptake and regeneration of nutrients **L1**
- Differentiate the distribution of micronutrients with seasonal variation in the ocean **L2**

UNIT – V: Estuarine chemistry

Behavior of dissolved and particulate material during estuarine mixing, interaction among them and speciation of dissolved elements in the estuary; physico-chemical characteristics of estuarine sediment, anoxic sediments and pore water; heavy metals in estuaries and the processes affecting their distribution

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the behavior of dissolved and particulate matter in estuarine system **L1**
- Analyze the physicochemical characteristics of estuarine system **L3**
- Differentiate the effect of heavy metals in estuaries and affecting in distribution **L2**

Text Books:

1. Riley, J.P. and Chester, R., Introduction to Marine Chemistry, Academic Press, 1971.
2. Chester, R., Marine Geochemistry, Blackwell Science, 1990, 2000

Reference Books:

1. Riley, J.P., Skirrow, G, Chemical Oceanography (Vol.1,2, 3), Academic Press, 1975.
2. Horne, R.A, Marine Chemistry - The Structure of Water and the Chemistry of the Hydrosphere, 1969 Wiley- Interscience.
3. Seawater: Its composition, properties & behaviour, 2nd Edn, The Open University Team, 1989
4. Martin, D.F., Marcel Dekker, Marine Chemistry (Vol.2), 2nd Edition, Academic Press, NY, 1970.
5. Broecker and Peng, Tracers in the Sea, Lamont-Doherty Geological Observatory, 1982, NY.
6. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press
7. Burton et al., Dynamic processes in the chemistry of the upper ocean, Plenum Press, 1986.
8. Heinrich D Holland, The Chemistry of the Atmosphere and Oceans, John Wiley & sons Inc, 1978.

Course Outcomes:

At the end of this Course the student will be able to

- List the various dissolved gases in sea water and factors affecting their. **L1**
- Demonstrate knowledge of concepts and principles of ocean acidification. Analyse and evaluate biomedical aspects of marine natural products. **L2**
- Integrate and apply the knowledge of stoichiometry of uptake and regeneration of nutrients elements. **L3**
- Reflect on the influence heavy metals in estuaries. **L4**
- Evaluate total findings in marine chemistry to solve engineering problems **L3**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE55a-AIR POLLUTION AND CONTROL

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To teach the basics of air pollution
- To impart the behavior of air due to metrological influence
- To throw light on air quality management
- To teach the design of air pollution control methods

UNIT – I:

INTRODUCTION : Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non- Point, Line and Areal Sources of air pollution- stationary and mobile sources.

EFFECTS OF AIR POLLUTION : Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holesetc.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the basics of air pollutants.
- Estimate the impact of air pollution

UNIT – II:

THERMODYNAMIC OF AIR POLLUTION: Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like Sox, Nox, CO, HC etc., air-fuel ratio. Computation and Control of products of combustion.

PLUME BEHAVIOUR : Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity, Influence of Meteorological phenomena on Air Quality-wind rosediagrams.

Learning Outcomes:

At the end of this unit, the student will be able to

- Study properties of atmosphere
- Learn plume behavior in different environmental conditions
- Analyse and compute the parameters of air pollutants
- Evaluate procedures for control of pollution

UNIT – III:

POLLUTANT DISPERSION MODELS : Lapse Rates, Pressure Systems, Winds and moisture plume behaviour and plume Rise Models; Gaussian Model for Plume Dispersion.

CONTROL OF PARTICULATES : Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control, Equipment"s – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the design principles of particulate control.
- Learn and design pollutant dispersion models

UNIT – IV:

CONTROL OF GASEOUS POLLUTANTS : General Methods of Control of Nox and Sox emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the design principles of gaseous control.
- Develop environmental friendly fuels and study their properties.

UNIT – V:

AIR QUALITY MANAGEMENT : Air Quality Management – Monitoring of SPM, SO; NO and CO Emission Standards.

Learning Outcomes:

At the end of this unit, the student will be able to

- Study the air quality management.
- Visualize emissions and their permissible standards

Text Books:

1. Air Quality by Thodgodish, Levis Publishers, Special India Edition, NewDelhi
2. Air pollution By M.N.Rao and H.V.N.Rao – Tata Mc.Graw HillCompany.
3. Air pollution by Wark and Warner.- Harper & Row, NewYork.

Reference Books:

1. An introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S.Publications
2. Air Pollution and Control by K.V.S.G.Murali Krishna, Kousal& Co. Publications, New Delhi.
3. Enivronmental meteorology by S.Padmanabhammurthy ,I.K.InternationalsPvtLtd,New Delhi

Course Outcomes:

At the end of this Course the student will be able to

- Evaluating the ambient air quality based on the analysis of air pollutants
- Design particulate and gaseous control measures for an industry
- Judge the plume behavior in a prevailing environmental condition
- Estimate carbon credits for various day to day activities

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE55b-GREEN BUILDINGS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Learn the principles of planning and orientation ofgreen buildings.
- Acquire knowledge on various aspects of green buildings

UNIT – I:

Introduction:ConceptofGreenBuilding,NeedforGreenBuilding,Benefitsof' Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand need for green building
- Obtain knowledge on features of green building

UNIT – II:

Green Building Concepts and Practices: Indian Green Building Council,Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

Green **Building** Opportunities And **Benefits:** Opportunities of Green Building, Green BuildingFeatures,MaterialandResources,WaterEfficiency,OptimumEnergyEfficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

Learning Outcomes:

At the end of this unit, the student will be able to

- Knowledge on benefits and energy efficiency of green buildings
- Knowledge on practices and concepts of green buildings

UNIT – III:

Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn steps in design of green buildings
- Learn how renewable energy resources are used in green buildings

UNIT – IV:

Air Conditioning Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller se1ection,pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco- friendly captive power generation for factory, Building requirement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn designing of air conditioning in green building

UNIT – V:

Material Conservation Handling of non process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indoor air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels

Learning Outcomes:

At the end of this unit, the student will be able to

- Suggest materials and technologies to improve energy efficiency of building.

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers,2009.
2. Green Building Hand Book by Tomwoolley and Samkimings,2009.

Reference Books:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

Course Outcomes:

At the end of this Course the student will be able to

- Explain the principles of green buildings , its byelaws
- Understand the concepts of design of green buildings and material conversation in green buildings
- knowledge on rating systems of green buildings
- Suggest materials and technologies to improve energy efficiency of building.

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE55c-BASICS OF CIVIL ENGINEERING MATERIALS AND CONSTRUCTION PRACTICE

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering
- to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

UNIT – I:

Introduction to Civil Engineering Building planning: Introduction to types of buildings as per NBC; Selection of site for buildings. Components of a residential building and their functions. Introduction to industrial buildings- office / factory / software development office / power house / electronic equipment service centre

Learning Outcomes:

At the end of this unit, the student will be able to

- learn different types of buildings as per NBC and their components and function
- learn how to select different type of buildings sites

UNIT – II:

Site plan, Orientation of a building, Open space requirements, Position of doors and windows, Size of rooms; Preparation of a scaled sketch of the plan of a single storeyed residential building in a given site plan. Introduction to the various building area terms - Computation of plinth area/ built up area, Floor area / carpet area - for a simple single storeyed building; Setting out of a building.

Learning Outcomes:

At the end of this unit, the student will be able to

- .learn site plans and orientation of buildings.
- learn setting out a building and preparation of scaled sketch of building plans

UNIT – III:

Surveying - Principles and objectives of surveying; Horizontal measurements – instruments used – tape, types of tapes; Ranging(direct ranging only) Theodolite and Total station-Principles

Learning Outcomes:

At the end of this unit, the student will be able to

- learn principles and objectives of surveying.
- learn instruments used in surveying and application in field

UNIT – IV:

Building materials: Bricks, cement blocks - Properties and specifications.Cement – OPC, properties, grades; other types of cement and its uses (in brief). Cement mortar – constituents, preparation. Concrete – PCC and RCC – grades. Steel - Use of steel in building construction, types and market forms.

Learning Outcomes:

At the end of this unit, the student will be able to

- learn basic civil engineering materials (bricks, cement, cement mortar, cement concrete)
- learn about steel and use of steel in building construction

UNIT – V:

Building construction – Foundations; Bearing capacity of soil (definitiononly); Functions of foundations, Types - shallow and deep (sketches only).

Brick masonry – header and stretcher bond, English bonds – Elevation and plan (one brick thick walls only).

Roofs – functions, types, roofing materials (brief discussion only).

Floors – functions, types; flooring materials (brief discussion only).

Decorative finishes – Plastering – Purpose, procedure.

Paints and Painting – Purpose, types, preparation of surfaces for painting (brief discussion only).

Learning Outcomes:

At the end of this unit, the student will be able to

- learn foundations, SBC and theirs functions.
- learn about brick masonry(header, stretcher bond and english bond).
- learn roofs, floors and their materials

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
3. Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house
4. Dr. K. R. Arora, "Surveying Volume-1", Standard book house, New Delhi, 13th Edition, 2012. 2. S. K. Duggal, "SurveyingVolume-2", Tata McGraw-Hill Education Private Limited, India,New Delhi, 3rd Edition, 2009.

Reference Books:

Course Outcomes:

At the end of this Course the student will be able to

- Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
- Explain different types of buildings, building components, building materials and building construction
- Describe the importance, objectives and principles of surveying.

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE55a- BASICS OF NON-CONVENTIONAL ENERGY SOURCES

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Identify various sources of Energy and the need of Renewable Energy Systems
- Understand the concepts of Solar Radiation, Wind energy and its applications
- Distinguish between solar thermal and solar PV systems
- Interpret the concept of geo thermal energy and its applications
- Understand the use of biomass energy and the concept of Ocean energy and fuel cells.

UNIT – I: Solar Energy **10 Hrs**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy thermal storage.

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about solar thermal parameters
- To distinguish between flat plate and concentrated solar collectors
- To know about thermal storage requirements
- To know about measurement of solar radiation

UNIT – II: PV Energy Systems **10 Hrs**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems..

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of PV effect in crystalline silicon and their characteristics
- Understand other PV technologies
- To know about electrical characteristics of PV cells & modules
- To know about grid connected PV systems

UNIT – III: Wind Energy **10 Hrs**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand basics of wind energy conversion and system
- To distinguish between VAWT and HAWT systems
- To understand about design considerations
- To know about site selection considerations of WECS

UNIT – IV: Geothermal Energy **10 Hrs**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India..

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Geothermal energy and its mechanism of production and its Applications
- Analyze the concept of producing Geothermal energies
- To learn about disadvantages and advantages of Geo Thermal Energy Systems
- To know about various applications of GTES

UNIT – V: Miscellaneous Energy Technologies **10 Hrs**

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the operation of tidal energy
- Analyze the operation of wave energy
- Analyze the operation of bio mass energy
- Understand the principle, working and performance of fuel cell technology
- Apply these technologies to generate power for usage at remote centres

Text Books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

Reference Books:

1. S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd,2008.
2. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

Course Outcomes:

At the end of this Course the student will be able to

- To distinguish between various alternate sources of energy for different suitable application requirements
- To differentiate between solar thermal and PV system energy generation strategies
- To understand about wind energy system
- To get exposed to the basics of Geo Thermal Energy Systems
- To know about various diversified energy scenarios of ocean, biomass and fuel cells

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE55b- ELECTRICAL MEASUREMENTS & SENSORS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements.
- The principle of working of CRO and its applications.
- Extending the range of an Instrument.

UNIT – I: Measuring Instruments **10 Hrs**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range–Numerical examples

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the operation of different in struments.
- Know the different types of errors and their compensation

UNIT – II: Measurement of Power, Power Factor and Energy **10 Hrs**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type–1-phand3-ph Power factor Meters. Single Phase Induction Type Energy Meter-Driving and Braking Torques–Errors and their Compensation, Three Phase Energy Meter-Numerical examples

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the working principles and construction of different types of Energy meters
- Distinguish between low and high power factor ranges in wattmeters

UNIT – III: Instrument transformers, Potentiometers, and magnetic measurements **10 Hrs**

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – MethodsforReductionofErrors-DesignConsiderations.DCPotentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types-Standardization – Applications. Determination of B-H Loop Methods of Reversals – Six Point magnetic measurement Method–A.C.Testing–Iron Loss of Bar Samples –Numerical Examples

Learning Outcomes:

At the end of this unit, the student will be able to

- Distinguish between CTs and PTs
- Understand the principles and working of various measuring instruments used to detect electrical circuit parameters R,L,C

UNIT – IV: D.C & A.C Bridges **10 Hrs**

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheat stone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance –Loss of Charge Method. Measurement of Inductance-Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge –Schering Bridge–Numerical Examples

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the bridge configurations and their applications for various ranges of resistance measurement
- Compute the unknown parameters of Inductance and Capacitance using the bridges

UNIT – V: CRO and Digital Meters **10 Hrs**

Cathode Ray Oscilloscope-Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers–Applications of CRO–Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns. Digital Voltmeters – Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter- Digital Tachometer.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the operation of CRO and its parts
- Know about Digital voltmeters and Distinguish between an along and digital meters

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments–by E.W.Golding and F.C.Widdis, 5th Edition, Reem Publications,2011.

Reference Books:

1. Electronic Instrumentation by H.S. Kalsi, Tata McGraw-Hill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications –by Reissland, M.U, New Age International (P) Limited,2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput,2nd Edition, S.Chand & Co., 2nd Edition,2013.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors **L1**
- Analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements. **L2**
- Analyze the different operation of extension range ammeters and voltmeters, **L3**
- Design and development of various voltage and current measuring meters. **L4**
- Analyze DC and AC bridges for measurement of parameters and different characteristics of periodic and a periodic signals using CRO. **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE55c- ELECTRIC VEHICLE ENGINEERING

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

UNIT – I: Introduction to EV Systems and Parameters **10 Hrs**

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about past, present and latest technologies of EV **L1**
- To understand about configurations of EV systems **L1**
- To distinguish between EV parameters and performance parameters of EV systems **L2**
- To distinguish between single and multiple motor drive EVs **L4**
- To understand about in-wheel EV **L5**

UNIT – II: EV and Energy Sources **10 Hrs**

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various types of EV sources **L1**
- To understand about e-mobility **L2**
- To know about environmental aspects of EV **L3**
- To distinguish between conventional and recent technology developments in EV systems **L4**

UNIT – III: EV Propulsion and Dynamics **10 Hrs**

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about what is meant by propulsion system **L1**
- To understand about single and multi motor EV configurations **L2**
- To get exposed to current and recent applications of EV **L3**
- To understand about load factors in vehicle dynamics **L4**
- To know what is meant acceleration in EV **L5**

UNIT – IV: Fuel Cells **10 Hrs**

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle. Introduction to HEV, brake specific fuel consumption, comparison of series, series parallel hybrid systems, examples

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about fuel cell technology of EV **L1**
- To know about basic operation of FCEV **L2**
- To know about characteristics and sizing of EV with suitable example **L3**
- To get exposed to concept of Hybrid Electric Vehicle using fuel cells **L4**
- To know about the comparison of various hybrid EV systems **L5**

UNIT – V: Battery Charging and Control **10 Hrs**

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction. Control: Introduction, modeling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about basic requirements of battery charging and its architecture **L1**
- To know about charger functions **L2**
- To get exposed to wireless charging principle **L3**
- To understand about block diagram, modeling of electro mechanical systems of EV **L4**
- To be able to design various compensation requirements **L5**

Text Books:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University PressInc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- To understand and differentiate between conventional and latest trends in Electric Vehicles **L1**
- To know about various configurations in parameters of EV system **L2**
- To know about propulsion and dynamic aspects of EV **L3**
- To understand about fuel cell technologies in EV and HEV systems **L4**
- To understand about battery charging and controls required of EVs **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC55a- FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To study the basic principle, construction and operation of semiconductor devices.
- To learn the real time applications of semiconductor devices.
- To introduce binary number systems, logic gates and digital logic circuits.
- To get an idea about the basic principles of communication systems and their applications.
- To learn the measurement of physical parameters using Sensors and Transducers.

UNIT – I:

Introduction to Electronics Engineering: Overview, scope and objective of studying Electronics Engineering. Introduction to semiconductor devices: Bond structure of semiconductors, intrinsic and extrinsic semiconductors; Basic principle and operation of semiconductor devices – diode, bipolar junction transistor, field effect transistors; Introduction to VLSI.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic principle, construction and operation of semiconductor devices. **L2**
- Learn about the diode, bipolar junction transistor and field effect transistors. **L1**

UNIT – II:

Applications of semiconductor devices: Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- To learn the real time applications of semiconductor devices.(L1) **L1**
- To understand the basic concepts of operational amplifier and their applications.(L2) **L2**

UNIT – III:

Introduction to digital systems: Binary number system, Boolean algebra, Logic gates, adders, one-bit memory, flip-flops (SR, JK), shift registers, Asynchronous counter.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the binary number systems, Boolean algebra and working of logic gates. **L2**
- Know the working and applications of digital logic circuits. **L1**

UNIT – IV:

Introduction to Communication Systems: Elements of a communication system – transmitter and receiver; Signal types in communication; FDM and TDM; Processing of signals for transmission – basic concepts of amplitude and frequency modulation; Examples of telecommunication systems – telephone, radio, television, mobile communication and satellite communication.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the basic elements of a communication system. **L2**
- Understand various examples of telecommunication systems. **L2**

UNIT – V:

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Learning Outcomes:
At the end of this unit, the student will be able to

- Understand the basic working principle and applications of different sensors and transducers. **L2**
- Measure physical parameters using different types of sensors and transducers. **L3**

Text Books:

1. Millman J, Halkias C.C andJit S, "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition.
2. Mano M.M., "Digital Design", Prentice-Hall, 3rd Edition. 2002
3. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai& Co. 3rd edition Delhi, 2010.
4. Kennedy G. and Davis B., "Electronic Communication Systems", Tata McGraw-Hill, 4th 2008 Edition.

Reference Books:

1. Tomasi W., "Advanced Electronic Communication Systems", Pearson/Prentice-Hall, 6th 2004 Edition.
2. Boylstead R.L. andNashelsky L., "Electronic Devices and Circuit Theory", Pearson, 10th 2009 Edition.

Course Outcomes:
At the end of this Course the student will be able to

- Understand the basic principle, construction and operation of semiconductor devices. **L2**
- Learn the real time applications of semiconductor devices. **L1**
- Comprehend the binary number systems, logic gates and digital logic circuits. **L1**
- Understand the basic principles of communication systems and their applications. **L2**
- Measure the physical parameters using Sensors and Transducers. **L3**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC55b- TRANSDUCERS AND SENSORS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To study about the characteristics of instrumentation system and transducers.
- To know the operation of different types of Temperature Transducers.
- To learn the operation of different types of Flow Transducers.
- To understand the working and operation of different types of Pressure Transducers.
- To gain the knowledge on working of Force and Sound Transducers.

UNIT – I:

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the characteristics of instrumentation system and transducers. **L1**
- Measure motion using different motion transducers. **L3**

UNIT – II:

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the working principle of temperature transducers. **L2**
- Study about different types of bio sensors and smart sensors. **L1**

UNIT – III:

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Bernoulli's principle and continuity. **L2**
- Learn how to measure flow using different types of flow meters. **L1**

UNIT – IV:

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Work with different types of manometers. **L3**
- Use different types of pressure transducersto measure pressure. **L3**

UNIT – V:

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn how to measure force using force transducers. **L1**
- Understand the working and operation of sound transducers. **L2**

Text Books:

1. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V,"Instrumentation Devices and Systems", TATA McGraw Hill publications, 2007.

Reference Books:

1. Doebelin. E.O, "Measurement Systems Application and Design",McGraw Hill International, New York, 2004.
2. Nakra B.CandChaudharyK.K , "Instrumentation Measurement and Analysis", Second Edition, Tata McGraw-Hill Publication Ltd.2006.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the characteristics of instrumentation system and transducers **L2**
- Know the operation of different types of Temperature Transducers. **L1**
- Compare the operation of different types of Flow Transducers. **L2**
- Correlate the working and operation of different types of Pressure Transducers. **L4**
- Gain the knowledge on working of Force and Sound Transducers. **L1**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC55c- PRINCIPLES OF COMMUNICATIONS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand the importance of modulation and Amplitude modulation.
- To know about the frequency modulation and phase modulation.
- To study different types of pulse analog modulation techniquesand multiple access techniques.
- To gain knowledge on pulse code modulation and different waveform coding techniques.
- To comprehend the wireless communication systems, their evolution and standards.

UNIT – I:

Analog communication-I: Elements of communication systems need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation(AM),Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier(DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband(SSB) transmission, VSB Modulation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic elements of communication systems. **L2**
- Compare the performance of analog modulation schemes. **L2**

UNIT – II:

Analog communication-II : Angle Modulation & Demodulation: Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM),Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare the performance of different frequency modulated schemes. **L2**
- Learn about the Pre-emphasis & De-emphasis circuits in frequency modulation. **L1**

UNIT – III:

Digital communications-I (Qualitative Approach only) :Pulse Analog Modulation Techniques : Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

Multiple Access Techniques: Introduction to multiple access techniques, FDMA,TDMA, CDMA, SDMA: Advantages and applications

Learning Outcomes: At the end of this unit, the student will be able to

- Analyze the performance of different pulse modulation techniques. **L4**
- Understand the basic principles of Multiple Access Techniques. **L2**

UNIT – IV:

Digital communications-II (Qualitative Approach only) :Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the performance of different types of digital modulation schemes. **L2**
- Explain different types of waveform coding techniques and their applications. **L1**

UNIT – V:

Wireless communications (Qualitative Approach only) : Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile(GSM),GSM services and features.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand various types of wireless communication systems. **L1**
- Explain GSM services and features. **L2**

Text Books:

1. H Taub, D. Schilling and Gautam Sahe, "Principles of Communication Systems", TMH, 2007, 3rd Edition
2. George Kennedy and Bernard Davis, "Electronics & Communication System", 4th Edition, TMH 2009
3. Wayne Tomasi, "Electronic Communication System: Fundamentals Through Advanced",2nd editions,PHI,2001.

Reference Books:

1. Simon Haykin, "Principles of Communication Systems", John Wiley, 2nd Edition.
2. Sham Shanmugam," Digital and Analog communication Systems",Wiley-India edition,2006.
3. Theodore. S.Rapport, "Wireless Communications",Pearson Education,2nd Edition,2002.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the importance of modulation and Amplitude modulation. **L2**
- Summarize the frequency modulation and phase modulation methods. **L2**
- Explain about different types of pulse analog modulation techniquesand multiple access techniques. **L3**
- Acquire knowledge on pulse code modulation and different waveform coding techniques. **L1**
- Comprehend the wireless communication systems, their evolution and standards. **L1**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS55a- OOPS CONCEPTS THROUGH JAVA

Open Elective-1

L	T	P	C
3	0	0	3

Course Objectives:

- Study the syntax, semantics and features of Java Programming Language
- Study the Object Oriented Programming Concepts of Java Programming language
- Learn the method of creating Multi-threaded programs and handle exceptions
- Learn Java features to create GUI applications & perform event handling

UNIT – I: INTRODUCTION **8hrs**

Introduction to Java: The key attributes of object oriented programming, simple program, The Java keywords, Identifiers, Data types and operators, Program control statements, Arrays, Strings, String Handling

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics. **L2**
- Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. **L2**

UNIT – II: CLASSES **8hrs**

Classes: Classes, Objects, Methods, Parameters, Constructors, Garbage Collection, Access modifiers, Pass Objects and arguments, Method and Constructor Overloading, Understanding static, Nested and inner classes.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use of geometric transformations on graphics objects and their application in composite form. **L3**
- Extract scene with different clipping methods and its transformation to graphics display device. **L3**

UNIT – III: INHERITANCE **8hrs**

Inheritance – Basics, Member Access, Usage of Super, Multi level hierarchy, Method overriding, Abstract class, Final keyword.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explore projections and visible surface detection techniques for display of 3D scene on 2D screen. **L4**
- Render projected objects to naturalize the scene in 2D view and use of illumination models . **L4**

UNIT – IV: INTERFACES **7 Hrs**

Interfaces – Creating, Implementing, Using, Extending, and Nesting of interfaces.

Packages – Defining, Finding, Member Access, Importing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of Multimedia basics, different graphics systems and applications of computer graphics. **L3**
- Discuss various multimedia data structures. **L3**

UNIT – V: EXCEPTION HANDLING

Exception handling: Hierarchy, Fundamentals, Multiple catch clauses, subclass exceptions, Nesting try blocks, Throwing an exception, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of Multimedia Authoring systems. **L5**
- Understand the how videos are placed. **L5**

Text Books:

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java The Complete Reference" Herbert Schildt, 8th Edition, 2011, Oracle press, TataMcGraw-Hill.
3. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.

Reference Books:

1. "Programming with Java" T.V.Suresh Kumar, B.Eswara Reddy, P.Raghavan Pearson Edition.
2. "Core Java", Nageswar Rao, Wiley Publishers.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. "A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.
5. "Head First Java", Kathy Sierra, Bert Bates, O'Reilly
6. "SCJP – Sun Certified Programmer for Java Study guide" – Kathy Sierra, Bert Bates, McGrawHill.
7. "Java in Nutshell", David Flanagan, O'Reilly
8. "Core Java : Volume I – Fundamentals, Cay S. Horstmann, Gary Cornell, The Sun Micro Systems Press.

Course Outcomes:

At the end of this Course the student will be able to

- Gain knowledge of client-side scripting, validation of forms and AJAX programming. **L3**
- Understand server-side scripting with PHP language. **L4**
- Understand what XML is and how to parse and use XML Data with Java. **L5**
- To introduce Server-side programming with Java Servlets and JSP.

III B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS55b- INTRODUCTION TO INTERNET OF THINGS

Open Elective-I

L	T	P	C
3	0	0	3

Course Objectives:

- Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

UNIT – 1: INTRODUCTION

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · **L2**
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

UNIT – II: M2M, IoT vs M2M

M2M, IoT vs M2M, SDN and NFV for IoT, IOT system Management with NETCONF-YANG.

. **Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · **L2**
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

UNIT – III: IOT SYSTEM MANAGEMNT

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · **L2**
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

UNIT – IV: SENSORS

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · **L2**
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

UNIT – V: IOT APPLICATIONS

IOT application for industry-Future factory concepts, Brownfield IoT, Smart objects, Smart applications, Study of existing IoT platforms/middleware, IoT- A, Hydra etc.

Sead

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · L2
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · L3

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.

Reference Books:

1. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
3. *Simon Monk, "Programming the Raspberry Pi: Getting Started with Python"*, McGraw-Hill, *2013.*
4. Charalampos Doukas, "Building Internet of Things With the Arduino", Second Edition, 2012.
5. Dr. John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.

Course Outcomes:

At the end of this Course the student will be able to

Introduction to computer graphics

Able to understand the application areas of IOT · L2

Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · L3

Able to understand building blocks of Internet of Things and characteristics L4

III B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS55c- INTRODUCTION TO OPERATING SYSTEMS

Open Elective-1

L	T	P	C
3	0	0	3

Course Objectives:

- To make the students understand the basic operating system concepts such as processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection.
- To get acquaintance with the class of abstractions afford by general purpose operating systems that aid the development of user applications

UNIT – 1: OPERATING SYSTEMS OVERVIEW

Operating Systems Overview: Operating system functions, Operating system structure, operating systems Operations, protection and security.

Operating System Structure: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand what makes a computer system function and the primary PC components. **L2**
- Understand past and current trends in computer technology. **L3**

UNIT – II: THREADS

Threads: overview, Multicore Programming, Multithreading Models, Thread Libraries, Implicit threading, Threading Issues.

CPU Scheduling: Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling.

. **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand past and current trends in computer technology. **L3**
- Use basic software applications. **L4**

UNIT – III: MEMORY MANAGEMENT

Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

Deadlocks: System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use basic software applications. **L4**
- Add functionality to the exiting operating systems **L5**

UNIT – IV: MASS-STORAGE STRUCTURE

Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

Learning Outcomes:

Sead

At the end of this unit, the student will be able to

- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

UNIT – V: I/O systems

I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition, 2009, Pearson Education.

Reference Books:

1. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.
4. Operating Systems, A.S.Godbole, Second Edition, TMH.
5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
6. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
7. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.

Course Outcomes:

At the end of this Course the student will be able to

- Understand what makes a computer system function and the primary PC components. **L2**
- Understand past and current trends in computer technology. **L3**
- Use basic software applications. **L4**
- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

OTE

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS14a-MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Humanities Elective-I)(Common to [illegible])

CE&ME

L	T	P	C
3	0	0	3

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting.
- To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost.

UNIT – 1

Introduction to Managerial Economics:

Definition of Managerial Economics, Nature and Scope – Managerial Economics and its relation with other subjects- Basic economic tools in Managerial Economics.

Demand Analysis & Elasticity of Demand: Meaning- Demand distinctions- Demand determinants- Law of Demand and its exceptions, Types of Elasticity of demand - Measurement of price elasticity of demand, Significance of Elasticity of Demand.

Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting - Forecasting demand for new products.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the nature and scope of Managerial Economics and its importance. **L1**
- Understand the concept of demand and its determinants. **L2**

UNIT – II

Theory of Production: Production Function- Isoquants and Isocosts, MRTS, Cobb-Douglas Production function.

Cost Analysis: Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break even analysis -Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the production function, Input-Output relationship and different cost concepts. **L1**
- Apply the least-cost combination of inputs. **L2**

UNIT – III

Introduction to Markets: Market structures: Types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition.

Pricing Policies: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Bundling Pricing, and Peak Load Pricing. Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model, Smart market mechanism model.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the price output relationship in different markets. **L1**
- Evaluate price-output relationship to optimize cost, revenue and profit. **L2**

1/10/21

UNIT – IV

Types of Industrial Organization: Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types.

Capital Budgeting: Introduction to capital, Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples of capital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems).

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the concept of capital budgeting and its importance in business. **L1**
- Contrast and compare different investment appraisal methods. **L2**

UNIT – V

Introduction to Financial Accounting: Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts (with simple adjustments) - Limitations of Financial Statements.

Interpretation and analysis of Financial Statement: Ratio Analysis – Liquidity ratios, Profitability ratios and solvency ratios – Preparation of changes in working capital statement and fund flow statement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the concept, convention and significance of accounting. **L1**
- Apply the fundamental knowledge of accounting while posting the journal entries. **L2**

Text Books:

1. **J.V. Prabhakar Rao**: Managerial Economics and Financial Analysis, Maruthi Publications, 2011.
2. **Prof. C.Viswanatha Reddy:** 'Financial Accounting-1' Himalaya Publishing House, Newdelhi.

Reference Books:

1. **A R Aryasri** - Managerial Economics and Financial Analysis, TMH 2011.
2. **Suma damodaran**- Managerial Economics, **Oxford** 2011.
3. **S.A. Siddiqui & A.S. Siddiqui,** Managerial Economics and Financial Analysis, New Age International Publishers, 2011.
4. **N. Appa Rao. & P. Vijaya Kumar**: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi, 2011.

Course Outcomes:

At the end of this Course the student will be able to

- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. **L1**
- Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives. **L2**
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. **L3**
- Evaluate the capital budgeting techniques. **L4**
- Students can analyze how to invest their capital and maximize returns. **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS14b-ENTERPRENUARSHIP AND INNOVATION MANAGEMENT

(Humanities Elective-I)(Common to [illegible])

CE & ME

L	T	P	C
3	0	0	3

Course Objectives:

- To enable students understand the opportunities available to start a business.
- To impart knowledge about various sources of support (Financial and Non-financial) available to start an enterprise.

UNIT – 1: FUNDAMENTALS OF ENTREPRENEURSHIP

Fundamentals of Entrepreneurship – Evolution and Theories of Entrepreneurship – Characteristics of Entrepreneurs –Myths of Entrepreneurship – Kakinada Experiment -Elements of leadership –Role of Entrepreneurs in Indian economy – Social and Ethical Perspectives of Entrepreneurship - Corporate entrepreneurship – Social Entrepreneur, women Entrepreneurship
- Opportunities & challenges.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define entrepreneurship and the characteristics of an entrepreneur. **L1**
- Explain the significance of entrepreneurship in the economic development of a nation. **L2**

UNIT – II: IDEATION AND EVALUATION OF BUSINESS IDEAS

Opportunity identification – Ideations process - Sources of business ideas – Role of creativity – Sources of Innovation - Business Idea Evaluation - Product/ Service design – Design Thinking - Customer Value Proposition (CVP) – Business models.

Case study: Business cases of OYO, Paytm and Flipkart/ Smartmart.

Activity: Idea generation in groups and CVP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Select the right business ideas. **L1**
- Explain the business idea evaluation process **L2**

UNIT – III: Business Organizations and Venture Establishment

Forms of business organisations/ownership – Techno-economic feasibility assessment – Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas – Challenges & Pitfalls in selecting new venture.

Activity: Preparation of business plan (draft).

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall different forms of business organizations. **L1**
- Develop business canvas. **L2**

UNIT – IV: Introduction to Innovation

Creativity, Invention and innovation, Types of Innovation, Relevance of Technology for Innovation, The Indian innovations and opportunities.

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to develop new ideas to discover new ways of looking problems and opportunities. **L1**
- Apply technology to innovation. **L2**

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UNIT – V: Promoting and managing innovation
Innovators and Imitators, Patents, Trademarks, Intellectual Property, Exploring, Executing, Leveraging and renewing innovation, Enhancing Innovation Potential & Formulating strategies for Innovation.

Learning Outcomes:
At the end of this unit, the student will be able to
- Intellectual Property Licensing. **L1**
- Summarize the importance of IPR. **L2**

Text Books:
1. Robin Lowe and Sue Marriott, Enterprise: Entrepreneurship and Innovation Concepts, Contexts and Commercialization.
2. John Bessant and Joe Tidd, Innovation and Entrepreneurship.

Reference Books:
1. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
2. Peter F. Drucker, Innovation and Entrepreneurship.
3. EDII "Faculty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.
4. Philips, Bonefiel and Sharma (2011), Social Entrepreneurship, Global vision publishing house, New Delhi.

Course Outcomes:
At the end of this Course the student will be able to
- Choose entrepreneurship as an alternative career. **L1**
- Distinguish between corporate and social entrepreneurs. **L2**
- Examine and build customer value proposition. **L3**
- Analyze feasibility of business ideas. **L4**
- Compare various supports schemes provided by GOI. **L5**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME56 – THERMAL ENGINEERING LAB

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- Understand the functioning and performance of I.C. Engines
- To find heat losses in various engines

List of Experiments

1. Demonstration of diesel and petrol engines by cut models.
2. Valve timing diagram of 4-stroke diesel engine.
3. Port timing diagram of 2-stroke petrol engine.
4. Performance of 2-stroke single cylinder petrol engine.
5. Morse test on multi cylinder petrol engine.
6. Performance of 4-stroke single cylinder diesel engine.
7. Performance of two stage reciprocating air compressor.
8. Performance of Refrigeration system.
9. Performance of Air conditioning system.
10. Assembly and disassembly of diesel and petrol engines.
11. Performance of heat pump.
12. Performance of variable compression ratio of petrol engine.
13. Demonstration of heat pipe

Course Outcomes:

At the end of this Course the student will be able to

- Explain different working cycles of engine **L2**
- Describe various types of combustion chambers in IC engines **L3**
- Illustrate the working of refrigeration and air conditioning systems **L5**
- Evaluate heat balance sheet of IC engine. **L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME57 – MANUFACTURING PROCESSES - II LABORATORY

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the construction and working of various machine tools.
- Teach selection of parameters for different machining processes.

List of Experiments

1. Demonstration of construction and operations of general purpose machines: Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder and surface grinder.
2. Measure the characteristic features of lathe with simple step turning operation.
3. Job on step turning, taper turning, knurling, thread cutting on lathe machine.
4. Perform drilling, reaming and tapping operations.
5. Job on milling (Groove cutting/Gear cutting).
6. Job on shaper.
7. Job on slotting.
8. Job on cylindrical and surface grinding.
9. Job on grinding of tool angles.

Course Outcomes:

At the end of this Course the student will be able to

- Explain the concept of machining with various machine tools. **L2**
- Get hands on experience on various machine tools and machining operations. **L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS16-ORGANIZATIONAL BEHAVIOR

(Common to CE & ME)

L	T	P	C
3	0	0	0

Course Objectives:

- To make the student understand about the organizational behavior
- To enable them to develop self motivation, leadership and management.

UNIT – 1:

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual, Behavior – Attitude - Perception - Learning - Personality Types.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Organizational Behavior. **L1**
- Evaluate personality types. **L2**

UNIT – II:

Individual Behavior – Diversity – Biographical Characteristics Ability – Implementing Diversity Management – Strategies – Attitudes & Job Satisfaction - Personality – Theories of Personality – Perception – Process of Perception – Perception & Individual Decision Making – Motivation from concepts to Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Organizational Behavior. **L1**
- Contrast and compare Individual Behavior and attitude. **L2**

UNIT – III:

Group Behavior – Foundations of Group Behaviour – Defining and Classifying Groups – Stages of Group Development –` Group Properties – Roles – Norms – Status, Size and Cohesiveness – Group Decision Making – Understanding Work Teams – Types of Teams – Creating Effective Teams.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the concept of Group Dynamics. **L1**
- Contrast and compare Group behavior and group development. **L2**

UNIT – IV:

Leadership and Motivational Theories: Leadership Theories – Characteristic of effective leader – Finding and Creating Effective Leaders – Power & Polities. Introduction to motivation, Maslow's Hierarchy of Needs, Two- factor theory of Motivation, Mcdregers theory of motivational Model.

Learning Outcomes:

At the end of this unit, the student will be able to

- Contrast and compare Traits theory and Managerial Grid. **L1**
- Know the difference between Transactional and Transformational Leadership. **L2**

UNIT – V:

Foundation of Organizational Structure: Conflicts & Negotiations – Organization Structure – Organization Change & Stress Management – Self Management – Managing Careers.

Learning Outcomes:

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At the end of this unit, the student will be able to

- Know the importance of organizational change and development. **L1**
- Apply change management in the organization. **L2**

Text Books:

1. Stephen P. Robbins, Timothy: Organizational Behaviour, Pearson 14th Edition, 2012.
2. Dr. Anjali Ghanekar, Organizational Behaviour Concepts & Cases, Everest, 19th Edition, 2013.

Reference Books:

1. Mirza S Saiyadain, Cases in Organizational Behavior , TMH,2011.
2. Gerard H.Seijts, Cases in Organizational Behavior, Sage,2008.
3. Nelson, Quick and Khandelwala, ORGB, 2/e, Cengage, 2012.
4. P.G. Aquinas: Organizational Behaviour Concepts, Realities, Application & Challenges, 2nd Edition, Excel Books 2012.

Course Outcomes:

At the end of this Course the student will be able to

- To bring about the through understanding of entrepreneurship and constraints for the growth of entrepreneurial culture. **L1**
- To demondtrate knowledge in entrepreneurship development. **L2**
- To understand the concept of entrepreneushiptaining and various entrepreneurship training institutes in India. **L3**
- To be able to demontrate progressive learning in the project report and ownership structures. **L4**
- To be able to demontrate progressive learning in the project report and ownership structures. **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS12-ENGLISH LANGUAGESKILLS

(Common to CE & ME)

L	T	P	C
3	0	0	3

Course Objectives:

- Facilitate active listening to enable inferential learning through expert lectures and talks
- Provide training and opportunities to develop fluency in English through participation in formal group discussions and presentations using audio-visual aids

UNIT – I: **12 Hrs**

Listening: Listening to famous speeches for structure and style
Speaking: Oral presentations on general topics of interest.
Reading: Reading for meaning and pleasure – reading between the lines.
Writing: Appreciating and analyzing a poem –Paraphrasing, note-taking.
Grammar and Vocabulary: Tenses (Advanced Level) Correcting errors in punctuation -Word roots and affixes.
Learning Outcomes:
At the end of this unit, the student will be able to

- Understand the purpose of rhythm and rhyme and the use of figures of speech in making the presentation lively and attractive. **L1**
- Apply the knowledge of structure and style in a presentation, identify the audience and make note of key points. **L2**

UNIT – II: **12 Hrs**

Listening: Following the development of theme; answering questions on key concepts after listening to stories online.
Speaking: Narrating personal experiences and opinions.
Reading: Reading for summarizing and paraphrasing; recognizing the difference between facts and opinions.
Writing: Summarizing, precis writing, letter and note-making
Grammar and Vocabulary: Subject-verb agreement, noun-pronoun agreement, collocations.
Learning Outcomes:

- At the end of this unit, the student will be able to
- Make formal structured presentations on academic topics. **L1**
- Use correct English avoiding common errors in formal speech and writing. **L2**

UNIT – III: **12 Hrs**

Listening: Identifying views and opinions expressed by different speakers while listening to speeches.
Speaking: Small talks on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.
Reading: Identifying claims, evidences, views, opinions and stance/position.
Writing: Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.
Grammar and Vocabulary: The use of Active and passive Voice, vocabulary for academic texts.
Learning Outcomes:
At the end of this unit, the student will be able to

- Participate in group discussions using appropriate conventions and language. Strategies. **L1**
- Use appropriate vocabulary to express ideas and opinions. **L2**

1/10/21

UNIT – IV **12 Hrs**

Listening: Listening to identify important moments - Understanding inferences; processing of information using specific context clues from the audio.

Speaking: Group discussion; reaching consensus in group work (academic context).

Reading: Reading for inferential comprehension.

Writing: Applying for internship/ job - Writing one's CV/Resume and cover letter.

Grammar and Vocabulary: Phrasal verbs, phrasal prepositions and technical vocabulary.

Learning Outcomes:

At the end of this unit, the student will be able to

- Express thoughts and ideas with acceptable accuracy and fluency **L1**
- Draw inferences and conclusions using prior knowledge and verbal cues **L2**

UNIT – V **12 Hrs**

Listening: Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.

Speaking: Formal team presentations on academic/ general topics.

Reading: Intensive and extensive reading.

Writing: Structure and contents of a Report – Abstract – Project report features.

Grammar and Vocabulary: Correcting common errors, improving vocabulary and avoiding cliches and jargons.

Learning Outcomes:

At the end of this unit, the student will be able to

- Develop advanced listening skills for in-depth understanding of academic texts. **L1**
- Collaborate with a partner to make effective presentations. **L2**

Text Books:

1. "Forging Ahead": A Course Book for B.Tech Students. Orient BlackSwan,2020.
2. Meenakshi Raman &Sangeeta Sharma, "Technical Communication" O U Press2009.

Reference Books:

1. Bailey, Stephen. "Academic writing: A handbook for international students "Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, "Speaking and Critical Thinking". Heinley ELT; 2nd Edition,2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. "Cambridge Academic English" (B2). CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD).

Course Outcomes:

- At the end of this Course the student will be able to
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English. **L1**
- Apply grammatical structures to formulate sentences and correct word forms **L2**
- Analyze discourse markers to speak clearly on a specific topic in informal discussions. **L3**
- Evaluate reading/listening texts and to write summaries based on global comprehension of the setexts. **L4**
- Create a coherent paragraph interpreting a figure/graph/chart/table. **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME61 – AUTOMOBILE ENGINEERING

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

UNIT – 1: Introduction to vehicle structure and engine components **10 Hrs**

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different parts of the automobile. L3
- Explain various parts of the engine. L2
- Describe the lubrication. L2

UNIT – II: Ignition and fuel supply **6 Hrs**

Ignition and fuel supply: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the working principles of ignition, fuel supply and emission control systems L2
- Compare the types of ignition systems and fuel systems. L2

UNIT – III: Steering and suspension system **6 Hrs**

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the steering and the suspension systems. (L2) L2
- Explain power steering system in automobiles.(L2) L2
- Identify the shock absorbers applications in automobiles. (L3) L3

UNIT – IV: Wheels, Tires and Braking System: **6 Hrs**

Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

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Learning Outcomes:
At the end of this unit, the student will be able to

- Understand the various types of wheels and tires. **L1**
- Classify the brakes in automobile. **L1**
- Illustrate working principle of anti-lock breaking system. **L2**

UNIT – V: Electrical systems and advances in automobile engineering **6 Hrs**

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - Hybrid vehicle.

Learning Outcomes:
At the end of this unit, the student will be able to

- Explain the working principles of various automobile electrical systems. **L2**
- Identify the various electrical components in automobile. **L3**
- Explain about ASS, ESP, EBD, TCS and GPS in automobile. **L2**
- Examine the recent developments of automobile engineering. **L4**

Text Books:

1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications year.
2. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, (2006).
3. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, (2009).
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International (2004).

Reference Books:

1. Bosch, Automotive Hand Book, (2007), 6/e SAE Publications year.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd. (year).
3. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004.

Course Outcomes:
At the end of this Course the student will be able to

- Identify different parts of automobile **L3**
- Explain the working of various parts like engine and brakes **L2**
- Describe the working of steering and the suspension systems **L2**
- Summarize the wheels and tires **L2**
- Outline the future developments in the automobile industry **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME62 – HEAT TRANSFER

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator, and condenser.

UNIT – 1: Introduction to heat transfer **10 Hrs**

Introduction: Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat conduction solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the phenomenon related to different modes of heat transfer **L1**
- Compare different types of conduction heat transfer **L2**
- Apply concept of thermal resistance and its importance in practical problems **L3**

UNIT – II: Convection **10 Hrs**

Convection: Basic concepts of convection–heat transfer coefficients - types of convection –forced convection and free convection.

Free Convection -development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation

Forced convection in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the convective heat transfer principles **L3**
- Use analogy between fluid friction and heat transfer to solve engineering problems **L3**

UNIT – III: Radiation **10Hrs**

Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the principles of radiation heat transfer **L3**
- Calculate the radiation heat transfer between two bodies **L2**
- Design a radiation shield for given conditions **L3**
- Examine the effect of greenhouse gases on atmosphere **L4**

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UNIT – IV: Heat Exchangers **8 Hrs**

Heat Exchangers: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

Learning Outcomes:
At the end of this unit, the student will be able to

- Explain the working of different types of heat exchangers **L2**
- Calculate the heat transfer in heat exchangers **L2**
- Design a heat exchanger for a given application **L3**

UNIT – V: Boiling and Condensation & Mass transfer **8 Hrs**

Boiling and Condensation: Different regimes of boiling- nucleate, transition and film boiling – condensation - filmwise and dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Learning Outcomes:
At the end of this unit, the student will be able to

- interpret the basic modes of condensation heat transfer **L2**
- identify different regimes of boiling in design of boilers **L3**
- explain the basic mechanism of mass transfer **L2**
- differentiate between mass transfer due to convection and diffusion **L4**

Text Books:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
3. S. C. Arora & S. Domkundwar , A Course in Heat and Mass Transfer, Dhanpat Rai & CO.(P) LTD-Delhi , 2007.

Reference Books:

1. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014.

Course Outcomes:
At the end of this Course the student will be able to

- Apply the concepts of different modes of heat transfer. **L3**
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes. **L3**
- Analyze free and forced convection phenomena in external and internal flows **L4**
- Design of thermal shields using the concepts of black body and non-black body radiation **L5**
- Apply the basics of mass transfer for applications in diffusion of gases. **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME63 – OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
To impart the basic concepts of modeling, models and statements of the operations research.

- Formulate and solve linear programming problem/situations.
- Model strategic behaviour in different economic situations.
- To solve transportation problems to minimize cost.
- Apply Queuing theory to solve problems of traffic congestion, counters in banks, railway bookings etc.
- Explain scheduling and sequencing of production runs and develop proper replacement policies.
- Learn how to manage and control inventory accuracy.

UNIT – I: Introduction to Operations Research **10 Hrs**

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

Learning Outcomes:

At the end of this unit, the student will be able to

- Formulate practical problems given in words into a mathematical model. **L6**
- Quantify OR models to solve optimization problems. **L5**
- Formulate linear programming problems and appreciate their limitations. **L6**

UNIT – II: Transportation and Assignment Problems **10 Hrs**

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution – North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

Learning Outcomes:

At the end of this unit, the student will be able to

- Model linear programming problems like the transportation. **L3**
- Solve the problems of transportation from origins to destinations with minimum time and cost. **L6**

UNIT – III: Game theory & Job Sequencing **10Hrs**

Game theory: Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Job Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify strategic situations and represent them as games. **L3**
- Solve simple games using various techniques. **L6**
- Solve problems of production scheduling and develop inventory policies. **L6**

UNIT – IV: Queuing Theory & Inventory Control **8 Hrs**

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

Inventory Control: Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

Learning Outcomes:

At the end of this unit, the student will be able to

- Model a dynamic system as a queuing model to compute performance measures. **L3**
- Apply optimality conditions for single- and multiple-variable constrained and unconstrained nonlinear optimization problems. **L3**
- Describe the functions and costs of an inventory system. **L2**
- Determine EOQ, reorder point and safety stock for inventory systems **L2**

UNIT – V: Replacement and Maintenance Analysis **8 Hrs**

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Dynamic Programming (DP): Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve problems using dynamic programming. **L3**
- Apply the concept of replacement model. **L3**

Text Books:

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15th Edition, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9th Edition, Prentice Hall of India, New Delhi, 2010.

Reference Books:

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7th Edition, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4th Edition, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3rd Edition, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2nd Edition, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- Develop mathematical models for practical problems. **L3**
- Apply linear programming to transportation problems. **L3**
- Solve games using various techniques. **L3**
- Solve production scheduling and develop inventory policies. **L6**
- Apply optimality conditions for constrained and unconstrained nonlinear problems **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME64a – HYBRID AND ELECTRICAL VEHICLES

(Professional Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
- To familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

UNIT – 1: Introduction to Hybrid and Electric Vehicles **10 Hrs**

History of hybrid and electric vehicles, Need for hybrid and electric vehicles and their limitations. Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Specifications of hybrid and electric vehicles.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summaries the concepts and recent trends in electrical and hybrid vehicles. **L2**
- Demonstrate the need for hybrid and electric vehicles and their limitations. **L2**
- Compare modern drive-trains with conventional drive-trains. **L2**
- Outline the specifications of hybrid and electric vehicles. **L2**

UNIT – II: Hybrid Electric Drive-trains & Electric Drive-trains **10 Hrs**

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources. **L1**
- Explain power flow control in hybrid drive-train topologies. **L2**
- Compare hybrid electric drive-trains and electric drive-trains. **L2**
- Analyze the fuel efficiency of hybrid and electric vehicles. **L4**

UNIT – III: Electric Propulsion unit **10Hrs**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Learning Outcomes:

At the end of this unit, the student will be able to

- Choose a suitable drive scheme for developing a hybrid and electric vehicles depending on resources. **L3**
- Explain power flow control in hybrid drive-train topologies. **L2**
- Compare hybrid electric drive-trains and electric drive-trains. **L2**

UNIT – IV: Energy Storage **8 Hrs**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain fundamental electrochemistry of battery operation and performance requirements for hev, phev, erev and full electric vehicles. **L2**
- Summarize different approaches to estimating state of charge, state of health, power and energy. **L2**
- Outline the functions performed by a battery management system. **L2**
- Select various battery testing procedures and verification of battery performances. **L3**
- Compare different energy storage devices. **L2**

UNIT – V: Sizing the drive system **8 Hrs**

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications,

Design Considerations For Electric Vehicles: Various Resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Power steering- Tire choice- Wing Mirror, Aerials and Luggage racks.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate matching the electric machine and the internal combustion engine. **L2**
- Select the energy storage technology. **L3**
- Design and develop basic schemes of electric and hybrid electric vehicles. **L3**

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2/e, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach, illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, 1/e, Wiley-Blackwell, 2018.

Course Outcomes:

At the end of this Course the student will be able to

- Explain the working of hybrid and electric vehicles. **L2**
- Choose a suitable drive scheme for developing a hybrid and electric vehicles depending on resources. **L3**
- Develop the electric propulsion unit and its control for application of electric vehicles. **L3**
- Choose proper energy storage systems for vehicle applications. **L3**
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles. **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME64b – SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS

(Professional Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain the concept of modeling and simulation of manufacturing systems.
- Familiarize manufacturing simulation languages.
- Describe the various approaches to analyze the output data.
- Impart knowledge applications of simulation.
- Expose the students G P S S, SIMAN and SIMSCRIPT.

UNIT – 1: System and Simulation **10 Hrs**

System – ways to analyze the system – Model – types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Implement various steps involved in simulation process. **L5**
- Illustrate the advantages and disadvantages of simulation process. **L2**
- List the various types of hypothesis. **L1**
- Apply simulation models to manufacturing systems. **L2**

UNIT – II: Building of simulation model **10 Hrs**

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

Learning Outcomes:

At the end of this unit, the student will be able to

- Build the simulation model for manufacturing systems. **L6**
- Apply statistical procedures for developing credible model. **L2**
- Describe modeling of stochastic input elements. **L2**
- Appraise the importance of stochastic input elements. **L5**
- Illustrate the principles of valid simulation modeling. **L2**

UNIT – III: Generation of random variates **10Hrs**

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

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Learning Outcomes:
At the end of this unit, the student will be able to
- List the various factors for selection of random variates. **L1**
- Explain how random variables can be generated. **L2**
- Compare various simulation languages used for generation of random varients. **L2**
- Select appropriate simulation software's like., GPSS, SIMAN-SIMSCRIPT etc **L3**

UNIT – IV: Output data analysis **8 Hrs**

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

Learning Outcomes:
At the end of this unit, the student will be able to
- Analyze the output data in manufacturing system. **L4**
- Illustrate the types of simulation with respect to output data analysis. **L2**
- List the approaches for steady of output data. **L1**
- Explain Welch algorithm for analyze the output data. **L2**

UNIT – V: Applications of Simulation **8 Hrs**

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

Learning Outcomes:
At the end of this unit, the student will be able to
- Illustrate the applications of simulation in manufacturing systems. **L2**
- Explain simple fixed period inventory system. **L2**
- Describe flow shop and job shop systems. **L2**
- Solve the manufacturing problems using Newboy paper method. **L3**

Text Books:
1. Law, A.M. & Kelton, Simulation Modelling and Analysis, McGraw Hill, 2/e, New York, 1991.
2. N. Viswanadham & Y. Narahari, Performance Modeling of Automated Manufacturing Systems, Prentice-Hall (12 March 1992).

Reference Books:
1. Banks J. & Carson J.S., PH, Discrete Event System Simulation, Englewood Cliffs, NJ, 1984.
2. Carrie A. Simulation of Manufacturing Systems, Wiley, NY, 1990.
3. Ross, S.M., McMillan, NY, A Course in Simulation / 1990. Simulation Modelling and SIMNET / Taha H.A / PH, Englewood Cliffs, NJ, 1987.

Course Outcomes:
At the end of this Course the student will be able to
- Summarizes the various approaches to modelling and simulation of manufacturing systems. **L2**
- Outline the concepts of output data analysis. **L2**
- Identify various software languages for simulation of manufacturing systems. **L3**

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME64c – DESIGN OF TRANSMISSION SYSTEMS

(Professional Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Explain the various elements involved in a transmission system.
- Focus on the various forces acting on the elements of a transmission system.
- Design the system based on the input and the output parameters.
- Produce working drawings of the system involving pulleys, gears, clutches and brakes.
- Demonstrate the energy considerations in the design of motion control elements.

UNIT – 1: Flexible power transmission systems **10 Hrs**

Flexible power transmission systems: Design of Belts – Flat Belts and Pulleys – V Belts and Pulleys – Design of chain drives – Wire ropes.

Design of bearing: Design of sliding contact bearing using Sommerfield number – Design using Mckee's equation – Selection of rolling contact bearings.

Learning Outcomes:

At the end of this unit, the student will be able to
- Demonstrate the importance of bearings in the transmission system. **L2**
- Design sliding contact bearing using Somerfield number **L4**
- Solve problem on design of sliding contact bearing using Mckees's equation. **L3**
- Identify the factors required for the selection rolling contact bearings **L2**
- Choose various types of flexible power transmission systems. **L3**

UNIT – II: Spur and Helical gears **10 Hrs**

Spur and Helical gears: Gear geometry – Kinematics – Forces on gear tooth – Stresses in Gear tooth – Selection of gear material based on bending stress and contact stress – Design of Spur gear – Power transmitting capacity, Parallel Helical Gears – Kinematics – Tooth proportions – Force analysis – Stresses in Helical gear – Design of helical gear – Crossed Helical gears.

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain Kinematics of different types of gears. **L2**
- Predict various forces and stresses acting on the gear tooth. **L3**
- Select materials for a gear based on bending and contact stresses **L3**
- Analyze the power transmitting capacity of a gear. **L4**
- Design a spur gear **L5**

UNIT – III: Bevel and Worm gears **8Hrs**

Bevel and Worm gears: Straight Bevel gears – Kinematics – Force analysis – Stresses in straight bevel gear tooth – Design of bevel gear – Worm gearing – Kinematics – Forces - Friction and Efficiencies – Stresses in worm gear tooth.

Learning Outcomes:

At the end of this unit, the student will be able to
- Identify the differences between the helical gear and a bevel gear. **L2**
- Solve problems on the design of helical gear. **L3**
- Explain the kinematics of helical, straight bevel gears and worm gears. **L3**
- Predict the various forces acting on the worm gear tooth. **L3**
- Select of helical, bevel and worm gears in power transmission **L3**

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UNIT – IV: Design of gear boxes **8 Hrs**

Design of Speed reducers – Design of multi speed gear boxes for machine tools – Structural and ray diagrams.

Learning Outcomes:

At the end of this unit, the student will be able to

- Select the speed reducers in power transmission. **L3**
- Design speed reducers. **L5**
- Design of multi speed gear boxes for various applications. **L5**
- Draw ray diagrams of gear boxes. **L2**

UNIT – V: Elements of motion control **8 Hrs**

Internal – Expanding Rim clutches and Brakes – External – Contracting Rim clutches and Brakes – Band type Clutches – Cone clutches and Brakes – Energy considerations – Temperature rise – Friction materials.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain on elements of motion control. **L2**
- Outline the importance of clutches and brakes in power transmission. **L2**
- Model various types of clutches and brakes. **L3**
- Solve problems on the design of clutches and brakes **L3**
- Calculate the temperature wise due to friction and select materials according. **L4**

Text Books:

1. Joseph Edward Shigley and Charles, R. Mischke, Mechanical Engineering Design, McGraw –Hill International Editions, 2000.
2. Machine Design- an integrated approach, (5th Edition) by Robert L. Norton, Pearson publisher, 2000

Reference Books:

1. Design Data, PSG College of Technology, DPV Printers, Coimbatore, 2005.
2. Malisa, Hand Book of Gear Design, Tata Mc Graw Hill, International Edition, 2000.
3. V.B. Bhandari , Design of Machine elements, Tata Mc Graw Hill, 2001.

Course Outcomes:

At the end of this Course the student will be able to

- Design pulleys, chain drives, rope drives and belt drives. **L5**
- Determine performance requirements in the selection of commercially available transmission drives. **L4**
- Design Brakes and Clutches **L4**
- Design various types of gear boxes. **L5**
- Select materials for various applications in the transmission elements. **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME64d – SOLAR AND WIND ENERGY SYSTEMS

(Professional Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.
- Familiarize the wind energy sources assessment
- Explain basics of designing aerofoil

UNIT – I: Solar radiation and collectors **12 Hrs**

Solar radiation and collectors: Solar angles – Sun path diagrams – Radiation - extra terrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

Solar thermal technologies: Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic concepts of solar radiation and solar collectors **L2**
- Develop sun path diagrams **L3**
- Explain the concepts of tracking systems **L2**
- Discuss the working principles of solar thermal technologies **L6**
- Develop design and operation of solar heating and cooling systems **L3**
- Explain the principles of thermal storage systems **L2**

UNIT – II: Solar PV fundamentals **10 Hrs**

Solar PV fundamentals: Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics.

SPV system design and applications: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of a semiconductor **L2**
- Apply the principles of solar thermo photo voltaics **L3**
- Outline the applications of SPV system **L2**

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- Analyze the performance of a solar cell array system L4
- Utilize centralized and decentralized SPV systems L3

UNIT – III: Introduction to wind energy **10Hrs**

Introduction: Historical Perspectives on Wind Turbines- Indian Energy Scenario - Global Energy Scenario - Introduction to Indian Wind Industry - Wind Energy potential of India and Global Wind Installations.

Basics of Wind Resource Assessment: Power in the wind –Wind Characteristics - Measurement of wind using anemometers (cup anemometer, propeller anemometer, pressure plate anemometer, pressure tube anemometer, sonic anemometer and other remote wind speed sensing techniques) – Turbulence-Wind Power Density –Average wind speed calculation - Statistical models for wind data analysis (Weibull and Rayleigh distribution). Energy estimation of wind regimes – Wind Rose, Wind Monitoring Station Siting and Instrumentation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall historical perspective of wind turbines L1
- Relate Indian and global energy requirements. L1
- Interpret power in the wind L2
- Classify different wind speed measuring instruments L2
- Apply different statistical models for wind data analysis L3

UNIT – IV: Wind Energy Conversion Systems **8 Hrs**

Wind Energy Conversion Systems: Types - Components of Modern Wind Turbine (HAWT and VAWT) - Fixed and Variable Speed operations - Power Control (Passive stall, Active pitch, Passive pitch and Active stall) - Electrical aspects of wind turbine, Safety of wind turbines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Utilize different wind parameters for design of rotor L3
- Make use of power curve for energy estimation L3
- List different components of modern wind turbine L1
- Explain how to control the power of a wind turbine L2
- Name different safety measures of wind turbine L1

UNIT – V: Wind Farm Design and Health (Condition) Monitoring **8 Hrs**

Wind Farm Design and Health (Condition) Monitoring: Planning of wind farm, Site selection, Micro siting, Grid Integration, Power evacuation, Wind Farm Feasibility Studies, Preparation of DPR, Environmental Benefits and Impacts.

Small Wind Turbines: Water pumping wind mills, offshore wind energy, Wind turbine testing, future developments.

Learning Outcomes:

At the end of this unit, the student will be able to

- Plan the wind farm L3
- Analyze the feasibility of wind farm L4
- List the environmental benefits and impacts L1
- Explain about small wind turbines L2

Text Books:

1. Goswami D.Y., Kreider, J. F. and Francis., "Principles of Solar Engineering', Taylor and Francis, 2000.
2. Chetan Singh Solanki, "Solar Photovoltatics – Fundamentals, Technologies and Applications", PHI Learning Private limited, 2011.

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Reference Books:

1. Sathyajith Mathew, Wind Energy Fundamentals, Resource Analysis and Economics, Springer Publications, (2006).
2. Sukhatme S.P.,. Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
3. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press, (2010).
4. Wind Power, Revised Edition: Renewable Energy for Home, Farm, and Business, Paul Gipe, 2004, Chelsea Green Publishing.
5. R. Jha, Wind Turbine Technology, CRC Press, (2010).

Course Outcomes:

At the end of this Course the student will be able to

- Understand with basics of solar radiation, available solar energy and its measurement **L2**
- Illustrate the solar collectors, construction and operation of solar collectors. **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME64e – MECHANICAL BEHAVIOUR OF MATERIALS

(Professional Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain the structure of material over the effects of mechanical properties.
- Familiarize the defects inside the structure and their effects on the mechanical properties.
- Train the methods for characterization of the mechanical behavior of materials.
- Impart knowledge about strengthening mechanisms of materials.
- Teach mechanisms of failures of materials (fracture, fatigue and creep) and their relationship with the different types of stress.

UNIT – I: Elastic and plastic behavior **10 Hrs**

Elastic behaviour of materials – Hooke's law, plastic behavior: dislocation theory – Burger's vectors and dislocation loops, dislocations in FCC, HCP and BCC lattice, stress fields and energies of dislocations, forces on and between dislocations, slip and twinning.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the elastic behavior of engineering materials. **L2**
- Recall Hooke's law. **L1**
- Explain the dislocation theory. **L2**
- Identify the dislocations in FCC, HCP and BCC lattice. **L3**
- Determine the forces on and between dislocations. **L3**

UNIT – II: Strengthening mechanisms **10 Hrs**

Cold Working, Grain Size Strengthening, Solid Solution Strengthening, Martensitic Strengthening, Precipitation Strengthening, Dispersion Strengthening, Fibre Strengthening, Examples. Yield Point Phenomenon, Strain aging and Dynamic strain aging.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe various strengthening mechanisms. **L2**
- Discuss grain size strengthening and solid solution strengthening. **L6**
- Apply dispersion strengthening and fibre strengthening. **L2**
- Differentiate strain aging and dynamic strain aging. **L3**

UNIT – III: Fracture and fracture mechanics **10Hrs**

Types of Fracture, Basic Mechanism of Ductile and Brittle Fracture, Griffith's Theory Of Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Factors Affecting DBTT, Determination of DBTT. Fracture Mechanics-Introduction, Modes of Fracture, Stress Intensity Factor, Strain Energy Release Rate, Fracture Toughness and Determination of K_{IC}.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic mechanism of ductile and brittle fracture. **L2**
- Identify importance of Griffith's Theory. **L3**
- Predict factors effecting on DBTT. **L6**
- Classify various modes of fracture. **L1**

UNIT – IV: Fatigue behaviour and testing **8 Hrs**

Stress Cycles, S-N Curves, Effect of Mean Stress, Factors Affecting Fatigue, Structural Changes Accompanying Fatigue, Cumulative Damage, HCF / LCF, Thermo-mechanical Fatigue, Application of Fracture Mechanics to Fatigue Crack Propagation, Fatigue Testing Machines.

Learning Outcomes:
At the end of this unit, the student will be able to

- Explain fatigue behaviour and testing. **L2**
- Draw the S-N curves for different materials. **L1**
- Discuss the factors affecting fatigue. **L6**
- Apply fracture mechanics in design. **L2**

UNIT – V: Creep behaviour and testing **8 Hrs**

Creep Curve, Stages In Creep Curve And Explanation, Structural Changes During Creep, Creep Mechanisms, Metallurgical Factors Affecting Creep, High Temperature Alloys, Stress Rupture Testing, Creep Testing Machines.

Learning Outcomes:
At the end of this unit, the student will be able to

- Identify various stages in creep curve. **L3**
- Determine various structural changes during creep. **L4**
- Predict the metallurgical factors affecting creep. **L6**
- Demonstrate various creep testing machines. **L2**

Text Books:

1. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill, SI Edition, 1995.
2. Davis. H. E., Troxell G.E., Hauck.G. E. W., "The Testing Of Engineering Materials", McGraw-Hill, 1982.

Reference Books:

1. Wulff, The Structure and Properties of Materials, Vol. III "Mechanical Behavior of Materials", John Wiley and Sons, 1983.
2. Honey Combe R. W. K., "Plastic Deformation of Materials", Edward Arnold Publishers, 1984.
3. Suryanarayana, A. V. K., "Testing of Metallic Materials", Prentice Hall India, 1979.

Course Outcomes:
At the end of this Course the student will be able to

- Apply materials based on their structure and failure modes **L2**
- Characterize materials using different machines **L3**
- Summarize the various strengthening mechanisms with suitable examples **L2**
- Identify the creep in different materials and its influence in selection of materials **L3**

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19AME64f – TOTAL QUALITY MANAGEMENT

(Professional Elective – II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the students, the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of customer satisfaction by the application of various quality concepts.
- Understand the importance of Quality standards in Production.

UNIT – I **10 Hrs**

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define what is quality. **L2**
- Explain the principles of Quality Planning. **L2**
- Explain the techniques of quality costs. **L2**
- Interpret the concepts of Total Quality Management. **L2**
- Contrast the present quality issues with the past. **L2**

UNIT – II: Historical Review **8 Hrs**

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of Quality council. **L2**
- Identify the barriers of TQM Implementation. **L3**
- Discuss the benefits of TQM. **L6**
- Summarize the essential characteristics of successful quality leader. **L2**
- Outline the contributions of TQM Gurus. **L2**

UNIT – III: TQM Principles **10Hrs**

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of customer satisfaction, Service Quality and Customer Retention. **L2**
- Apply the principles of motivation and Empowerment. **L3**
- Compare the perfection and continuous improvement. **L2**
- Measure the Process improvement using Juran Trilogy. **L5**

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UNIT – IV: TQM Tools **10Hrs**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Infer the benefits of benchmarking. **L2**
- List the benefits of QFD Process. **L1**
- Identify various zones in House of Quality. **L3**
- Apply Six sigma towards quality improvement. **L3**
- List the seven tools of quality. **L1**

UNIT – V: Quality Systems **8 Hrs**

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of ISO Standards. (L2) **L2**
- Discuss the need of ISO9000 and Other Quality systems. (L6) **L6**
- Build awareness on the services of ISO9000. (L6) **L6**
- Infer the process of documentation. (L2) **L2**
- Compare ISO 9000 and ISO 14000. (L2) **L2**

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005
1. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, NewAge International, 1996
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

Course Outcomes:

At the end of this Course the student will be able to

- Develop an understanding on quality Management philosophies and frameworks **L3**
- Adopt TQM methodologies for continuous improvement of quality **L6**
- Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement **L4**
- Apply benchmarking and business process reengineering to improve management processes. **L3**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS11-COMPETITIVE & SPOKEN ENGLISH

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To train students to use language effectively in everyday conversations and to participate in group discussions.
- To enable them to learn and practice competitive English and ready for competitive examinations.

UNIT – 1: Grammar

Sentences-Construction-Types-Affirmative-Interrogative-Nouns-Pronouns-Verbs-Models-Tenses-Adverb-Adjective-Speech-Voice-Articles-Prepositions-Conjunctions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Students will improve their speaking ability in English both in terms of fluency and comprehensibility by enlarging their vocabulary. **L1**
- Students will attain and enhance competence in the four modes of literacy: listening, speaking, reading and writing **L2**

UNIT – II: Vocabulary

Content of the Unit – II

Competitive Vocabulary List-Word Building Tips- Antonyms-Synonyms-One word Substitutes-Idioms and Phrases-Phrasal Verbs-Reading Comprehension-importance- tips- Cracking unknown passage.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the factors that influence use of grammar and vocabulary in speech and writing **L1**
- Comprehend the meaning of paragraphs and unknown passages **L2**

UNIT – III: Speaking Skills

Dynamics of Speaking-Communication Skills -Public Speaking- Significance to Professionals- establishing credibility & Confidence- Preparation of Speech-Audience-Analysis -Topic generation Techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Display competence in oral, written and visual communication **L1**
- Showan understanding of opportunities in the field of communication **L2**

UNIT – IV: Stage Dynamics

Organization of Speech- Platform Manners- Body language- Psychology of Persuasion- Speeches for Special Occasions-exercises-Recording and feedback sessions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze your audience and design speeches to reflect your analysis. **L1**
- Evaluate speeches based on a variety of verbal and non-verbal criteria. **L2**

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UNIT – V:Accent Neutralization

Realization of past tense and plural forms- Stress Rules– Intonation- Connected speech- weak forms-assimilation-elision- Linking and Intrusion-juncture-contractions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to identify which are stressed and unstressed words. **L1**
- Reproduce in speech, appropriate pattern of intonation and rhythm. **L2**

Reference Books:

1. Hari Mohan Prasad, ***Objective English for Competitive Examination,*** Tata McGraw Hill, New Delhi, 2014.
2. V SASIKUMAR and PV DHAMIJA ***: SPOKEN ENGLISH A Self- Learning Guide to Conversation Practice,*** 2nd Edition, TATA McGRAW-HILL'S SERIES.
3. M.Sambaiah, ***Technical English,*** Wiley publishers India. New Delhi. 2014.
4. JK GANGAL, A PRCACTICAL COURSE IN EFFECTIVE ENGLISHSPEAKING SKILLS, PHI LEARNING Private Ltd. New Delhi. 2012
5. KRISHNA MOHAN and N.P. SINGH,***SPEAKING ENGLISH EFFECTIVELY,*** 2nd Edition, Trinity Press, 2015.
6. Wren and Martin,***High School English Grammar and Composition,*** S. Chand Publication, New Delhi, 2014.
7. Neetu Singh, ***English for General Competitions from Plinth To Paramount*** *(Volume-I&II),*Paramount Reader Publications, 2014.
8. Dale Carnegie,***The Quick And Easy Way To Effective Speaking,*** Vermilion Publications, 1990.
9. E Suresh Kumar. ***Effective Publish Speaking,*** Orient Longman, 2016.

Course Outcomes:

At the end of this Course the student will be able to

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students. **L1**
- Speaking with clarity and confidence thereby enhancing employability skills of the students. **L2**
- Participate in critical conversations and prepare, organize and deliver in public contexts **L3**
- Improving their speaking ability in English both in terms of fluency and comprehensibility **L4**
- Equipped with competitive proficiency in English for various competitive examinations at state, national and international level. **L5**

Department of Mathematics *R19*

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS23-INTEGRAL TRANSFORMS AND ITS APPLICATIONS

(Open Elective -II)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing the student

- With the concepts and several methods of integral transforms and its applications.
- The concepts of fractional calculus and its applications.

UNIT – 1: Basic concepts of integral transforms:: Fourier transforms: **9 Hrs**

Introduction, basic properties, applications to solutions of Ordinary Differential Equations (ODE), Partial Differential Equations (PDE) and Integral Equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve ordinary differential equations and partial differential equations. **L3**
- Solve Integral equations. **L3**

UNIT – II: Laplace transforms:

Introduction, existence criteria, Convolution, differentiation, integration, inverse transform, Tauberian Theorems, Watson's Lemma, solutions to ODE, PDE including Initial Value Problems (IVP) and Boundary Value Problems (BVP).

Applications of joint Fourier-Laplace transform, definite integrals, summation of infinite series, transfer functions, impulse response function of linear systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve initial and boundary value problems using Laplace transform technique. **L3**
- Apply the techniques of joint Fourier-Laplace transform techniques. **L4**

UNIT – III: Hankel Transforms & Hilbert Transforms

Hankel Transforms: Introduction, properties and applications to PDE Mellin transforms: Introduction, properties, applications; Generalized Mellin transforms.

Hilbert Transforms: Introduction, definition, basic properties, Hilbert transforms in complex plane, applications; asymptotic expansions of 1-sided Hilbert transforms.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve PDE by using the concepts of Hankel transforms. **L4**
- Learn the concepts of Hilbert transforms. **L3**

UNIT – IV: Stieltjes Transform, Legendre transforms and Radon transforms

Stieltjes Transform:

Definition, properties, applications, inversion theorems, properties of generalized Stieltjestrans form.

Legendre transforms:

Introduction, definition, properties, applications.

Radon transforms:

Introduction, properties, derivatives, convolution theorem, applications, inverse radon transform.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyzes the Stieltje's and Legender's transforms. **L4**
- Analyzes random transforms and focuses on thier applications. **L3**

UNIT – V: Fractional Calculus and its applications & Integral transforms in fractional equations

Fractional Calculus and its applications: Introduction, fractional derivatives, integrals, Laplace transform of fractional integrals and derivatives.

Integral transforms in fractional equations: fractional ODE, integral equations, IVP for fractional Differential Equations (DE), fractional PDE, green's function for fractional DE.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the basic concepts of fractional calculus. **L2**
- Applies the concepts of integral transforms in fractional calculus. **L4**

Text Books:

1. Advanced Topics in Applied Mathematics for Engg. & physical Science: Sudhakar Nair
2. Introduction to Applied Mathematics, Gilbert Strang

Reference Books:

1. Fractional Calculus Theory and Applications of Differentiation and Integration to Arbitrary Order: J. Spanier and K. B. Oldham
2. Handbook of Mathematical Functions: M. Abramowitz & I. Stegun

Course Outcomes:

At the end of this Course the student will be able to

- Use the basic concepts of integral transforms, Stieltjes Transform, Legendre transforms and Radon transforms etc., in real life problems. **L1**
- Use the concepts of Laplace transforms in solving the initial value and boundary value problems. **L2**
- Applies the concepts of Hankel Transforms & Hilbert Transforms while addressing the various problems related to engineering sciences. **L3**
- Analyze the problems in engineering and technology using various techniques of integral transforms and applications. **L4**
- Uses the ideas of fractional calculus and its applications in solve the real world problems. **L5**

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS24-NUMERICAL ANALYSIS

(Open Elective –II)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing the student

- With the concepts and several methods of Numerical methods.
- To explore the solutions of ordinary differential equations, partial differential equations and integral equations.

UNIT – 1: Solution of Algebraic and Transcendental equations & Solution to System of Nonlinear Equations and Spline Functions **9 Hrs**

Solution of Algebraic and Transcendental equations:

Ramanujan's method – Secant method – Muller's method – Graeffe's root-squaring method – Lin-Bairstow's method – Quotient-Difference method

Solution to System of Nonlinear Equations and Spline Functions:

Method of Iteration- Newton-Raphson method. Linear splines - Quadratic splines – Cubic splines : Minimizing property of Cubic splines – Error in the Cubic Spline ad its derivatives – Surface fitting by cubic splines. – Cubic B-Splines: Representation of B- Splines – Least squares solution – Applications of B-Splines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve the algebraic and transcendental equations **L2**
- Solve the system of nonlinear equations and spline functions. **L4**

UNIT – II: Numerical Linear Algebra:

Triangular matrices – LU decomposition of a matrix – vector and matrix norms. – Solutions of linear systems – Direct methods: Gauss elimination – necessary for pivoting – Gauss-Jordan method – modification of the Gauss method to compute the inverse – number of arithmetic operations – LU decomposition method – computational procedure for LU decomposition method – Lu decomposition from Gauss elimination – solution of tridiagonal systems – Ill conditioned linear systems – Method for Ill- conditioned systems. – Solution of linear systems –Iterative methods. – Matrix Eigen value problems – Eigen values of a symmetric tridiagonal matrix – Householder's method – QR method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of numerical linear algebra. **L1**
- Apply the concepts of numerical linear algebra. **L3**

UNIT – III: Numerical solution of ordinary differential equations:

Solution by Taylor's series, Picard's method,Euluer's method , Runge-Kutta methods, Predictor-Corrector methods: Adams-Moulton method – Milne's method. – Cubic Spline method – Simultaneous and higher order equations. – Boundary value problems: Finite difference method – Cubic Spline method – Galerkin's method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve first order initial value problems. **L3**
- Solve ssimultaneous and higher order equations and boundary value problems. **L4**

UNIT – IV: Numerical solution of Partial differential equations:

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve Laplace's equation using finite difference technique. **L3**
- Solve Heat equation and wave equation. **L4**

UNIT – V: Numerical solution of Integral equations:

Numerical methods for Fredholm equations: Method of degenerate Kernels – method of successive approximations – Quadrature methods – use of Chebyshev series – cubic Spline method – singular Kernels – method of invariant imbedding.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply numerical methods for solving Fredholm equations. **L3**
- Analyzes cubic Spline method, singular Kernels – method of invariant imbedding etc. **L4**

Text Books:

1. S. S. Sastry, Introductory Methods of Numerical Analysis(Fifth Edition 2012), PHI Learning Private Limited, New Delhi.

Reference Books:

1. M.K.Jain,S.R.K.Iyengar, R.K.Jain, Numerical Methods for Scientific and Engineering Computation (sixth edition),Nee Age International(P) Limited, Publishers, New Delhi.
2. K.E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.S.D. Conte and C. De Boor, Elementary Numerical Analysis 302226 An Algorithmic Approach, McGraw-Hill, 1981.
3. K. Eriksson, D. Estep, P. Hansbo and C. Johnson, Computational Differential Equations, Cambridge Univ. Press, Cambridge, 1996.
4. G.H. Golub and J.M. Ortega, Scientific Computing and Differential Equations: An Introduction to Numerical Methods, Academic Press, 1992.
5. J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, 2nd ed., Texts in Applied Mathematics, Vol. 12, Springer Verlag, New York, 1993.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the need of numerical methods in solving engineering problems of various fields. **L1**
- Learn various numerical techniques to solve initial and boundary value problems. **L2**
- Apply various methods in solving initial and boundary value problems **L3**
- Emphasizes the numerical solutions of Integral equations. **L4**
- Analyze the problems in engineering and technology using various techniques of Numerical methods. **L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS25-OPTIMIZATION TECHNIQUES
(Open Elective -II)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing the student
- With the basic concepts and several methods of optimization.
- With the concepts of geometric programming & constrained minimization problems.

UNIT – 1: Linear programming I : Simplex Method **9 Hrs**
Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method.
Learning Outcomes:
At the end of this unit, the student will be able to
- Solve the problems related to linear programming. L3
- Lear the simplex method and two phase simplex method. L3

UNIT – II: Linear programming II : Duality in Linear Programming
Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem.
Learning Outcomes:
At the end of this unit, the student will be able to
- Understand the dual relations and duality theorem L2
- Solve transportation problem and assignment problem. L4

UNIT – III: Non-linear programming: Unconstrained optimization techniques & Direct Search Methods
Non-linear programming: Unconstrained optimization techniques: Introduction: Classification of Unconstrained minimization methods
Direct Search Methods: Random Search Methods: Random jumping Method, Random Walk method. Grid Search Method.
Learning Outcomes:
At the end of this unit, the student will be able to
- Classify Unconstrained minimization methods and direct search methods. L2
- Apply the unconstrained minimization methods and direct search methods L3

UNIT – IV: Non-linear programming: Constrained optimization techniques
Introduction , Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.
Learning Outcomes:
At the end of this unit, the student will be able to
- Understand the Constrained optimization techniques. L2
- Solve nonlinear programming problems. L3

UNIT – V: Geometric Programming & Constrained minimization Problems
Geometric Programming:
Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.
Constrained minimization Problems :
Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve unconstrained geometric programming using differential calculus and arithmetic-geometric inequality. **L3**
- Solve Solution of a constrained geometric programming problem, primal-dual programming. **L4**

Text Books:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.

Reference Books:

1. Chong, E.K.P.and Zak, S. H.. An Introduction to Optimization, John Wiley & Sons, N.Y.
2. Peressimi A.L., Sullivan F.E., Vhl, J.J..Mathematics of Non-linear Programming, Springer – Verlag.

Course Outcomes:

At the end of this Course the student will be able to

- Remembers the concepts of linear programming problems. **L1**
- Understand various techniques of linear programming problems. **L2**
- Solve constrained and unconstrained linear programming problems. **L3**
- Analyzes geometric programming using differential calculus and arithmetic-geometric inequality. **L4**
- Analyze optimization problems that occur in real world in engineering and technology using various elegant optimization techniques. **L5**

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Department of Physics R19

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

19ABS33-FUNCTIONAL NANOMATERIALS FOR ENGINEERS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To learn and understand the fundamental concepts of functional/smart nanomaterials.
- To understand the classification and important applications of functional materials
- To learn and understand the materials utilized for energy applications
- To learn and understand the principle and applications of nanosensors
- To understand the concept of self-assembling molecular layers and its applications

UNIT – I: INTRODUCTION TO FUNCTIONAL /SMART NANOMATERIALS 9 Hrs

Introduction: Nanomaterials and their importance (in brief), Functional/ Smart Nanomaterials, – (Hydrogels, polymer brushes, Carbon nanotubes, Cellulose),Functionalization techniques, Properties of Smart materials (Sensing materials, Actuation materials, Control devices, Self-detection, self-diagnostics, Self-corrective, self-controlled, self-healing, Shock Absorbers, Damage arrest)-components of smart systems (Sensor :- Data Acquisition, Data Transmission; Command and control unit, Actuator:- Data Instructions, Action Devices)

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic properties and fictionalization of smart nanomaterials L1
- Explain the need of functional/smart nanomaterials for advanced technology L2
- Identify engineering applications of sensors L3
- Analyze the sensing, control and detection mechanism in smart nanomaterials L4
- Illustrate the components of smart systems L2

UNIT – II: CLASSIFICATION AND APPLICATIONS 9 Hrs

Classification of smart materials (piezoelectric, electrostrictive, Magnetostrictive, Thermoresponsive, Electrochromic and Smart gels), Shape Memory Alloys and their working principle, Quantum Tunneling Composites and their working principle, Applications of smart materials in Aircrafts, Medicine, Robotics, Smart fabrics, Sporting goods and smart glass, Merits and demerits of smart materials.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify smart materials based on electrical, magnetic and thermal characteristics L1
- Understand the basic concepts and working principle of memory alloys L2
- Identifies the Engineering applications of smart materials L2
- Apply the concepts to Aircrafts, Medicine and Robotic fields L3
- Explain the working principle of Quantum Tunneling Composites L2
- Identify the Merits and demerits of smart materials in engineering field L2

UNIT – III: NANOSENSORS

Introduction, Sensor definition, Working principle of nanosensors, Types of nanosensors (Physical nanosensors – Pressure, Force, Mass, Displacement, Optical nanosensors – Proximity, Ambient light, Chemical nanosensors- Chemical composition, Molecular concentration). Applications of nanosensors (Medicine, Aerospace, Communication, Structural Engineering).

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the working principle and concept of nanosensors L1
- Classify the nanosensors based on their working principle and application L2

- Summarize various types of nanosensors L2
- Explain the applications of nanosensors in various fields L2
- Apply the concept of nanosensors in Medicine, Aerospace, Communication, Structural Engineering fields L3

UNIT – IV: SELF-ASSEMBLING MOLECULAR LAYERS **9Hrs**

Introduction, principles of self-assembly, monolayers, Characteristics of Self assembled monolayers (SAMs), Molecular SAMs, Types of SAMs, Factors influencing Monolayer order, methods of preparation (Langmuir- Boldgett film : Mechanism, Experimental arrangement, Assembly, Advantages and disadvantages of LB films) patterning of SAMs (Locally attract, Locally remove, Modify tail group). Applications (Self-cleaning and moisture repellent).

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of self-assembling L1
- Understand the significance of molecular layers L2
- Explain the concept of Langmuir- Boldgett film preparation L2
- Explain the important factors influencing Monolayer order L2
- Classify the materials based on patterning of SAMs L2
- Apply the concept of Self-cleaning and moisture repellent L3

UNIT – V: NANOMATERIALS FOR ENERGY APPLICATIONS

Introduction, **Solar Cells** (Silicon Solar Cells, Thin film Solar Cells, Organic Solar Cells - Dye Sensitized Solar Cells, Polymer solar cells) Working Principle, Efficiency estimation and advantages, **Hydrogen Fuel Cells** – Working Principle, Structure, Assembly of fuel cell, **Water splitting** – H_2 Production, Photocatalytic process.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of solar cell L1
- Classify the solar cells based on manufacturing material L2
- Explain the construction and working principle of solar cell L2
- Interpret the efficiency and advantages in various solar cells L2
- Explain the construction and working principle of hydrogen cells L2
- Identify applications of water splitting for H_2 production L2
- Explain the photocatalytic process L2

Text Books:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2012
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Identify the various functional/smart nanomaterials materials L1
- Classify the smart nanomaterials based their applications and properties L2
- Apply the various functional nanomaterials in various applications L3

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

19ABS34-MATERIALS CHARACTERIZATION TECHNIQUES

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To learn and understand an exposure to evaluation of special characteristics of materials.
- To understand the principle and important applications of characterization techniques
- To learn and understand the materials structural characteristics
- To learn and understand the materials Mechanical & Thermal characteristics

UNIT – I: STRUCTURE ANALYSIS BY POWDER X-RAY DIFFRACTION 9 Hrs

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams –factors affecting Diffraction Intensities - structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and WH Methods, Small angle X-ray scattering (SAXS) (in brief).

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the diffraction phenomenon in crystals L1
- Identify the factors affecting diffraction pattern intensities L2
- Explain the polycrystalline nature of the material L3
- Analyze the crystal structure and crystallite size by various methods L4
- Illustrate the Small angle X-ray scattering (SAXS) L2

UNIT – II: MICROSCOPY TECHNIQUE -1 –SCANNING ELECTRON MICROSCOPY(SEM) 9 Hrs

Introduction, Principle, Construction and working principle of Scanning Electron Microscope, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic concepts and working principle of Scanning Electron Microscope L1
- Classify the different types of Scanning Electron Microscope modes used L2
- Identifies the specimen preparation for Scanning Electron Microscope L2
- Analyze the morphology of the sample by using Scanning Electron Microscope L4
- Understand the advantages and limitations of Scanning Electron Microscope L2

UNIT – III: MICROSCOPY TECHNIQUE -2 - TRANSMISSION ELECTRON MICROSCOPY (TEM) 9Hrs

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantages and Limitations of Transmission Electron Microscopy.

Learning Outcomes:

- Explain the basic principle and working principle of Transmission Electron Microscope
- Classify the different types of Transmission Electron Microscope modes used L1
- Identifies the specimen preparation for Transmission Electron Microscope L2
- Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope L2
- Understand the advantages and limitations of Transmission Electron Microscope L2
- Explain the basic principle and working principle of Transmission Electron Microscope L3

UNIT – IV:SPECTROSCOPY TECHNIQUES **9Hrs**

Principle, Experimental arrangement, Analysis and Advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principle and experimental arrangement of spectrometers **L1**
- Understand the analysis and advantages of the spectroscopic techniques **L2**
- Explain the concept of UV-Visible spectroscopy **L2**
- Explain the principle and experimental arrangement of Raman Spectroscopy **L2**
- Explain the principle and experimental arrangement of Fourier Transform infrared (FTIR) spectroscopy **L2**
- Explain the principle and experimental arrangement of X-ray photoelectron spectroscopy (XPS) **L2**

UNIT – V: ELECTRICAL & MAGNETIC CHARACTERIZATION TECHNIQUES

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID (Superconducting Quantum Interference Device)

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the various types of electrical properties analysis techniques **L1**
- Classify the solar cells based on manufacturing material **L2**
- Explain the effect of magnetic field on the electrical properties **L2**
- Analyze the magnetization by using induction method **L2**
- Explain the construction and working principle of VSM **L2**
- Explain the construction and working principle of SQUID **L2**

Text Books:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall ,2001 – Science.

Course Outcomes:

At the end of this Course the student will be able to

- Identify the various characterization techniques **L1**
- Classify the characterization techniques based on their applications and properties **L2**
- Apply the various characterization techniques for materials characterization. **L3**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS44-Green Chemistry and Catalysis for sustainable Environment

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products

Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

UNIT – 1: Principles and concepts of green chemistry **9 Hrs**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic reactions: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the Green chemistry Principles for day to day life as well as synthesis L3
- Describe the sustainable development and green chemistry L2
- Explain economic and un-economic reactions L2
- Demonstrate Polymer recycling L2

UNIT – II: : Catalysis and green chemistry **10Hrs**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal ion Catalysis, Organo-catalysis, Greener Lewis Acids, Asymmetric Catalysis, Phase transfer catalysis: Hazard Reduction, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries L2
- Differentiate Homogeneous and Heterogeneous catalysis L2
- Identify the importance of Bio and Photo Catalysis L3
- Discuss Transition metal and Phase transfer Catalysis L3

UNIT – III: Organic solvents: environmentally benign solutions **7 Hrs**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbon dioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalysts and solvents

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate Organic solvents and importance of solvent free systems L3
- Discuss Super critical carbondioxide L2
- Explain Super critical water and water as a reaction solvent L2
- Interpret Ionic Liquids as Catalyst and Solvent L2

UNIT – IV: Emerging greener technologies and alternative energy sources **8 Hrs**

Biomass as renewable resource, solar power, other forms of renewable energy, introduction and applications of Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources. The Syngas Economy, The Bio-refinery, Design for energy efficiency: Photochemical Reactions and Examples, advantages and Challenges.

Microwave-assisted Reactions-examples and applications, sono-chemical reactions- examples and applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe importance of Biomass and Solar Power L2
- Illustrate Sonochemistry and Green Chemistry L2
- Apply Green Chemistry for Sustainable Development L3
- Discuss the importance of Renewable resources L3

UNIT – V: Green processes for green nanoscience **8 Hrs**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing nanoscience. Green Synthesis of nanophase inorganic materials and metal oxide nanoparticles: microwave-assisted synthesis, green synthesis of metal and metal oxide nanoparticles, green chemistry applications of inorganic nanomaterials

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss green Chemistry Principles for practicing Green nano synthesis L3
- Illustrate Microwave Assisted Synthesis L2
- Differentiate Hydrothermal and Reflux synthesis L2
- Demonstrate Green Chemistry applications of Inorganic nanomaterials L2

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA, 1997.

Reference Books:

1. Sanjay K. Sharma and AckmezMudhoo, Green Chemistry for Environmental Sustainability, First Edition, , CRC Press, 2010.
2. AlvisePerosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013

Course Outcomes:

At the end of this Course the student will be able to

- Apply the Green chemistry Principles for day to day life as well as synthesis for sustainable development. L3
- Differentiate Homogeneous and Heterogeneous catalysis L2
- Demonstrate Organic solvents and importance of solvent free systems L2
- Describe importance of Biomass and Solar Power for green environment. L2
- Discuss green Chemistry Principles for practicing Green nano synthesis using Microwave Assisted technique. L3

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS45-Chemistry of Nanomaterials and applications

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- And also characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

UNIT – 1: Introduction to nanoscience **8 Hrs**

Introduction, importance of nanomaterials, nanoscience in nature, classification of nanostructured materials, properties, scope of nanoscience and nanotechnology& applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the nanostructure materials L2
- Describe scope of nanoscience and technology L2
- Explain different synthetic methods of nanomaterials L2
- Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material L3

UNIT – II: : Synthesis of nanomaterials **10 Hrs**

Bottom-Up approach:- Sol-gel synthesis, micro emulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis.

Top-Down approach:- Arc discharge Plasma arc method, aerosol synthesis, ion sputtering, laser pyrolysis, laser ablation, chemical vapour deposition method, electro deposition method, and high energy ball milling.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the top down approach L2
- Explain aerosol synthesis and plasma arc technique L2
- Differentiate chemical vapour deposition method and electrodeposition method L2
- Discuss about high energy ball milling L3

UNIT – III: Characterization nanomaterials **7 Hrs**

Techniques for characterization: Dynamic light scattering for particle size determination, Diffraction technique, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss different technique for characterization of nanomaterial L3
- Explain electron microscopy techniques for characterization of nanomaterial L3
- Describe BET method for surface area analysis L2
- Apply different spectroscopic techniques for characterization L3

UNIT – IV: Structural studies of nanomaterials **8 Hrs**

Properties of nanomaterials: fullerenes, carbon nanotubes, core-shell nanoparticles. Nano-crystalline materials, magnetic nanoparticles and important properties in relation to nano-magnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain synthesis and properties and applications of nanaomaterials **L2**
- Discuss about fullerenes and carbon nanotubes **L3**
- Differentiate nanomagnetic materials and thermoelectric materials **L2**
- Describe liquid crystals **L2**

UNIT – V: Applications of Nanomaterials **7 Hrs**

Engineering, medicine, aerospace applications of nanomaterials

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate applications of nanaomaterials **L2**
- Discuss the magnetic applications of nanomaterials **L3**
- List the applications of non-linear optical materials **L1**
- Describe the applications fullerenes, carbon nanotubes **L2**

Text Books:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012

Reference Books:

1. Ludovico Cademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Concepts of Nanochemistry; Wiley-VCH, 2011.
2. Guozhong Cao, Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Imperial College Press, 2007
3. C. N. R. Rao, Achim Muller, K.Cheetham, Nanomaterials Chemistry, , Wiley-VCH, 2007

Course Outcomes:

At the end of this Course the student will be able to

- Understand the state of art synthesis of nano materials **L1**
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry. **L2**
- Analyze nanoscale structure in metals, polymers and ceramics **L3**
- Analyze structure-property relationship in coarser scale structures **L3**
- Understand structures of carbon nano tubes **L1**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS46-Environmental Management and Audit

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To make the student understand evolution of LCA, stages in product LCA, procedure and applications for LCA.
- To understand the EMS core elements, benefits, certification, ISO 14000 series, evolution, principles, structure.
- To impart knowledge on environmental monitoring, modelling, technology assessment, risk assessment.
- Understand necessity of environmental design, principles, benefits, strategies.
- To understand types of audit, general audit methodology, audit process and apply the various domestic, industrial activities.

UNIT – 1: Life Cycle Assessment (LCA): 8 Hrs

Evolution, stages, a code of good conduct for LCA, procedure for LCA-goal and scope, analyzing the inventory, assessing the environmental impact, evaluating environmental profiles, applications in government & private Sector

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate code of good conduct for LCA **L2**
- Discuss scope, analyzing the inventory and assessing the environmental impact **L3**
- List evolution and stages of LCA **L1**
- Describe the applications in government & private Sector **L2**

UNIT – II: Environmental Management System Standards: 8 Hrs

Environmental Management Systems – Core Elements, benefits, certification and documentation, EMS Standards – ISO 14000 series – evolution, principles, structure, supporting systems, specification standards, implementation and benefits of Implementing

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain Environmental Management Systems **L3**
- Describe EMS Standards – ISO 14000 series **L2**
- Apply Environmental Management Systems for certification and documentation **L3**

UNIT – III: Environmental Monitoring, Modeling& Risk Assessment 8 Hrs

Forecasting & Growth modeling, sensitivity Analysis, Applications of remote sensing and GIS, Environmental technology Assessment. Environmental risk assessment in industry, ecosystem approach to risk assessment, Eco-Mapping, Environmental Education

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate Applications of remote sensing and GIS in Environmental assessment **L2**
- Discuss environmental risk assessment in industry **L3**
- List ecosystem approach to risk assessment, Eco-Mapping, Environmental Education **L1**

UNIT – IV: Environmental Design & Economics **10 Hrs**

Principles, Benefits, Motivation, ED for manufactured products- Considerations in product life stages, Tools for products, Eco-labelling, ED for Building – Principles and Strategies for green building construction, ED for development and planning.

Economics and Environment -environmental cost, benefits, taxes, accounting, environmental Valuation – categorization and valuation techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe principles, benefits and motivation of environmental Design for manufactured products **L2**
- Explain principles and Strategies for green building construction **L2**
- Differentiate ED for Building cost, benefits and taxes **L2**
- Discuss about categorization and valuation techniques w.r.t economics and environment **L3**

UNIT – V: Environmental Auditing **8 Hrs**

Objectives, Scope, types, Basic structure and steps of EA, Elements of Audit process – What, Who, Why, How, Waste audits, EA in industrial projects, Liability audit and site assessment.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate Basic structure and steps of environmental auditing **L2**
- Discuss environmental auditing in industrial projects in terms of liability audit and site assessment **L3**
- List Scope and types environmental auditing **L1**

Text Books:

1. Environmental Management, Vijay Kulkarni & T. V. Ramachandra, Capital Publishing Company, New Delhi, 2006.
2. Concepts of Environmental Management for Sustainable Development, M.C. Dash, Wiley Publications, 2019.

Reference Books:

1. Ajith Sankar, Environmental Management, OXFORD publications, 2015
2. Ni Bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, Tata McGraw-Hill Publications, 2006.
3. Gary Skinner, Ken Crafer, Environmental Management, , Cambridge, IGCSE, 2017

Course Outcomes:

At the end of this Course the student will be able to

- Classify the stages in LCA with goal and procedures **L2**
- Describe the structure of EMS, Explain benefits of EMS, Differentiate core elements of EMS, Discuss about certification of ISO 14000 series. **L2**
- Discuss Forecasting & Growth modeling and Ecosystem Approach to Risk Assessment and Environmental Education. **L3**
- Explain Principles and Strategies for green building construction. **L2**
- Illustrate Objectives, Scope of Environmental auditing, elements of Audit process, liability audit and site assessment. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE65a-REMOTE SENSING AND GIS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Introduce the basic principles of Remote Sensing and GIS techniques.
- Teach various types of satellite sensors and platforms
- Impart concepts of visual and digital image analyses
- Teach concepts of principles of spatial analysis
- Teach about the application of RS and GIS in Civil engineering

UNIT – I:

Introduction to photogrammetry: Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

Learning Outcomes:

At the end of this unit, the student will be able to
- Understand concepts of photogrammetry
- Estimate heights and distances.

UNIT – II:

Remote sensing: Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

Learning Outcomes:

At the end of this unit, the student will be able to
- Understand advantages of remote sensing
- Demonstrate concepts of remote sensing.

UNIT – III:

Geographic information system: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

Learning Outcomes:

At the end of this unit, the student will be able to
- Understand concepts of GIS.
- Explain data collection and data interpretation
- Develop terrain characteristics using Mapping

UNIT – IV:

GIS spatial analysis: Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know applications of GIS and data interpretation.

UNIT – V:

Water resources applications: Land use/Land cover in water resources, Surface water mapping and inventory -Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know applications of RS & GIS in water resources applications.
- Study technological problems like reservoir sedimentation ground water identification

Text Books:

1. Remote Sensing and GIS by B.Bhatta, Oxford University Press,NewDelhi
2. Advanced surveying : Total station GIS and remote sensing – Satheesh Gopi – Pearson publication.

Reference Books:

1. Fundamentals of remote sensing by gorge Joseph , Universities press, Hyderabad.
2. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall(India) Publications
3. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications
4. Remote sensing and GIS by M.Anjireddy , B.S.Pubiliications, NewDelhi
5. Remote Sensing and its applications by LRA Narayana University Press1999
6. GIS by Kang – tsungchang, TMH Publications &Co
7. Principals of Geo physical Information Systems – Peter A Burragh and Rachael Mc Donnell Oxford Publishers2004

Course Outcomes:

At the end of this Course the student will be able to

- Comparing with ground, air and satellite based sensor platforms.
- Interpret the aerial photographs and satellite imageries.
- Create and input spatial data for GIS application.
- Apply RS and GIS concepts in water resources engineering.
- Applications of various satellite data.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE65b-ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart knowledge on different concepts of Environmental Impact Assessment
- To teach procedures of risk assessment
- To teach the EIA methodologies and the criterion for selection of EIA methods
- To teach the procedures for environmental clearances and audit

UNIT – I:

INTRODUCTION: Basic concept of EIA : Initial environmental Examination, Elements Of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the elements of EIA

UNIT – II:

EIA METHODOLOGIES:-

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the criteria for selection of EIA methodology

UNIT – III:

IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE:-

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

Learning Outcomes:

At the end of this unit, the student will be able to

- Study the factors causing impact of development activities
- Decide mitigation measures of pollution on environment

UNIT – IV:

ASSEMENT OF IMPACT ON VEGETATION AND WILDLIFE :

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation -- Causes and effects of deforestation.

ENVIRONEMNTAL AUDIT :

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand effect of development activities on environment.
- Know the design procedures for assessment of environmental risk

- Learn about the process of environmental auditing.
- Understand procedures for preparation of environmental audit report

UNIT – V:

ENVIRONEMENTAL ACTS (PROTECTION AND PREVENTION)

Post Audit activities, The Environmental protection Act, The water preventation Act, The Air (Prevention & Control of pollution Act.), and Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the importance of environmental protection acts
- Explain acts and notifications in Environmental legislation

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers

Reference Books:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katari& Sons Publication., NewDelhi
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

Course Outcomes:

At the end of this Course the student will be able to

- Understand the concept of Environmental impact
- Understand the methodologies related to EIA
- Appreciate various laws related to environmental protection
- Prepare the environmental impact assessment statement and to evaluate it.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE65c-DISASTER MANAGEMENT AND MITIGATION

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ
- Understand the 'relief system' and the 'disaster victim.'
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management

UNIT – I:

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about the natural hazards and its management
- To understand about the global warming, cyclones and tsunamis

UNIT – II:

Classification of hazards & Disasters: Natural hazards and Disasters - Man Made hazards & Disasters - Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate different types of hazards
- Understand different consequences of hazards

UNIT – III:

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake

Learning Outcomes:

At the end of this unit, the student will be able to

- understand about earthquakes and volacanicerruptions
- Understand effects of earthquakes and mitigation measures

UNIT – IV:

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters
Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves.Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts ofdroughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards /Disasters- Physical hazards/ Disasters

Learning Outcomes:

At the end of this unit, the student will be able to

- Obtain knowledge on exogenous hazards and causes
- Obtain knowledge on mitigation measures of cyclones, droughts etc.,

UNIT – V:

Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion.Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes.Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation-Biological hazards/ disasters:- Population Explosion.

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage(preparedness)-HVRA Atlas
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

Learning Outcomes:

At the end of this unit, the student will be able to

- Knowledge on soil erosion and its effects
- education related to risk reduction in communities in post and pre stage

Text Books:

1. Disaster Management by Rajib Shah, Universities Press, India,2003
2. Disaster Mitigation: Experiences And Reflections by PardeepSahni
3. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning
4. National Disaster Management Authority-Guidelines

Reference Books:

1. Kates,B.I& White, G.F The Environment as Hazards, oxford, New York, 1978
2. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
3. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
4. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo,1994
5. Dr. Satender, Disaster Management in Hills, Concept Publishing Co., New Delhi

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE65a- ENERGY CONSERVATION & MANAGEMENT

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand energy efficiency, scope, conservation and technologies.
- To design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation Techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient Technologies.

UNIT – I: **09 Hrs**

Basic Principles of Energy Audit and management Energy audit – Definitions – Concept– Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various types of Energy Audit **L1**
- To know about various types of Energy conservation schemes and Energy Manager functions **L2**

UNIT – II: **09 Hrs**

Lighting Modification of existing systems – Replacement of existing systems – Priorities: Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various Lighting systems and types of lamps. **L1**
- To evaluate illumination level Illumination of inclined surface to beam and Design of Energy efficient lighting systems. **L2**

UNIT – III: **09 Hrs**

Power Factor and energy instruments Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various Methods of Power Factor improvement **L1**
- To know about various Energy Instruments **L3**

UNIT – IV: **09 Hrs**

Space Heating and Ventilation Ventilation – Air–Conditioning (HVAC) and Water Heating: Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about analysis of Heating and HVAC L1
- To know about Energy conservation methods L2

UNIT – V: **09 Hrs**

Economic Aspects and Analysis Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).Computation of Economic Aspects Calculation of simple payback method – Net present worth method – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic concept of Analysis of Economics and different methods L1
- To know about Computation of Economic Aspects Calculation L2

Text Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy efficient electric motors by John.C.Andreas, Marcel Dekker Inc Ltd-2nd edition,1995.

Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1stedition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I K International Publishing House pvt.ltd, 2011.
5. http://www.energymanagertraining.com/download/Gazette_of_IndiaP art IISecI-37_25-08-2010.pdf

Course Outcomes:

At the end of this Course the student will be able to

- Explain energy efficiency, conservation and various technologies. L1
- Design energy efficient lighting systems. L2
- Calculate power factor of systems and propose suitable compensation techniques. L3
- Explain energy conservation in HVAC systems. L4
- L5

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE65b- PLC AND ITS APPLICATIONS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The student will be able to:

- Understand the basic functions and types of PLCs
- Get exposure of Easy Veep software, its applications
- Classification of PLCs and applications
- Programming using PLCs
- Troubleshooting aspects using PLCs

UNIT – I: Introduction

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen- Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about basic functions of PLCs & classification of PLCs — **L1**
- To distinguish between PLCs and Mechanical relays — **L2**
- To know about Processor and I/O cards

UNIT – II: **10 Hrs**

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about Easy Veep software & about Logic diagrams — **L1**
- To understand about Search engine & interfacing of PC and PLCs — **L2**

UNIT – III: PLC software and applications **10 Hrs**

Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic features of PLCs & various instructions of PLC — **L1**
- To know about various PLC versions & understand about Cascade control and subroutines — **L2**

UNIT – IV: Programming instructions **10 Hrs**

Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions – Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various Programming instructions & understand Math instructions in PLCs **L1**
- To know about Logical instructions & understand about Communications with PLC using set up and monitoring **L2**

UNIT – V: Analog and Digital parameters **10 Hrs**

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about analog and digital parameters in certain PLCs & apply PLCs for control system stability aspects **L1**
- To know about troubleshooting techniques & identify few applications of PLCs in Science and Technology fields **L2**

Text Books:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

Reference Books:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers,2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Understand different types of PLCs **L1**
- Understand the usage of Easy Veep software **L2**
- Understand the hardware details of Allen Bradley PLC **L3**
- Programming of PLCs **L4**
- Know about few applications of PLCs in different fields of Science and Technology **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE65c- SYSTEM RELIABILITY CONCEPTS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- The Basic concepts, rules for combining probabilities of events, failure density and distribution functions.
- Evaluation of network Reliability / Unreliability and types of redundancies.
- Evaluation of network Reliability / Unreliability using conditional probability method.
- Expected value and standard deviation of Exponential distribution and Measures of reliability.
- Evaluation of Limiting State Probabilities of one, two component repairable models.

UNIT – I: Basic Probability Theory **09 Hrs**

Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic rules for probabilities of events **L1**
- Get detailed information about Probability of failure density and distribution Functions and obtain the expected value and standard deviation for binomial distribution. **L2**

UNIT – II: Network Modeling and Reliability Evaluation **09 Hrs**

Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cutset based approach – complete event tree and reduced event tree methods - Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- How to find the Probability of success and failures of network using different approaches for series-parallel configurations. **L1**
- To find reliability / unreliability of complex systems using different methods **L2**

UNIT – III: Time Dependent Probability **09 Hrs**

Basic concepts – Reliability functions f(t), Q(t), R(t), h(t) – Relationship between these functions – Bath tub curve – Exponential failure density and distribution functions - Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel, Series-Parallel systems - Partially redundant systems - Evaluation of reliability measure – MTTF for series and parallel systems – Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of time domain functions and relationship between them. and obtain the expected value and standard deviation for exponential distribution. **L1**
- To obtain probabilistic measures for fully redundant and partially redundant configurations **L2**

UNIT – IV: Discrete Markov Chains & Continuous Markov Processes **09 Hrs**

Markov Chains: Basic concepts – Stochastic transitional Probability matrix – time dependent probability evaluation – Limiting State Probability evaluation – Absorbing states.

Markov Processes: Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach - Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of Stochastic Transitional Probability Matrix, Limiting State Probability **L1**
- Understand the concept of Frequency balance approach. And To distinguish between Markov chains and Markov processes **L2**

UNIT – V: Multi Component & Approximate System Reliability Evaluation **09 Hrs**

Recursive relation for evaluation of equivalent transitional rates– cumulative probability and cumulative frequency and 'n' component repairable model – Series systems, Parallel systems, Basic probability indices – Series, Parallel systems – Complex Systems– Cutset approach – Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of recursive relation for evaluation of equivalent transitional rates. **L1**
- To know about computation of basic probability indices for series, parallel configurations **L2**

Text Books:

1. Reliability Evaluation of Engineering Systems by Roy Billinton and Ronald N. Allan, Reprinted in India B. S. Publications, 2007.
2. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.

Reference Books:

1. Introduction to Reliability Engineering by E. E. Lewis by Wiley Publications.
2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000.
3. Reliability and Safety Engineering by Ajit Kumar Verma, SrividyaAjit and Durga Rao Karanki, Springer, Second Edition, 2016. System Reliability Theory Marvin Rausand and ArnljotHoyland, Wiley Publictions.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the concepts for combining Probabilities of events, Bernoulli's trial, and Binomial distribution. **L1**
- Network Reliability/Unreliability using conditional probability, path and cutest based approach, complete event tree and reduced event tree methods. **L2**
- Understanding Reliability functions and to develop relationship between these functions, expected value and standard deviation of Exponential distribution and measures of reliabilities. **L3**
- Analyze the time dependent reliability evaluation of single component repairable model, frequency and duration concepts, Frequency balance approach. **L4**
- `Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model. **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC65a-INTRODUCTION TO MICROCONTROLLER AND APPLICATIONS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand the basic concepts and architecture of 8051.
- To learn various instructions and addressing modes used in 8051
- To be able to write programs in assembly language for 8051
- To be able to program 8051 Timers and implement serial communication for a given application.
- To learn interfacing of memory, I/O devices and the usage of Interrupts.

UNIT – I:

Architecture of 8051: Introduction, Block diagram of 8051 Microcontroller, Functions of each block, Pin details of 8051, ALU,ROM, RAM, Memory Organization of 8051, Special function registers, Program Counter, PSW register, Stack, I/O Ports, Timer, Interrupt, Serial Port, Oscillator and Clock, Clock Cycle, Machine Cycle, Instruction cycle, Reset, Power on Reset.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the architecture of 8051 microcontroller. **L2**
- Learn the functions of each block of 8051 microcontroller. **L1**

UNIT – II:

Instruction Set of 8051: Instruction set of 8051, Classification of 8051 Instructions, Data transfer instructions, Arithmetic Instructions, Logical instructions, Branching instructions, Bit Manipulation Instructions

Assembler and Addressing Modes: Assembling and running an 8051 program, Structure of Assembly Language, Assembler directives, Different addressing modes of 8051.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know different instructions available in the Instruction set of 8051. **L1**
- Learn and use different types of addressing modes of 8051 microcontroller. **L1**

UNIT – III:

Programs: Arithmetic operations, Biggest Number / Smallest Number, Ascending order / Descending order, BCD to HEX Conversion, HEX to BCD Conversion, Odd Parity Generator Even Parity Generator, Time delay routines

I/O: Bit addresses for I/O and RAM, I/O programming, I/O bit manipulation programming.

Learning Outcomes:

At the end of this unit, the student will be able to

- Write assembly language program in 8051 for simple operations. **L6**
- Gain knowledge about different mappings used in 8051 microcontroller. **L1**

UNIT – IV:

Timer: Programming 8051 Timers, Timer registers, Different modes of Timer, Programming timer in different modes, Counter programming, Different modes of Counter, Sample programs.

Serial Communication: Basics of Serial communication, UART, RS 232 Protocol, 8051 interface to RS 232, 8051 UART Programming, SPI and I^2C implementation on 8051.

Learning Outcomes:

At the end of this unit, the student will be able to

- Write programs to use the 8051 Timers for a given application. **L6**
- Use different types of serial communication devices based on the application. **L3**

UNIT – V:

Interrupt: 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in 8051.**IC 8255**: IC 8255, Block Diagram, Modes of 8255, Interfacing with 8051.

Interfacing Techniques: Interfacing external memory to 8051, Sensor interfacing, ADC interfacing, DAC interfacing, Keyboard interfacing, Seven segment LED Display Interfacing, Stepper Motor interfacing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Interface memory and I/O devices for specific applications. **L4**
- Learn and apply Interrupts based on the application and usage. **L3**

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, 2008.
2. Ajit pal, "Microcontrollers, Principles and Applications", – PHI Ltd., - 2011.

Reference Books:

1. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", TATA McGraw Hill publications, 2007.
2. Krishna Kanth, "Microprocessors and Microcontrollers", PHI Publications, 2010

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts and architecture of 8051. **L2**
- Know the usage of various instructions and addressing modes in 8051 **L1**
- Write programs in assembly language for 8051 **L6**
- Program 8051 Timers and implement serial communication for a given application. **L6**
- Interface memory, I/O devices and use Interrupts. **L4**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC65b-PRINCIPLES OF DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete fourier series and fourier transforms.
- To design & analyze IIR digital filters from analog filters.
- To know various structures used in implementation of FIR digital filters.
- To grasp the importance and applications of Multirate Digital signal processing.

UNIT – I:

Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, LTI system Properties. Solution of Linear constant coefficient difference equations , frequency domain representation of discrete time signals and systems. Review of Z-transforms.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze and process signals in the discrete domain. **L4**
- Determine time domain representations and frequency domain analysis of discrete-time signals and systems. **L3**

UNIT – II:

Discrete Fourier Series and Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the pproperties of discrete fourier series. **L2**
- Describe DFT using FFT algorithms. **L1**

UNIT – III:

Design of IIR Digital Filters and Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design IIR digital filters from analog filters. **L6**
- Construct IIR digital filters with different realization techniques. **L6**

UNIT – IV:

Design of FIR Digital Filters and Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR digital filters using window techniques and frequency sampling technique, comparison of IIR & FIR filters, basic structures of FIR systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design FIR digital filters using window techniques. **L6**
- Construct the basic structures of FIR systems. **L6**

UNIT – V:

DSP Applications: Introduction to programmable DSPs, Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Adaptive filters: Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply Interpolation and Decimation with help of sampling and filtering. **L3**
- Understand the principle and applications of Forward Linear Predictive filter. **L2**

Text Books:

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithmsand Applications", Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing",PHI.
3. B.Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", TATA McGraw Hill, 2002.

Reference Books:

1. Andreas Antoniou, "Digital Signal Processing", TATA McGraw Hill, 2006
2. MH Hayes, "Digital Signal Processing", Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling and Sandra L. Harris, "Fundamentals of Digital Signal Processing using Matlab", Thomson, 2007.

Course Outcomes:

At the end of this Course the student will be able to

- Articulate the frequency domain analysis of discrete time signals. **L3**
- Understand the properties of discrete fourier series and fourier transforms. **L2**
- Design & analyze IIR digital filters from analog filters. **L6**
- Design various structures used in implementation of FIR digital filters. **L6**
- Summarize the importance and applications of Multirate Digital signal processing. **L2**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC65c-INTRODUCTION TO IMAGE PROCESSING

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To learn the fundamentals of Image Processing and learn the different types of image transforms.
- To study different types of filtering techniques for image enhancement.
- To understand various types of image segmentation and thresholding techniques.
- To gain knowledge on wavelets and multi resolution image processing techniques.
- To comprehend various types of image compression and colour image processing methods.

UNIT – I:

Digital Image Fundamentals: Fundamental steps of digital image processing, Components of Digital Image processing, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. Applications of Digital Image Processing.

Image Transforms: Fourier Transform and its properties in one dimensional and Two dimensional, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Sine transform, Walsh transform, Hadamard transform, Slant transform, KL Transforms and its properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the fundamentals of digital image processing. **L2**
- Analyze the image transforms in one and two dimensions. **L4**

UNIT – II:

Image Enhancements and Filtering: Gray level transformations, Histogram processing, histogram equalization, Enhancement of Frequency domain, Homomorphic filtering, Filtering in the frequency domain. Image Restoration: A Model of the Image Degradation \ Restoration Process, Noise Models, Inverse filtering, Minimum Mean Square Error (Weiner) Filtering, Constrained least squares filtering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the filters in spatial and frequency domains. **L4**
- Understand the image restoration model and various types of noises in image restoration. **L2**

UNIT – III:

Image Segmentation: Detection of Discontinuities: Point detection, Line detection, Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the concept of image segmentation. **L1**
- Analyze various types of thresholding techniques. **L4**

UNIT – IV:

Wavelets and Multi-resolution image processing: Back ground, Image Pyramids, Sub band coding, The Haar Transform.Multi resolution Expansions: Series Expansions, Scaling Functions, Wavelet Functions, Wavelet Transform in One dimension: The wavelet series expansions, The Discrete wavelet transform, The Continuous Wavelet Transform, The Fast wavelet Transform, Wavelet transform in two dimensions, Wavelet Packets.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the wavelets in one dimension and two dimensions. **L2**
- Explain the multi-resolution expansions and fast wavelet transform. **L1**

UNIT – V:

Image Compression: Redundancy, coding, inter-pixel and psycho-visual; Loss less compression – Huffmann coding, predictive coding; Lossy Image compression- predictive and transform coding; Image compression standards.

Color Image Processing: Color Fundamentals, Color models–RGB, CMY, HSI; Pseudo color Image Processing, Basics of Full color Image Processing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the need for image compression and its types. **L2**
- Learn the color image processing and various types of color models. **L1**

Text Books:

1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Second Edition, Pearson Education, 2008.
2. Anil Kumar Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2nd edition 2004.

Reference Books:

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, "Digital Image processing using MATLAB", Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan and T Veerakumar, "Digital Image processing", Tata McGraw Hill.
3. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the fundamentals of Image Processing and apply different types of image transforms. **L2**
- Correlate different types of filtering techniques for image enhancement. **L4**
- Understand various types of image segmentation and thresholding techniques. **L2**
- Gain knowledge on wavelets and multi resolution image processing techniques. **L1**
- Summarize different types of image compression and colour image processing methods. **L2**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS65a- INTRODUCTION TO MACHINE LEARNING

Open Elective-II

L	T	P	C
3	0	0	3

Course Objectives:

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.

UNIT – I: INTRODUCTION **8hrs**

Introduction: An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT – II: DECISION TREE LEARNING **8hrs**

Decision Tree Learning: - Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over fitting. Neural Network Learning: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT – III: SAMPLE COMPLEXITY AND OVER FITTING **8hrs**

Sample Complexity and Over fitting: Errors in estimating means. Cross Validation and jackknifing VC dimension. Irrelevant features: Multiplicative rules for weight tuning. Support Vector Machines: functional and geometric margins.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT – IV: INSTANCE-BASED TECHNIQUES **7 Hrs**

Instance-based Techniques: Lazy vs. eager generalization. K nearest neighbor, case- based reasoning. Clustering and Unsupervised Learning: K-means clustering, Gaussian mixture density estimation, model selection

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**

- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT – V: Genetic Algorithms

Genetic Algorithms: Different search methods for induction - Explanation-based Learning: using prior knowledge to reduce sample complexity. Dimensionality reduction: feature selection, principal component analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Tom Michel, Machine Learning, McGraw Hill, 1997
2. Trevor Has tie, Robert Tibshirani & Jerome Friedman. The Elements of Statically Learning, Springer Verlag, 2001.

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001 3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.

Course Outcomes:

At the end of this Course the student will be able to

- Student should be able to understand the basic concepts such as decision trees and neural networks.Ability to formulate machine learning techniques to respective problems **L2**
- Apply machine learning algorithms to solve problems of moderate complexity. **L3**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS65b- INTRODUCTION TO COMPUTER NETWORKS

Open Elective-II

L	T	P	C
3	0	0	3

Course Objectives:

This course is designed to:

- Introduce the basic concepts of Computer Networks.
- Familiarize with the layered approach and different layers of computer networks.
- Familiarize with the design issues of different layers.
- Explain the working of different protocols of a computer network..

UNIT – I: INTRODUCTION **8hrs**

Introduction: Uses of computer networks, network hardware, Protocol Hierarchies, Design Issues for the layers, Connection oriented vs Connectionless Service. **The physical layer:** The theoretical basis for data communication, Guided transmission media, wireless transmission, communication satellites.

Learning Outcomes:

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT – II: THE DATA LINK LAYER **8hrs**

The data link layer: Data link layer design issues, error detection and correction, elementary data link protocols, sliding window protocols

The medium access control: The channel allocation problem, multiple access protocols, Ethernet.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT – III: THE NETWORK LAYER **8hrs**

The network layer: Network layer design issues, Flooding, Distance Vector Routing, Link state Routing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT – IV: IP VERSION 4 PROTOCOL **7 Hrs**

The IP version 4 Protocol, IP Addresses, IP version 6, Internet control protocols, OSPF, BGP, Internet multicasting.

The transport layer: Elements of transport protocols, congestion control, The internet transport protocols: UDP and TCP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**

- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT – V: THE APPLICATION LAYER

The application layer: DNS- The Domain Name System, Electronic Mail, WWW Architectural Overview, Static Web pages, Dynamic web pages and web applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.

Course Outcomes:

Students will be able to:

- Recognize the method of using layered approach for design of computer networks. **L2**
- Explain the functionality of each layer of a computer network. **L3**
- Apply the knowledge of layered approach for the design of computer network software **L4**
- Analyze the performance of protocols of a computer network. **L4**
- Recommend the protocols for different applications. **L5**
- Propose new protocols for a computer networks. **L6**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS65c- WEB DESIGN AND MANAGEMENT

Open Elective-II

L	T	P	C
3	0	0	3

Course Objectives:

- To Learn the basic concepts in HTML, CSS, JavaScript
- To Understand the responsive design and development
- To learn the web project management and maintenance process
- To Design a Website with HTML, JS, CSS / CMS - Word press

UNIT – I: WEB DESIGN - HTML MARKUP FOR STRUCTURE **8hrs**

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

Learning Outcomes:

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT – II: CSS AND JAVASCRIPT **8hrs**

CSS - Formatting text - Colours and Background - Padding, Borders and Margins – Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation – JavaScript - Using Java Script.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT – III: RESPONSIVE WEB DESIGN **8hrs**

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or DesktopFirst - CSS Grids; CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT – IV: WEB PROJECT MANAGEMENT **7 Hrs**

Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development, Communicaton, Documentation - QA and testing -Deployment - Support and operations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**
- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT – V: PROJECT CASE STUDY

Using HTML, CSS, JS or using Opensource CMS like Word press, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015
3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

Reference Books:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014
2. Jon Duckett, Jack Moore, "JavaScript & JQuery: Interactive Front-End Web Development", John Wiley and Sons, edition 2014
3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017 4. Word press - http://www.wpbeginner.com/category/wp-tutorials/

Course Outcomes:

At the end of this Course the student will be able to

- Recognize the method of using layered approach for design . **L2**
- Explain the functionality of each layer of a computer network. **L3**
- Apply the knowledge of layered approach for the design of computer network software **L4**
- Analyze the performance of protocols of a computer network. **L4**
- Recommend the protocols for different applications. **L5**
- Propose new protocols for a computer networks. **L6**

OPL · II

Department of Humanities R19

B.Tech ~~IV~~ III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS15a-MANAGEMENT SCIENCE

(Humanities Elective-II)(Common to [illegible])

CE & ME

L	T	P	C
3	0	0	3

Course Objectives:

- Understand the role of entrepreneurship in economic development.
- Identify the general characteristics of entrepreneurs.

UNIT – I

INTRODUCTION TO MANAGEMENT

Concepts of Management - Nature, importance and Functions of Management - Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Leadership Styles, Social responsibilities of Management.

DESIGNING ORGANIZATIONAL STRUCTURES

Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, team structure) their merits, demerits and suitability.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of management and organization. **L1**
- Apply the concepts & principles of management in real life industry. **L2**

UNIT – II

OPERATIONS MANAGEMENT:

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study. Statistical Quality Control: *c* chart, *p* chart, (simple Problems) Deming's contribution to quality.

MATERIALS MANAGEMENT: EOQ, Purchase Procedure and Stores Management. Inventory — functions. Types, inventory classification techniques.

Marketing: Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the core concepts of Management Science and Operations Management. **L1**
- Evaluate Materials departments & Determine EOQ. **L2**

UNIT – III

HUMAN RESOURCES MANAGEMENT (HRM):

Concepts of HRM, Personnel Management and Industrial Relations (PMIR), Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation, Merit Rating and methods.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development. **L1**
- Apply Managerial and operative Functions. **L2**

1/10/21

UNIT – IV

STRATEGIC MANAGEMENT:

Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

PROJECT MANAGEMENT (PERT/CPM):

Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise. **L1**
- Evaluate PERT and CPM Techniques. **L2**

UNIT – V

CONTEMPORARY MANAGEMENT PRACTICES:

Basic concepts of MIS, Materials Requirement Planning (MRP), Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma concept, Supply Chain Management, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze CRM, MRP, TQM. **L1**
- Understand modern management techniques. **L2**

Text Books:

1. **Management Science**, Aryasri: TMH, 2004.
2. **Management**, Stoner, Freeman, Gilbert, 6th Ed, Pearson Education, New Delhi, 2004.

Reference Books:

1. **Marketing Mangement**, Kotler Philip & Keller Kevin Lane: 12/e, PHI,2005.
2. **Essentials of Management** ,Koontz & Weihrich:, 6/e, TMH, 2005.
3. **Management—Principles and Guidelines**, Thomas N.Duening & John M.Biztantra, 2003.
4. **Production and Operations Management**, Kanishka Bedi, , Oxford University Press, 2004.

Course Outcomes:

At the end of this Course the student will be able to

- Equipping engineers for a lifelong career addressing the critical technical and managerial needs of private and public organizations. **L1**
- Exploring and developing analytic abilities, making better decisions, developing and executing strategies while also leading people who innovate. **L2**
- Cultivating the technical skills as well as the behavioral challenges of running organizations and complex systems. **L3**
- Emphasizing quantitative analytic skills and an entrepreneurial spirit **L4**
- Have an introductory understanding of global entrepreneurship concepts. **L5**

Department of Humanities R19

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS15b-BUSINESS ENVIRONMENT

(Humanities Elective-II)(Common to [illegible])

CE & ME

L	T	P	C
3	0	0	3

Course Objectives:

- To make the student understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.

UNIT – I: BUSINESS ENVIRONMENT

Meaning – Various environments affecting business – Social Economic; Political and Legal; Culture; Competitive Demographic; Technological and International environments.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Business environment. **L1**
- Explain various types of business environment. **L2**

UNIT – II: FISCAL & MONETARY POLICY

FISCAL POLICY - Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - **MONETARY POLICY** - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of public revenue and public Expenditure **L1**
- Explain the functions of RBI and its role. **L2**

UNIT – III: TRADE POLICY

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - **BALANCE OF PAYMENTS** – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the role of Indian international trade. **L1**
- Analyze causes for Disequilibrium and correction measure. **L2**

UNIT – IV: WORLD TRADE ORGANIZATION

WORLD TRADE ORGANIZATION - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Dispute Settlement Mechanism. **L1**
- Compare and contrast the Dumping and Anti-dumping Measures. **L2**

UNIT – V: MARKETS

MONEY MARKETS AND CAPITAL MARKETS - Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

Learning Outcomes:

1/10/21

At the end of this unit, the student will be able to

- Apply the knowledge in future investments. **L1**
- Understand the role of SEBI in investor protection. **L2**

Text Books:

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hallof India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition.HPH2016.

Reference Books:

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases,Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the knowledge of Money markets in future investment. **L1**
- Analyze India's Trade Policy. **L2**
- Evaluate fiscal and monitory policy. **L3**
- Develop a personal synthesis and approach for identifying business opportunities. **L4**
- `Understand various types of business environment. **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS13-ENGLISH LANGUAGE SKILLS LAB

(Common to CE & ME)

L	T	P	C
0	0	3	1.5

Course Objectives:

- Students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL and GMAT etc.
- students will be trained to use language effectively to face interviews, group discussions, public speaking

UNIT – I: **12Hrs**

1. Phonetics for listening comprehension of various accents -2
2. Formal Presentations using PPT slides without Graphic Elements.
3. Paraphrasing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different accents spoken by native speakers of English **L1**
- Make formal structured presentations on general topics using PPT slides without graphical elements **L2**

UNIT – II: **12Hrs**

1. Debate – 2 (Following Argument).
2. Listening to short speeches/ short stories for note-making and summarizing.
3. E-mail Writing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Participate in formal discussions and speak clearly on a specific topic using suitable discourse markers. **L1**
- Make formal structured presentations on academic topics using ppt slides with relevant graphical elements. **L2**

UNIT – III **12Hrs**

1. Listening for Discussions.
2. Group Discussions.
3. Writing Persuasive/argumentative essays on general topics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Participate in group discussions using appropriate conventions and language strategies. **L1**
- Produce logically coherent persuasive/argumentative essays. **L2**

UNIT – IV **12Hrs**

1. Reviewing film/book.
2. Group Discussions – reaching consensus in Group Work.
3. Resume Writing – Cover Letter – Applying for Internship.

Learning Outcomes:

At the end of this unit, the student will be able to

- Express thoughts and ideas with acceptable accuracy and fluency with a view to reach consensus in group discussions **L1**
- Prepare a CV and write a cover letter to seek internship/job **L2**

UNIT – V **12Hrs**

1. Writing Project Reports.
2. Editing Short Texts.
3. Answering FAQs in Interviews.

Learning Outcomes:

At the end of this unit, the student will be able to

- Collaborate with a partner to make effective presentations. **L1**
- Understand the structure and produce an effective project report. **L2**

Suggested Software

- Walden Infotech English Language Communication Skills.
- iTell- Orell Digital Language Lab.
- Digital Teacher.
- LES(Learn English Select) by British council.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.
- English Pronunciation in Use (Elementary, Intermediate, Advanced)CUP.
- Cambridge Advanced Learners' English Dictionary withCD.

Reference Books:

1. Meenakshi Raman &Sangeeta Sharma, "Technical Communication" O U Press2009.
2. Barron's Books on TOEFL/GRE/GMAT/CAT/IELTS /DELTA/Cambridge University Press.2012
3. Butterfield Jeff, "Soft Skills for Everyone", Cengage Publications,2011.
4. "Practice Psychometric Tests": How to familiarize yourself with genuine recruitment tests, 2012.
5. David A McMurrey & Joanne Buckely "Handbook for Technical Writing" CENGAGE Learning2008.
6. "A Textbook of English Phonetics for Indian Students", 2nd Edition, T.Balasubramanyam. (Macmillan),2012.
7. "A Handbook for English Laboratories", E. Suresh Kumar, P. Sreehari, Foundation Books, 2011.
8. Sambaiah.M. ***Technical English***, Wiley publishers India. New Delhi. 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills. **L1**
- Apply communication skills through various language learning activities. **L2**
- Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. **L3**
- Evaluate and exhibit acceptable etiquette essential in social and professional settings **L4**
- Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. **L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME66 – HEAT TRANSFER LAB

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to make the students learn about

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

List of Experiments

1. Determine the overall heat transfer coefficient across the width of composite wall
2. Determine the thermal conductivity of a metal rod
3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus
4. Determine the thermal conductivity of insulating material through lagged pipe apparatus
5. Determine the efficiency of a pin fin in natural and forced convection.
6. Determine the heat transfer coefficient for a vertical cylinder in natural convection
7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9. Determine the effectiveness of a parallel and counter flow heat exchanger.
10. Study the pool boiling phenomenon and different regimes of pool boiling.
11. Experiment on pool boiling
12. Determine the emissivity of the test plate surface.
13. Experiment on Stefan-Boltzmann apparatus
14. Determine the heat transfer rate coefficient in fluidized bed apparatus

Course Outcomes:

At the end of this Course the student will be able to

- Explain different modes of heat transfer **L1**
- Identify parameters for measurement for calculating heat transfer **L1**
- Determine effectiveness of heat exchanger **L5**
- Design new equipment related to heat transfer **L5**
- Apply principles of heat transfer in wide application in industries. **L3**

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AHS17-RESEARCH METHODOLOGY

(Common to CE & ME)

L	T	P	C
3	0	0	0

Course Objectives:

- Students should understand a general definition of research design.
- Students should be able to identify the overall process of designing a research study from its inception to its report.

UNIT – 1:

Meaning of Research — Objectives of Research — Types of Research — Research Approaches — Guidelines for Selecting and Defining a Research Problem — research Design — Concepts related to Research Design — Basic Principles of Experimental Design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of research and its process. **L1**
- Explain various types of research. **L2**

UNIT – II:

Sampling Design — steps in Sampling Design —Characteristics of a Good Sample Design — Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement — Tests of Sound Measurement — Scaling and Scale Construction Techniques — Time Seri. Analysis — Interpolation and Extrapolation. Data Collection Methods — Primary Data — Secondary data — Questionnaire Survey and Interviews.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of sampling and sampling design. **L1**
- Explain various techniques in measurement and scaling. **L2**

UNIT – III:

Correlation and Regression Analysis — Method of Least Squares — Regression on Correlation — Correlation on Determination — Types of Correlations and Their Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the association of two variables. **L1**
- Understand the importance of correlation and regression. **L2**

UNIT – IV:

Statistical Inference: Tests of Hypothesis — Hypothesis Testing Procedure — Sampling Theory — Sampling Distribution — Chi-square Test — Multi-variate Analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the statistical inference. **L1**
- Understand the hypothesis testing procedure. **L2**

UNIT – V:

Report Writing and Professional Ethics: Interpretation of Data — Report Writing — Layout of a Research Paper — Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars — Professional Ethics in Research.

Learning Outcomes:

1/10/21

At the end of this unit, the student will be able to

- Learn about report writing. **L1**
- Understand how to write research paper. **L2**

Text Books:

1. C.R.Kothari, "Research Methodology: Methods and Techniques",2nd edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, "Research Methodology":Ranjit Kumar, Sage Publications.

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1st Edition, Excel Books, New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9th edition.
3. S C Gupta, "Fundamentals of Statistics", 7th edition Himalaya Publications.
4. Dr. P.Satyanarayana, "a Companion to Literary Research", 1st edition 2020, HSRA publications.

Course Outcomes:

At the end of this Course the student will be able to

- Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling. **L1**
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project. **L2**
- Have basic knowledge on qualitative research techniques. **L3**
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting. **L4**
- Have basic awareness of data analysis-and hypothesis testing procedures. **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME71 – METROLOGY AND MEASUREMENTS

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the basic concepts of metrology and measurement methods.
- Demonstrate the importance of metrology in manufacturing
- Explain the concepts of transducers and its practical applications.
- Expose with various measuring instruments

UNIT – 1: Concept of Measurement **8 Hrs**

Concept of Measurement: General concept-generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

Linear and Angular Measurement: Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical. Angular measurements: Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

Learning Outcomes:
At the end of this unit, the student will be able to

- Identify important parameters in metrology. L3
- Differentiate interchangeability and selective assembly L4
- Select limits and tolerances for different assemblies. L1

UNIT – II: Flatness Measurement & Surface Roughness Measurement **6 Hrs**

Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Surface Roughness Measurement: Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R,M,S Values-Ra , Rz values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

Learning Outcomes:
At the end of this unit, the student will be able to

- Inspect the flatness of surfaces. L4
- Recall the terms used in surface roughness measurement. L1
- Explain the factors affecting the surface finish in machining. L2
- Demonstrate the application of different surface measuring instruments. L2

UNIT – III: Metrology of Screw Threads & Gear measurement **6Hrs**

Metrology of Screw Threads:

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-runout, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the errors in screw threads. **L3**
- Explain the principles of gear measuring instruments **L2**
- Select the tools and methods for measuring screw thread, gear profiles. **L1**

UNIT – IV: Measurement of Displacement & Strain **6 Hrs**

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurements of Strain: Various types of electrical strain gauges, gauge factor, method of usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque, strain gauge rosettes.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various types of transducers used for the measurement of displacement. **L1**
- Explain the static and dynamic characteristics of transducers. **L3**
- Classify the transducers with respect to change in resistance, capacitance and inductance **L4**
- Experiment with measurement of strain **L3**

UNIT – V: Replacement and Maintenance Analysis **6 Hrs**

Measurement of Force: Direct method - analytical balance, platform balance; elastic members – load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

Measurement of Pressure: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify various types of transducers used for the measurement of force, torque and pressure **L3**
- Explain methods of measurement of force, torque and pressure **L2**
- Develop the techniques for calibration of force, torque and pressure measuring devices **L3**

Text Books:

1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.

Reference Books:

1. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
2. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
3. Anand K Bewoor & Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- List various measuring instruments used in metrology. **L4**
- Examine geometry of screw threads and gear profiles. **L4**
- Measure force, torque and pressure. **L5**
- Calibrate various measuring instruments. **L4**

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME72 – INTRODUCTION TO CAD/CAM

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.
- Explain the principles robotics, CIM, AR,VR and AI in CIM

UNIT – 1: CAD/CAM, 2D and 3D geometric transformations **12 Hrs**

CAD/CAM: Introduction, hardware and software, I/O devices, benefits. Graphics standards-Neutral file formats – IGES, STEP.

2D and 3D geometric transformations: Translation, scaling, rotation, mirroring, homogenous transformations, concatenation of transformations, viewing transformations.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various input and output devices **L1**
- Apply geometric transformations in 2D and 3D **L3**
- Apply window to viewport transformation. **L3**

UNIT – II: Parametric representation & Geometric Modelling of Solids **10Hrs**

Parametric representation: Representation of curves, Hermite curves, Spline, Bezier and B-spline curves in two dimensions; Geometric modelling of surfaces: Surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, sweep surfaces, surface of revolution, blending of surfaces;

Geometric Modelling of Solids: Wireframe, surface modelling, solid entities, boolean operations, CSG approach and B-rep of solid modelling, geometric modelling of surfaces.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the concepts of parametric representation to curves and surfaces. **L3**
- Create surfaces such as Coons, Bezier and B-spline **L6**
- Differentiate wireframe, surface and solid modeling. **L4**
- Apply the solid modeling concepts. **L3**

UNIT – III: Computer Aided Manufacturing (CAM) **8Hrs**

Structure of numerical control (NC) machine tools, designation of axes, drives and actuation systems, feedback devices, computer numerical control (CNC) and direct numerical control (DNC), adaptive control system, CNC tooling, automatic tool changers and work holding devices, functions of CNC and DNC systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the differences between NC, CNC and DNC **L3**
- Use devices and activation systems. **L3**
- Apply adaptive control system **L3**
- Apply different tooling and tool chargers, working holding devices. **L3**

UNIT – IV: Part programming and APT Programming **10 Hrs**

Part Programming: Part programming instruction formats, information codes, preparatory functions, miscellaneous functions (G-codes, M-codes). Tool codes and tool length offset, interpolations canned cycles.

APT Programming: APT language structure, APT geometry, Definition of point, line, circle, plane.

APT Motion Commands: set-up commands, pint to point motion commands; continuous path motion commands part programming preparation for typical examples (milling and turning operation)

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the fundamentals of part programming in CNC. **L3**
- Use G codes, M codes in CNC part programs. **L3**
- Apply the concept of canned or fixed cycles for the hole making operations. **L3**
- Identify geometric features in APT language. **L3**

UNIT – V: Automation **8Hrs**

Automation: Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages. Computer integrated manufacturing (CIM): Elements of CIM, Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI) and expert systems in CIM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize the fundamentals of robotics. **L2**
- Categorize the CIM environment and its elements. **L4**
- Explain the role VR, AR and AI in manufacturing engineering. **L3**

Text Books:

1. P.N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the basics of geometric representation and transformations in CAD/CAM **L3**
- Choose geometric modeling methods for building CAD models. **L1**
- Compare NC, CNC and DNC **L2**
- Develop manual and computer aided part programming for turning and milling operations. **L3**
- Summarize the principles of robotics AR, VR and AI in CIM **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME73 – FINITE ELEMENT ANALYSIS

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem.
- Learn to model complex geometry problems and solution techniques.
- Understand the importance of Quality standards in manufacturing.

UNIT – 1: Introduction to finite element methods **12 Hrs**

Introduction to finite element methods for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.

One dimensional Problem: Finite element modelling of ID bar elements, coordinates and shape functions. Requirements for Convergence and Interpolation functions, Pascal's Triangle, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the numerical methods involved in Finite Element theory **L2**
- Understand direct and formal (basic energy and weighted residual) methods for deriving finite element equations. **L2**
- Understand the concept of nodes and elements **L2**
- Understand the general steps of finite element methods. **L2**

UNIT – II: Parametric representation & Geometric Modelling of Solids **10Hrs**

Analysis of trusses: Stiffness Matrix for 1D truss element, Stress Calculations and Problems with maximum of three elements.

Analysis of beams: Element Stiffness Matrix and Load vector for 1 D beam element, Hermite shape functions and simple problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the use of the basic finite elements for structural applications using truss and beam. **L2**
- Formulate and analyze truss and beam problems. **L6**

UNIT – III: Two dimensional Problems **10Hrs**

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the formulation of two – dimensional elements (Triangular Elements). **L2**
- Apply the formulation techniques to solve two – dimensional problems using triangle elements **L3**
- Formulate and solve axisymmetric problems **L6**

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UNIT – IV: Quadrilateral Elements **8 Hrs**

Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded and 8 noded quadrilateral elements and simple problems. Numerical Integration.

Steady state heat transfer analysis: One dimensional analysis of composite slab and fin.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the formulation of two – dimensional elements (Quadrilateral Elements). **L2**
- Apply the formulation techniques to solve two – dimensional problems using quadrilateral elements. **L3**
- Explain the application and use of the Finite Element Methods for heat transfer problems **L2**
- Formulate and solve heat transfer problems. **L6**

UNIT – V: Dynamic analysis **8Hrs**

Analysis of a 1D uniform shaft subjected to torsion – Simple problems

Dynamic analysis: Formulation of finite element model, element – mass matrices, evaluation of Eigen values and Eigen vectors for a bar and shaft.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand problems involving dynamics using Finite Element Methods. **L1**
- Evaluate the Eigen values and Eigen Vectors for steeped bar. **L6**

Text Books:

1. Chandraputla, Ashok & Belegundu, Introduction to Finite Element in Engineering, Prentice Hall.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth Heinemann 2nd Edition

Reference Books:

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.
2. S.Md.Jalaludeen, Finite Element Analysis in Engineering, 2nd Edition, Anuradha Publications, 2016.
3. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989.
4. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs,1982.
5. G.Lakshmi Narasaiah, Finite Element Analysis, 1st Edition, B.S. Publications, 2008.
6. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3rd Edition. McGraw-Hill, 1989.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the concepts behind variational methods and weighted residual methods in FEM. **L1**
- Identify the application and characteristics of FEA elements such as bars, beams, and isoparametric elements, and 3-D element. **L2**
- Develop element characteristic equation procedure and generation of global stiffness equation will be applied. **L5**
- Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form. **L6**
- Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow. **L2**

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME74a- AUTOMOTIVE TRANSMISSION SYSTEM

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain operation and performance of various clutches and gear boxes.
- Familiarize hydrodynamic drives.
- Teach various types of gear boxes used for automotive transmission
- Impart principle of operation and performance of various hydrostatic and electric drives provide.
- Identify the applications of automatic transmission

UNIT – 1: Clutch & gear box: **10 Hrs**

Requirements of transmission system and role of clutch in driving system, Types of Clutches, Construction and Working of Single Plate, Multi Plate, Cone Clutch, Centrifugal and Semi Centrifugal clutch and its operating characteristics, Equation for torque capacity of a single plate clutch. Need for a gear box in an automobile and types of Gear boxes – Construction and working of Sliding mesh, Constant mesh gear box, Synchromesh gear box and principle of synchronizers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the requirements of transmission system **L2**
- Recognize the role of clutch in driving system **L1**
- List various types of clutches **L1**
- Explain the need of gear box in an automobile **L2**

UNIT – II: Planetary gear trains: **10Hrs**

Construction and working Principle of Epi-cyclic gear train, Planetary gear box, Ford T Model gear box, Wilson gear box, Cotal electromagnetic transmission and Automatic over drive. Gear ratios for Wilson gear box and Automatic Over drive. Hydraulic control system for Automatic transmission.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate working of epicyclic and planetary gear boxes. **L2**
- Explain electromagnetic transmission. **L2**
- Demonstrate hydraulic control system for automatic transmission. **L2**

UNIT – III: Hydrostatic drives: **10Hrs**

Introduction to hydrostatic drives, Working principle, types, Advantages and limitations of Hydrostatic drives, Comparison of hydrostatic drive with hydro dynamic drive, Construction and working of Janny Hydrostatic drive.

Hydrodynamic and hydrokinetic drives: Introduction to fluid coupling, Fluid coupling – Construction, Principle of operation and Performance characteristics, Drag torque and various drag reducing devices of fluid coupling, Problems on design and torque capacity of fluid coupling, Construction and working of Torque converter, converter coupling, Multistage torque converter, and Poly phase torque converter - Performance characteristic of multistage and poly phase torque converters.

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Learning Outcomes:
At the end of this unit, the student will be able to

- Explain hydrostatic drives L2
- Differentiate hydrostatic and hydrodynamic drives. L2
- Summarize construction and working of Janny hydrostatic drive L2
- Give the advantages and limitations of hydrostatic drives. L1

UNIT – IV: Automatic transmission applications: 8 Hrs

Layout of Automatic transmission system, construction and working of Turbo glide transmission, Power glide transmission, ECT- intelligent transmission , Automatic transmission with intelligent electronic control systems, Hydraulic clutch actuation for Automatic transmission.

Learning Outcomes:
At the end of this unit, the student will be able to

- Draw layout of automatic transmission system L3
- Compare construction and working different types of transmission L4
- Explain the working of turbo glide transmission and power glide transmission L3
- Identify the importance of intelligent electronic control systems in automatic transmission L2

UNIT – V: Electric Drives: 8Hrs

Introduction to Electric drive: Layout Advantages, limitations and performance characteristics of Electric drive, Principle of Early Ward Leonard control system of electric drive. Principle of Modified Ward Leonard control system of electric drive.

Learning Outcomes:
At the end of this unit, the student will be able to

- Explain the concepts of electric drives. L2
- Contrast the advantages and limitations of electric drives L2
- Explain performance characteristics of electric drives L2

Text Books:

1. Harald Naunheimer , Bernd Bertsche , Joachim Ryborz , Wolfgang Novak "Automotive Transmission:Fundamentals, Selection, Design and Application", 2nd Edition, Springer, 2011.
2. Heldt P.M, "Torque converters", Chilton Book Co., 1992.

Reference Books:

1. Newton Steeds & Garrot, "Motor Vehicles", SAE International and Butterworth Heinemann, 2001.
2. CDX Automotive, "Fundamentals of Automotive Technology, Principles and practice", Jones & Barlett Publishers, 2013.
3. SAE Transactions 900550 & 930910.
4. Crouse W.H, Anglin D.L, "Automotive Transmission and Power Train construction", McGraw Hill, 1976.

Course Outcomes:
At the end of this Course the student will be able to

- Understand the working principles of clutches and gearboxes L2
- Remember the working of planetary gear box. L1
- Identify the differences between the hydrostatic and hydrodynamic drives L2
- discuss various types of automatic transmission systems L3

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME74b – ADDITIVE MANUFACTURING

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize of additive manufacturing / rapid prototyping and its applications in various fields.
- Impart reverse engineering technician.
- Explain different processes available in additive manufacturing.
- Bring awareness on mechanical properties of materials and geometric issues related to additive manufacturing applications.

UNIT – I: Introduction to Additive Manufacturing (AM) Systems: **10 Hrs**

History and Development of AM, Need of AM, Difference between AM and CNC, Classification of AM Processes: Based on Layering Techniques, Raw Materials and Energy Sources, AM Process Chain, Benefits and Applications of AM, Representation of 3D model in STL format, RP data formats: SLC, CLI, RPI, LEAF, IGES, CT, STEP, HP/GL.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the applications for additive manufacturing processes. **L3**
- Explain the process of additive manufacturing. **L2**
- represent a 3D model in STL format and other RP data formats to store and retrieve the geometric data of the object **L3**

UNIT – II: CAD & Reverse Engineering: **10Hrs**

Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation, Part Orientation and support generation, Model Slicing, Tool path Generation, Software's for Additive Manufacturing Technology: MIMICS, MAGICS. Reverse Engineering (RE) –Meaning, Use, RE – The Generic Process, Phase of RE Scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply various digitalization techniques. **L3**
- explain the concept of reverse engineering and scanning tools **L2**

UNIT – III: Solid and Liquid Based AM Systems: **10Hrs**

Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of solid and liquid based AM systems. (L2) **L2**
- Identify the materials for solid and liquid based AM systems. (L3) **L3**

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UNIT – IV: Powder Based AM Systems: **8 Hrs**

Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of powder based AM systems **L2**
- Apply SLS, LENS and EBM 3D printing methods **L3**

UNIT – V: Other Additive Manufacturing Systems: **8Hrs**

Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain principles and limitation of 3D printing using BPM and SDM **L2**
- Use BPM and SDM 3D printing methods **L3**

Text Books:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e World Scientific Publishers, 2003.
3. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007

Reference Books:

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005
4. RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate various additive manufacturing and rapid prototyping techniques applications **L5**
- Describe different additive manufacturing processes. **L4**
- Apply methods in rapid prototyping. **L5**
- Use powder based AM system. **L6**
- Model 3D printing using SDM and BPM methods. **L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME74c- MECHANICAL VIBRATIONS

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Demonstrate basic concepts and definitions of mechanical vibrations. To write equation of motion for discrete spring-mass systems with different configuration using classical and energy methods.
- To train the students about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about two degree freedom system and various types of vibration absorbers.
- To analyze the two degree and multi degree of freedom systems.

UNIT – I: Single Degree Freedom Systems: **10 Hrs**

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

Whirling of shafts: Transverse vibrations: Dunkerley's lower bound approximation, Critical speed of shafts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find natural frequency of un-damped single degree freedom systems **L4**
- Find the behavior of single degree freedom systems with damping **L4**

UNIT – II: Forced vibrations of Single Degree Freedom Systems **10Hrs**

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve vibration problems with forcing function. **L5**
- Calculate transmissibility and isolation. **L4**
- Explain different types of isolators and power absorbers. **L2**

UNIT – III: Two Degree Freedom Systems: **10Hrs**

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the two degree freedom systems with and without damping **L4**
- Solve problems on vibration absorber **L5**

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UNIT – IV: Multi Degree Freedom Systems: **8 Hrs**

Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the multi degree freedom systems using Stodola method, Holzer"s method and Matrix iteration method. **L5**
- calculate natural frequencies with Rayleighs method and Dunkerleys method **L4**

UNIT – V: Vibration measurement and Applications **8Hrs**

Transducers: variable resistance transducers, Piezoelectric transducers, electrodynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electrodynamic shaker.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify various transducers **L3**
- Use different vibration pickups **L4**
- Explain mechanical exciters and electro dynamic shaker **L2**

Text Books:

1. Singrasu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018.
2. G.K.Groover, Mechanical Vibrations, 8/e, 2009

Reference Books:

1. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, 1986
2. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996
3. William Thomson, Theory of Vibrations with Applications, 5/e, Pearson, 2008
4. William Weaver, Timeoshenko, and Young, Vibration Problems in Engineering, 5/e, John Wiley, 2013
5. C. Nataraj, Vibration of Mechanical Systems, 1/e, Cenage Learning, 2012

Course Outcomes:

At the end of this Course the student will be able to

- find natural frequency of un-damped single degree freedom systems. **L4**
- analyze the two degree freedom systems with and without damping. **L4**
- Calculate transmissibility and isolation. **L4**
- Solve problems on vibration absorber. **L5**
- Calculate natural frequencies of multi degree freedom system. **L4**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME74d- REFRIGERATION AND AIR CONDITIONING

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry.
- Introduce the students how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.
- Expose the students on various refrigeration methods like VCR, VAR and latest developments.
- Know the various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT – 1: Introduction To Refrigeration **10 Hrs**

Introduction To Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods.

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the terminologies associated with refrigeration. **L2**
- Describe the first and second law applied to refrigerating machines. **L2**
- Demonstrate the Bell-Coleman cycle in air refrigeration. **L2**
- Identify the various refrigeration cycles. **L3**

UNIT – II: Vapour Compression Refrigeration **10Hrs**

Vapour Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of vapour compression refrigeration system. **L5**
- Draw the T-S and P-h charts for representation of cycle **L1**
- Classify various refrigerants used in vapour compression refrigeration systems **L1**
- Model the numerical problems on refrigeration cycles. **L3**
- Demonstrate the influence of various parameters on system performance **L2**

UNIT – III: Vapor Absorption Refrigeration (VAR) System- **10Hrs**

Vapor Absorption Refrigeration (VAR) System- Description and Working of NH_3 - Water System and Li Br -Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of vapour absorption refrigeration system. **L5**
- Identify the latest developments of Electrolux, thermo electric vortex tube methods. **L3**
- Illustrate the working of various components of steam jet refrigeration system. **L2**
- Estimate the motive steam required for steam jet refrigeration system **L6**
- Describe the working principle of Themo- Electric refrigerator and bortex tube refrigerator **L2**

UNIT – IV: Introduction To Air Conditioning **8 Hrs**

Introduction To Air Conditioning: Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate the psychrometric properties & processes **L2**
- Select the air conditioning systems for different realistic situations **L6**
- Define the terms sensible heat load and latent heat load **L1**
- Draw the psychrometric charts for various air conditioning environments **L1**

UNIT – V: Air Conditioning Equipment **8Hrs**

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of humidifiers and dehumidifiers. **L5**
- Select the requirements of temperature and humidity for human comfort. **L6**
- Demonstrate the heat pump working and its components. **L2**
- List the various air conditioning equipments. **L1**

Text Books:

1. Refrigeration and Air Conditioning ,CPArora,TMH, 15th edition, 2013.
2. A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4th edition, 2013.

***NOTE:** Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam*

Course Outcomes:

At the end of this Course the student will be able to

- Summarize the various refrigeration and air conditioning equipments and it's working **L3**
- Apply the basic knowledge to operate the refrigeration systems **L6**
- Evaluate the COP for vapour absorption system **L4**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME74e – MATERIAL CHARACTERIZATION

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the fundamentals in material characterization.
- Explain principles in X-ray diffraction and Stereographic projections.
- Describe the fundamental principles of characterization.
- Evaluate the uncertainty of observations and results from the different methods.
- Impart the methods of characterization for different material problems.

UNIT – 1: Basic crystallography and Need for Material Characterization **10 Hrs**

Basic crystallography and Need for Material Characterization - unit cells, Crystal structure, Primitive and Non- primitive cells, Symmetry elements and point group notations, Stereographic projections - Need for Material Characterization - Methodology for Material Characterization and Analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of materials structure **L5**
- Define the terminology of crystallography **L1**
- Demonstrate the characterization techniques **L2**

UNIT – II: Diffraction and Imaging **10Hrs**

Diffraction and Imaging - Phenomena of diffraction; Radiation-matter Interactions and response signals; X-ray diffraction: powder diffraction, phase identification, Scherrer formula, strain and grain size determination; Fundamentals of Imaging: magnification, resolution, depth of field and depth of focus aberration and astigmatism; X-Ray reflectivity.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain diffraction techniques **L2**
- Utilize fundamental imaging processes **L3**

UNIT – III: Optical microscopic & Spectroscopic Techniques **10Hrs**

Optical microscopic Techniques - Special microscopy techniques and applications: Bright field and dark field imaging; confocal microscopy; interference microscopy; polarized light microscopy; phase contrast microscopy. Scanning near field laser microscopy; Image processing and quantification.

Optical Spectroscopic Techniques - Principle, Working and Result Analysis of Fourier Transformation Infra-Red Spectroscopy; Raman Spectroscopy; UV-Vis Absorption Spectroscopy; Photoluminescence Spectroscopy - Ellipsometer Spectroscopy.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the need for microscopy and types of microscopy. **L3**
- Summarize optical microscopy principles and working. **L2**
- Explain basic aspects of optical characterization methods. **L2**
- Explain the concepts of spectroscopy. **L2**

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UNIT – IV: Electron Microscopic Techniques **8 Hrs**

Electron Microscopic Techniques - Basics of Electron Microscopy - Introduction - Principle of SEM, Instrumentation, Contrast formation, Operational variables, Specimen preparation, imaging modes, Applications, Limitations – FE-SEM , FIB, EDAX. TEM - Introduction, Instrumentation, Specimen preparation: Mechanical thinning, electrochemical thinning, ion milling, sputter coating and carbon coating, replica methods. Image modes - mass density contrast, diffraction contrast, phase contrast, Applications, Limitations

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain fundamentals of electron microscopy **L2**
- Outline thinning and coating processes **L2**
- Interpret techniques of polishing for image processing **L2**

UNIT – V: Thermal analysis **8Hrs**

Thermal analysis - Instrumentation, experimental parameters, Differential thermal analysis, Differential Scanning Calorimetry, Thermogravimetry, Dilatometry, Dynamic mechanical analysis-Basic principles, Instrumentation, working principles, Applications, Limitations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain thermal stability techniques used for materials. **L2**
- Illustrate principles and working of different equipments used for thermal analysis **L2**

Text Books:

- Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 2/e, Wiley Publications, 2013.

Reference Books:

1. D. Brandon and W.D. Kaplan, Microstructural Characterization of Materials, John Wiley and Sons, 2008.
2. S. Zhang, Lin Li and Ashok Kumar, Materials Characterisation Techniques, CRC Press, 2009.
3. B.D.Williams and C.B.Carter, Transmission Electron Microscopy –Springer, 2009.
4. E.J. Mittemeijer, Fundamentals of Materials Science - the microstructure-property relationship using metals as model systems, Springer, 2010.

Course Outcomes:

At the end of this Course the student will be able to

- Explain the production of characteristic x-rays **L2**
- Use the principles of diffraction (Bragg's Law) in determination of crystal structure determination **L2**
- Interpret the properties of electrons and the affect of accelerating potential **L2**
- Apply basic operational modes of a SEM and TEM **L2**
- Explain the formation of diffraction patterns in the electron microscopes **L2**

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19AME74f- PRODUCTION AND OPERATIONS MANAGEMENT

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduction to the technical design and manufacturing operations and supply management to the sustainability of an enterprise.
- Need for forecasting and types of forecasting.
- Import the basic principles of project management and other business functions such as value engineering, purchasing, marketing, finance etc.
- Analyze the new demands of the globally competitive business environment that supply chain managers face today.
- Knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT – 1: Introduction: **10 Hrs**

Operations Management – Definition, Objectives, Types of Production System, Difference between OM & PM, Historical Development of Operations Management, Current Issues in Operation Management, Product Design – Requirements of Good Product Design, Product Development – Approaches, Concepts in Product Development, Standardization, Simplification, Speed to Market, Introduction to Concurrent Engineering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of operations management, production systems **L1**
- Analyze steps in design a new product. **L4**

UNIT – II: Forecasting: **10Hrs**

Introduction, Statistical Forecasting Techniques, Moving Average, Exponential Smoothing Technique, Errors in Forecasting and Evaluation of Forecasting Techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of forecasting. **L1**
- Understand and analyze the various methods of forecasting **L1**

UNIT – III: Value Engineering and Plant Layout: **10Hrs**

Value Engineering – Objectives, Types of Values, Function and Cost, Product Life Cycle, Steps in Value Engineering, Methodology in Value Engineering, FAST Diagram and Matrix Method. Facility Location and Layout – Factor Considerations in Plant Location, Comparative Study of Rural and Urban Sites, Methods of Selection of Plant Layout, Objectives of Good layout, Principles, Types of Layout, Line Balancing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of value engineering **L1**
- Identify the factors for locating a Plant Layout **L3**
- Understand types of plant layout and line balancing **L1**

UNIT – IV: Aggregate Planning and MRP: **8 Hrs**

Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning-Transportation and Graphical Models, Master scheduling, Material Requirement Planning(MRP)-Terminology, Types of Demands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, Manufacturing Resources Planning (MRP II), Just in Time (JIT) Philosophy, Kanban System, Calculation of Number of Kanbans, Pull Systems vs. Push Systems, Requirements for Implementation of JIT, JIT Production Process, Benefits of JIT.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of aggregate planning, material requirement planning and JIT **L1**
- Implement the concepts of JIT **L5**

UNIT – V: Scheduling: **8Hrs**

Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loading Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flow Shop Scheduling, Job Shop Scheduling, Line of Balance.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand types and policies of scheduling. **L1**
- Analyze and implement single machine, parallel machine, flow shop, and job shop scheduling algorithms **L6**

Text Books:

1. Buffa E.S. and Sarin R.K., Modern Production / Operations Management, 8th Edition, Wiley India Pvt. Ltd., New Delhi, 2009.
2. Joseph G. Monks, Operations Management-Theory and Problems, 3rd Edition, McGraw Hill Education, 1987.

Reference Books:

1. James L. Riggs, Jim Rigs, Production Systems: Planning, Analysis and Control, 4th Edition, Wave Land Press, 1992.
2. Chary S.N., Production and Operations Management, 5th Edition, McGraw Hill Education, 2017.
3. Richard B.Chase, Ravi Shankar, Robert Jacobs F., Operations and Supply Chain Management, 15th Edition, McGraw Hill Education, 2018.
4. Pannerselvam R., Production and Operations Management, 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
5. Steven Nahmias, Tava Lennon Olsen, Production and Operation Analysis: Strategy – Quality – Analytics – Applications, 7th Edition, Waveland Press Inc., 2015.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the operations and supply management to the sustainability of an enterprise **L2**
- Identify the need for forecasting and understand different forecasting methods **L3**
- Identify various production and plant layouts **L3**
- Examine the quality control of the production **L4**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME76a- VEHICLE DIAGNOSIS AND CONTROL

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce various techniques in Vehicle Diagnosis.
- Familiarize sensors and actuators associated with Oscilloscope Diagnostics
- Identify various faults in the engine system.
- Discuss the concepts of engine system and vehicle systems diagnosis

UNIT – 1: Introduction To Fault Diagnosis **10 Hrs**

Introduction To Fault Diagnosis, Safe Working Practices And Techniques. Diagnostics On Paper, Mechanical And Electrical Diagnostic Techniques. Faults Codes, Systems And Standards. On and Off Board Diagnostics. Data Sources, Tools And Equipments. Oscilloscopes, Scanners/Fault Code Readers, Engine Analyzers. Application Methods and Procedures.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the safe working practices and techniques of fault diagnosis. **L2**
- Demonstrate on fault codes, systems and standards. **L2**
- List various tools and equipments used for fault diagnosis. **L1**

UNIT – II: On and off Board Diagnostics. **10Hrs**

Introduction to oscilloscope Diagnostics. Sensors And Actuators Associated With Oscilloscope Diagnostics. On-Board Diagnostics Various Perspectives. Petrol/Gasoline On-Board Diagnostics. On-Board Sensors And Actuators. Sensors And Actuators Comparative Case Study.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various sensors and actuators associated with oscilloscope Diagnostics. **L1**
- Explain Various Perspectives of On-Board Diagnostics. **L2**
- Determine the practical applications of onboard sensors and actuators **L3**

UNIT – III: Engine Systems Diagnostics **10Hrs**

Introduction Engine Systems Diagnostics. Engine Operation And Fuel System. Ignition System And Emission System. Fuel Injection, Starting And Charging System. Power Flow Control And Energy Efficiency Analysis. Engine Management and Fault finding Information. Air Supply, Exhaust System, Cooling and Lubrication System.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of engine operation and fuel system **L2**
- Explain the working of fuel injection, starting and charging systems **L2**
- Discuss the importance of engine management and fault finding information **L3**

UNIT – IV: Chassis and Brake System Diagnosis. **8 Hrs**

Introduction to Vehicle System Diagnostics, Anti-Lock Braking System Diagnostics. Traction Control System Diagnostics, Steering And Tires. Transmission Systems Diagnostics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstration on antilock braking system diagnostics **L2**
- Familiarize with the concepts of traction control system Diagnostics **L3**
- Identify the importance of transmission system diagnostics **L2**

UNIT – V: Electrical Systems Diagnosis **8Hrs**

Introduction To Electronic Components And Circuits. Multiplexing And De Multiplexing. Lighting System Faults And Auxiliary Faults. In-Car Entertainment Security And Communications Implementation. Body-Electrical Systems, Instruments System Faults. Heating Ventilation and Air Conditioning. Cruise Control, Air Bags And Belt Tensioners.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall the concepts of electronic circuits and electronic components **L1**
- Compare multiplexing and demultiplexing **L4**
- Explain the various types of faults in electrical systems **L2**

Text Books:

1. Richard.C.Dorf and Robert.H.Bishop , "Modern Control System" 12th edition Pearson Prentice Hall,2013.
2. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.

Reference Books:

1. Tom denton "Advanced automotive fault diagnosis", Elsevier butterworth-heinemann linacre house, jordan hill, oxford ox2 8dp, uk - isbn-10: 0-75-066991-8.
2. Tom Denton "Automotive Electronics Handbook", - - McGraw-Hill Publishing Co.; 2nd Revised edition 1999, ISBN10:0070344531
3. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
4. Routledge "Automobile Electrical and Electronic Systems", 4th edition 2012, ISBN10: 0080969429.

Course Outcomes:

At the end of this Course the student will be able to

- Perform vehicle diagnosis and apply the fault finding techniques practically **L3**
- Understand the basic concepts of On board and off board diagnosis **L2**
- Recall the concepts of Exhaust, Cooling and Lubrication systems **L1**
- List various faults in the electrical system diagnosis **L3**
- Summarize the principles of traction control system diagnosis and transmission system diagnosis **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME76b- MECHATRONICS AND MEMS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development of mechatronic system and MEMS.

UNIT – 1: Introduction: **10 Hrs**

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the role of mechatronics in industry. **L2**
- Identify the application of mechatronics in automation industry **L3**

UNIT – II: Sensors: **10Hrs**

Sensors: Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various types of sensors **L2**
- Choose sensors for particular application **L3**
- Measure different quantity's using sensors **L4**

UNIT – III: Actuators: **10Hrs**

Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various actuation systems **L2**
- Choose the criterion for different actuators **L1**

UNIT – IV: Microprocessors, Microcontrollers and Programmable Logic Controllers **8 Hrs**

Microprocessors, Microcontrollers and Programmable Logic Controllers: Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the architecture of microprocessors, microcontrollers and PLC **L2**
- Formulate various programs using PLC **L6**

UNIT – V: Micro Electro Mechanical Systems (MEMS): 8Hrs

History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate the knowledge of MEMS **L2**
- Classifying different fabrication techniques of MEMS **L4**
- Illustrate the application of MEMS in industry **L2**

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , WBolton, 3/e Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010.

Reference Books:

1. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2004.
2. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005.
3. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010.

Course Outcomes:

At the end of this Course the student will be able to

- Explain mechatronics systems in industry **L2**
- Identify mechatronic systems encountered in practice **L3**
- Examine the components of a typical mechatronic system **L4**
- Compare the various techniques used for development of MEMS **L4**
- Develop programs using PLC **L6**

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19AME76c- DESIGN OF OIL HYDRAULIC AND PNEUMATIC SYSTEMS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize on Fluid Power Engineering and Power Transmission System.
- Introduce the students, the basic concepts of hydraulic and pneumatic systems.
- Expose the students with various hydraulic and pneumatic actuators.
- Familiarize on fluid power systems and its applications to real time.
- Know the problem, which occur in fluid power systems and take necessary troubleshooting/ maintenance activities.

UNIT – 1: Introduction: **10 Hrs**

INTRODUCTION: Introduction to fluid power - Types, advantages and application of fluid power systems. Properties of hydraulic fluids – General types of fluids – Fluid power symbols as per ISO/ANSI. Basic Components of Oil Hydraulic and Pneumatic Systems. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems for force and motion analysis in automation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of fluid power and its types **L2**
- List the advantages and applications of fluid power systems. **L1**
- Explain the properties of hydraulic fluids **L2**
- Draw the ISO/ANSI symbols of fluid power **L1**
- Compare mechanical, electrical, hydraulic and pneumatic systems. **L2**

UNIT – II: Oil Hydraulic Pumps, Actuators: **10Hrs**

OIL HYDRAULIC PUMPS, ACTUATORS: Types of hydraulic pumps - construction and working principle - design considerations, selection, specifications and characteristics of pumps. Types of actuators-construction and working principle - design considerations, selection, specifications and characteristics of actuators.

CONTROL AND REGULATION ELEMENTS: Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for hydraulic circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic working principles of the hydraulic pumps and actuators **L2**
- List the types of pumps and actuators. **L1**
- Explain the design considerations of pumps and actuators. **L2**
- Identify the importance of control and regulation elements in fluid power **L3**
- Select the valves for hydraulic circuits **L1**

UNIT – III: Design Of Hydraulic Circuits: **10Hrs**

Design Of Hydraulic Circuits: Speed control circuits - Regenerative circuits- Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier–Intensifier circuit. - Reservoir design - Selection of components. Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Safety circuits - Industrial circuits - Press - Milling Machine - Planner - Fork Lift.

Learning Outcomes:
At the end of this unit, the student will be able to
- Develop the hydraulic circuits for practical applications **L6**
- Create circuits for various machines. **L6**
- Discuss the importance of accumulators and intensifiers in hydraulic circuits **L6**
- Select the size of the accumulators. **L1**
- Explain the working principles of safety circuits **L2**

UNIT – IV: Pneumatic Systems: **8 Hrs**
Pneumatic fundamentals - Properties of air – Compressors – Filter, Regulator, and Lubricator unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Control Elements - Logic Circuits -Position - Pressure Sensing - Switching – Electro Pneumatic - Electro Hydraulic Circuits - Robotic Circuits.

Learning Outcomes:
At the end of this unit, the student will be able to
- Explain the fundamental concepts of pneumatic systems **L2**
- List the properties of air for pneumatic system **L1**
- Demonstrate on F-R-L UNIT **L2**
- Identify various control elements in pneumatic system **L3**
- Develop electro pneumatic and electro hydraulic circuits for robotic applications **L6**

UNIT – V: Design Of Pneumatic Circuits: **8Hrs**
Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors -Uses - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies.

Learning Outcomes:
At the end of this unit, the student will be able to
- Design a pneumatic circuit using classic, cascade and step counter methods **L6**
- Select pneumatic components for installation and maintenance of power packs **L1**
- Explain the architectures of PLC and Microprocessors **L2**
- Develop logical circuits in PLC for automation **L6**
- Determine the faults in fluid power systems **L3**

Text Books:
1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Majumdar S.R, "Oil Hydraulics", Tata McGraw Hill, 2000.
3. Majumdar S.R, "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2001.

Reference Books:
1. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
2. Andrew Parr, Hydraulic & Pneumatics, 2/e, Jaico Publishing House Elsevier, 1999.
3. Harry L. Stevart D.B, "Practical Guide to Fluid Power", Taraoeala Sons and Port Ltd. Broadey, 1976.

Course Outcomes:
At the end of this Course the student will be able to
- Compare the differences between hydraulic and pneumatic systems **L2**
- Identify the practical applications in automation **L3**
- Build the circuits for a given applications **L6**
- Develop hydraulic and pneumatic power packs **L6**
- Discuss the importance of PLC and microprocessor in hydraulic and pneumatic systems **L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME76d- COMPUTATIONAL FLUID DYNAMICS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Teach the basics of the major theories, approaches and methodologies used in CFD.
- Familiar with the differential equations for flow phenomena and numerical methods for their solutions.
- Introduce explicit and implicit schemes in hyperbolic equations.
- Expose the students to solve the problems through finite volume method.
- Understand the concepts of linear fluid flow problems, steady state problems and transient problems.

UNIT – 1: Introduction & Solution methods **12 Hrs**

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare FDM, FEM, FVM methods **L2**
- List the various solution methods of elliptical equations **L1**
- Identify the types of parabolic equations **L3**

UNIT – II: Hyperbolic equations: **10Hrs**

Explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe explicit and implicit schemes **L2**
- List second order one-dimensional wave equations **L1**
- Explain the Runge-Kutta method **L2**
- Explain Von Neumann stability analyses **L2**

UNIT – III: Formulations Of Incompressible Viscous Flows: **10Hrs**

Formulations Of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

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Learning Outcomes:
At the end of this unit, the student will be able to
- Apply numerical models to fluid flow and heat transfer calculations **L3**
- Determine incompressible viscous flows by FDM, PCM and Vortex methods **L3**
- Formulate potential equation and Euler equations **L6**

UNIT – IV: Finite Volume Method: **8 Hrs**
Finite volume method via finite difference method, formulations for two and three-dimensional problems.

Learning Outcomes:
At the end of this unit, the student will be able to
- Formulate finite volume method for two and three dimensional fluid flow problems **L3**
- Solve the fluid flow problems using finite volume method **L6**

UNIT – V: Standard Variational Methods: **8Hrs**
Linear fluid flow problems, steady state problems, Transient problems.

Learning Outcomes:
At the end of this unit, the student will be able to
- Model equations for linear fluid flow, steady state and transient flow problems. **L3**
- Apply standard variational methods to solve fluid flow problems **L3**

Text Books:
1. Computational fluid dynamics/ T. J. C'hung/ Cambridge University press,2002.
2. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.

Reference Books:
1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985.
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications.
4. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
5. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford

Course Outcomes:
At the end of this Course the student will be able to
- Summarize the major theories, approaches and methodologies used in CFD. **L2**
- Formulate finite volume method for two and three dimensional fluid flow problems. **L3**
- apply numerical models to fluid flow and heat transfer calculations **L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME76e – GEOMETRIC DIMENSIONING AND TOLERANCING

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Teach the basics of the geometric dimensioning and tolerances.
- Familiar with the form and orientation tolerances.
- Introduce tolerances of profiles of lines and surfaces with or without datums.
- Expose the students to various surface roughness parameters and their measurements in two dimensions.
- Understand the concepts of dimensional chains and inspection techniques.

UNIT – 1: Basic Concepts **12 Hrs**

General terms and definitions of geometrical features - General principle of sizes - System of limits and fits - Principles of dimensioning - Introduction to geometric dimensioning and tolerancing (GD&T) - Inspection of dimensional and geometrical deviations - Datums and datum systems, Rule #1 and Rule #2- Boundary principle.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the general terms and definitions of geometrical features **L2**
- List the various boundary principle rules **L1**
- Identify the types of datums and datum systems **L3**

UNIT – II: Form and Orientation Tolerances **10Hrs**

Form tolerances: types, specifications and interpretations - measurement and evaluation of straightness, flatness and roundness - Orientation tolerances: types, specifications and interpretations, and verification of orientation tolerances. Exercises on each group.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe orientation tolerances **L2**
- List types of form tolerances and its specifications **L1**
- Explain the measurement and evaluation of straightness and flatness **L2**
- Explain the measurement and evaluation of roundness **L2**

UNIT – III: Location, Runout and Profile Tolerances **10Hrs**

Tolerances of location: types, specifications and interpretations - verification techniques - Tolerances of profiles of lines and surfaces with or without datums - Tolerances of runout - Tolerancing of angles and cones. Exercises on each group.

Learning Outcomes:

At the end of this unit, the student will be able to

- List the types of tolerances of locations **L3**
- Explain the concept of tolerances of run out **L2**
- Explain tolerancing of angles and cones **L2**

UNIT – IV: Surface Roughness **8 Hrs**

Various parameters and their measurements in two dimensions - filtering and filtering techniques - areal parameters.

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Learning Outcomes:
At the end of this unit, the student will be able to
- Understand the concept of surface parameters in two dimensions **L2**
- Explain the filtering techniques **L2**

UNIT – V: Related Topics **9Hrs**
Vectorial dimensioning and tolerancing - Statistical tolerancing of mechanical assemblies - Dimensional chains - Measurement uncertainty - Computer-aided tolerancing and verification. Inspection techniques- conventional and CMM.

Learning Outcomes:
At the end of this unit, the student will be able to
- Compare various statistical tolerancing of mechanical assemblies. **L3**
- Identify the various computer aided tolerancing techniques. **L3**

Text Books:

1. Drake, P. J., Dimensioning and Tolerance Handbook, McGraw-Hill, Inc., New York.
2. Meadows, J. D., Geometric Dimensioning and Tolerancing: Applications and Techniques for use in Design, Manufacturing and Inspection, Marcel Dekker, Inc., New York.
3. Gill, P. S., Geometric Dimensioning and Tolerancing, S. K. Kataria & Sons, New Delhi.

Reference Books:

1. Gupta, I. C., A Textbook of Engineering Metrology, Dhanpat Rai Publications, New Delhi.
2. Galyer, J. F. W. and C. R. Shotbolt, Metrology for Engineers, Cassell Publishers, London.
3. Henzold, G., Handbook of Geometrical Tolerancing: Design, Manufacturing and Inspection, John Wiley & Sons, Chichester.
4. Muralikrishnan, B. and J. Raja, Computational Surface and Roundness Metrology, Springer, USA.

Course Outcomes:
At the end of this Course the student will be able to
- Introduce the essentials of the language of geometric dimensioning and tolerancing (GD&T) based on ASME and ISO standards, as well as the essentials of surface roughness measurements in both 2D and 3D including filtering techniques. **L2**
- Relate concepts of Vectorial dimensioning and tolerancing, dimensional chains, measurement uncertainty, etc. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME76f- PRODUCT MARKETING

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the basic concepts of Product marketing.
- Familiarize with market information systems and research.
- Understand the nature and importance of industrial market.
- Discuss the major stages in new product development.
- Identify the factors affecting pricing decisions.

UNIT – I: Introduction **12 Hrs**

Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, Characteristics affecting Consumer behavior, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation Concept of Marketing Myopia. Importance of marketing in the Indian Socio economic system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define Marketing **L1**
- Discuss marketing philosophies **L2**
- Sketch the buying decision process **L3**
- Understand the importance of marketing in the Indian socio economic system **L2**

UNIT – II: Marketing of Industrial Products **10 Hrs**

Components of marketing information system--benefits & uses marketing research system, marketing research procedure, Demand Estimation research, Test marketing, Segmentation Research - Cluster analysis, Discriminate analysis. Sales forecasting: objective and subjective methods. Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the components of marketing information system **L2**
- List the advantages and uses of marketing research system **L2**
- Demonstrate sales forecasting **L3**
- Explain the major factors influencing industrial buying behavior **L2**

UNIT – III: Product Management and Branding **10 Hrs**

The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of "New – product; major stages in new – product development product life cycle. Branding: Reasons for branding, functions of branding features of types of brands, kinds of brand name.

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Learning Outcomes:
At the end of this unit, the student will be able to

- Indentify the factors influencing change in product mix **L2**
- Sketch various stages in product life cycle **L2**
- Recall the features of a product and product policies **L1**
- Demonstrate on features, functions and reasons of branding **L3**

UNIT – IV: Pricing and Packaging **8 Hrs**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions Labeling: Types, functions advantages and disadvantages, Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

Learning Outcomes:
At the end of this unit, the student will be able to

- List the factors affecting pricing decisions **L1**
- Explain the procedure for price determination **L2**
- Employ Pricing strategies and decisions **L3**
- Understand the functions of labeling and packaging **L2**

UNIT – V: Product Promotion **8 Hrs**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. Advertising and sales promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. Personal Selling: Objectives of personal selling, qualities of good salesman, types of salesman, major steps in effective selling.

Learning Outcomes:
At the end of this unit, the student will be able to

- Discuss the procedures for price determination **L2**
- Explain the objectives of advertisement function of advertising **L2**
- List the advantages and disadvantages of advertising. **L1**
- Describe the major steps in effecting selling **L2**

Text Books:

1. Philip Kotler, Principles of Marketing, Prentice – Hall.
2. Philip Kotler, Marketing Management, Prentice – Hall.

Reference Books:

1. Wiliam J Stanton, Fundamentals of Marketing, McGraw Hill.
2. R.S.N. Pillai and Mrs.Bagavathi, Marketing, S. Chand & Co. Ltd .
3. Rajagopal, Marketing Management Text & Cases, Vikas Publishing House.

Course Outcomes:
At the end of this Course the student will be able to

- Understand basic marketing management concepts and their relevance to business development **L2**
- Prepare a questionnaire for market research **L5**
- Design marketing research plan for business organizations **L5**
- Optimize marketing mix to get competitive advantage **L4**

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE75a-ARCHITECTURE AND TOWN PLANNING

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To know the western architecture and Indian architecture and also to gain knowledge on the principles of architectural design and historical background of town planning.

A) ARCHITECTURE:

UNIT – I:

At the end of this unit, the student will be able to

History of Architecture:

a) Western Architecture: Egyptian, Greek, Roman Architectures; influences- Comparative Analysis Orders

b) Indian Architecture: Vedic age - Indus Valley civilization - Buddhist period; stambas, Slenstas. Roranas, Chaityans, Viharas with one example for each Hindu temples - Evaluation of Dravidian and Indo Aryan Styles - Principle factors. Temple of Aibole, Mahabalipuram, Madurai, Deograph, Bhuvaneshwar, Mount Abu.

c) Indo - Sarsanic Architecture; Mosque - Place- FortTomb

Learning Outcomes:

Understand the different architectures of Indian and western countries

Understand the various principle factors of architecture

UNIT – II:

Architectural Design:

a) Principle of designing : Composition of plan Relationship between plan and elevation elements, form, surface Mass, Texture, Color,Tone.

b) Principle of Compositions: Unity, contrast, proportion, scale, Bab Rhuthm, character. Principles of Planning a Residence; Site Orientation prospect, Grouping, circulation, privacy, services and otherfactors

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the design pricnciples and compositions of architecture

UNIT – III:

Introduction of Post-classic Architecture and contribution of eminent architects to modern period.Brief summary of post - classic architecture - Indian and Western Architectural contribution of Edward Lutyens, Le Corbusier), Frank Lloyd Wrigt, Walter Groping, Vender Rohe, Caarihan, Nervi, Oscar Niemyer, Edward Durell stone

Learning Outcomes:

At the end of this unit, the student will be able to

- Obtain the knowledge of contribution of different architects in architecture

B) TOWNPLANNING:

UNIT – IV:

Historical Back Ground: Town planning in India - town plans of Magad - town plans of ancient Indian towns; Mourya, Pataliputravijayanagara, Delhi.Town planning in the West-town plans of Acropolis, Rome, Paris, London

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the need of town planning
- Knowledge on planning of different towns in India and other countries

UNIT – V:

Components of Planning;

a) Zoning
b) Roads and road Traffic.
c) Housing-Slums, Parks, Playgrounds.
d) Public Utility Services.
e) Surveys and maps for planning.
f) Neighbourhood Planning

Planning New town, planning standards, National and regional Planning, town planning and legislation.Garden cities and satellite town

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the different components of town planning
- Knowledge on national standards in country and town planning

Text Books:

Reference Books:

A) ARCHITECTURE

1. Indian Architecture – Vol:- I and II by Percy Brown, Taraporevala Publications, Bombay.
2. Planning and 'Design of Building -Section of Architecture byY.S.Sane.
3. Modern Architecture and Design by Nikolans,Pevshar.
4. Modern Ideal Hol1 lnes for India byR.S.Deshpande.

B) TOWNPLANNING

1. Town and Country .Planning - A.J.Brown andH.M.Sherrard.
2. Town Design .-FederikGibbard, Architectural press,London.
3. National Building Code ofIndia.
4. Town Planning in India - Town and Country Planning Organisation, New Delhi1962.
5. Regional Planning - Misra R.P., Mysore University.
6. Urban and Regional Planning; Principles and case studies by K.S.Rama Gouda, Mysore University Publications.
7. Town and Country Planning - P. Abercrombe, Oxford University press.

Course Outcomes:

At the end of this Course the student will be able to

- Learn the importance of architecture and its principles in designing
- The different architectures till date and the contribution of different architects
- The necessity of town planning and different components of planning

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE75b-EXPERIMENTAL STRESS ANALYSIS

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To bring awareness on experimental method of finding the response of the structure to different types of load
- Demonstrates principles of experimental approach
- Teaches regarding the working principles of various strain gauges
- Throws knowledge on strain rosettes and principles of non destructive testing of concrete
- Gives an insight into the principles of photo elasticity

UNIT – I:

PRINCIPLES OF EXPERIMENTAL APPROACH: - Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate the merits and principles of experimental approach
- Give an insight into the uses and advantages of experimental stress analysis

UNIT – II:

STRAIN MEASUREMENT USING STRAIN GAUGES:-

Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base.

Learning Outcomes:

At the end of this unit, the student will be able to

- Introduce various strain gauge systems and their properties
- Give information regarding the gauge factor and materials of adhesion bases

UNIT – III:

STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE:- Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

Learning Outcomes:

At the end of this unit, the student will be able to

- Introduces various strain rosettes and corrections for strain gauges
- Gives an insight into the destructive and non destructive testing of concrete

UNIT – IV:

THEORY OF PHOTOELASTICITY: - Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster"s Stress Optic law.

Learning Outcomes:

At the end of this unit, the student will be able to

- Introduces stress optic laws.
- Gives the arrangements and working principles of polariscope

UNIT – V:

TWO DIMENSIONAL PHOTOELASTICITY: - Introduction – Iso-chromatic Fringe patternsIsoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials

Learning Outcomes:

At the end of this unit, the student will be able to

- Introduces the understanding of different fringe patterns.
- Introduces model analysis and properties of photo elastic materials

Text Books:

1. J.W.Dally and W.F.Riley, "Experimental stress analysis College House Enterprises"
2. Dr.Sadhu Singh, "Experimental stress analysis", khanna Publishers

Reference Books:

1. U.C.Jindal, "Experimental Stress analysis", Pearson Publications.
2. L.S.Srinath, "Experimental Stress Analysis", MC.Graw Hill Company Publishers.

Course Outcomes:

At the end of this Course the student will be able to

- The student will be able to understand different methods of experimental stress analysis
- The student will be able to understand the use of strain gauges for measurement of strain
- The student will be exposed to different Non destructive methods of concrete
- The student will be able to understand the theory of photo elasticity and its applications in analysis of structures

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACE75c-FINITE ELEMENT ANALYSIS

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem
- Learn to model complex geometry problems and solution techniques

UNIT – I:

INTRODUCTION: Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh –Ritz method of functional approximation.

PRINCIPLES OF ELASTICITY: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of nodes and elements.(L2)
- Understand the general steps of finite element methods.(l2)
- Understand the role and significance of shape functions in finite element formulations (l2)

UNIT – II:

ONE DIMENSIONAL & TWO DIMENSIONAL ELEMENTS: Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems .Two Dimensional Elements - Different types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the formulation of one dimensional and two – dimensional elements (L2)
- Apply the formulation techniques to solveone dimensional two – dimensional problems (L2)
- Formulate and solve axisymmetric problems.(L6)

UNIT – III:

GENERATION OF ELEMENT : Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.

Learning Outcomes:

At the end of this unit, the student will be able to

Apply the formulation techniques to solve problems using triangle and quadrilateral elements. (L3)

UNIT – IV:

ISOPARAMETRIC FORMULATION : Concepts of, isoparametric elements for 2D analysis – formulation of CST element, 4 –Noded and 8-noded iso-parametric quadrilateral elements – Lagrangian and Serendipity elements. **AXI-SYMMETRIC ANALYSIS:** Basic principles-Formulation of 4-noded iso-parametric axi-symmetric element

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand concepts of isoparametric elements(L1)
- Formulate and solve axisymmetric problems.(L6)

UNIT – V:

SOLUTION TECHNIQUES: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads

Learning Outcomes:

At the end of this unit, the student will be able to

Text Books:

1. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad.2003.
2. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers

Reference Books:

1. Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press,Hyderabad
2. Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, NewDelhi
3. Finite element analysis by S.S. Bhavakatti-New age internationalpublishers

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the differential equilibrium equations and theirrelationship
- Apply numerical methods tofem
- Demonstrate the displacement models and loadvectors
- Compute the stiffness matrix for isoperimetricelements
- Analyze plane stress and plane strainproblems

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE75a- ELECTRICAL ENGINEERING MATERIALS

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Classification of materials.
- Properties of materials and its applications.
- Domestic wiring and earthling
- Concept of polarization and dipolar polarization
- Classification of materials.

UNIT – I: Conducting Materials **10 Hrs**

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials–classification of electrical materials–concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting resistivity of electrical materials–electrical / mechanical / thermal properties of copper, aluminum, iron, steel, lead, tin and their alloys–applications.

Learning Outcomes:

At the end of this unit, the student will be able to

1. Understand the classification of conducting materials. **L1**
2. Analyze the properties of different conducting materials **L2**

UNIT – II: Dielectric and High Resistivity Materials **10 Hrs**

Introduction–solid, liquid and gaseous di electrics, leakage current, permittivity, dielectric constant, dielectric loss –loss angle –loss constant, Breakdown voltage and di electric strength of –solid, liquid and gaseous dielectrics, effect of break down–electrical and thermal effects, Polarization – electric, ionic and dipolar polarization. Effect of temperature and Frequency on dielectric constant of polar dielectrics. High Resistivity materials – electrical / thermal /mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the classification of di electric and high resistivity materials. **L1**
- Analyze the properties of di electric and high resistivity materials **L2**

UNIT – III: Solid Insulating Materials **10 Hrs**

Introduction–characteristics of a good electrical insulating materials–classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials-Asbestos, Bakelite, rubber, plastics, thermoplastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand about various characteristics of solid insulating materials **L1**
- Understand the classification of solid insulating materials. **L2**

UNIT – IV: Liquid & Gas Insulating Materials **10 Hrs**

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids–Electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties Gaseous insulators– classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the classification of liquid insulating materials. **L1**
- Analyze the properties of liquid insulating materials **L2**

UNIT – V: Domestic Wiring **10 Hrs**

Wiring materials and accessories–Types of wiring–Types of Switches-Specification of Wiring–Staircase wiring- Fluorescent lamp wiring-God own wiring–Basics of earthling–single phase wiring layout for residential building.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand about wiring materials and accessories **L1**
- Understand about earthing and wiring layout of domestic buildings **L2**

Text Books:

1. Electrical Engineering Materials by G.K. Mithal, Khanna publishers, 2nd edition,1991.
2. Acourse in Electrical Engineering Materials by R.K. Rajput, Laxmi publications,2009.

Reference Books:

1. An Introduction to Electrical Engineering Materials by C.S.Indulkar and S.Thiruvengadam, SChand&Company,2008.
2. Electrical engineering Materials by Technical Teachers Training Institute, Madras, McGraw Hill Education,1st Edition,2004.
3. A course in Electrical Engineering Materials Physics Properties & Applications by S P.Seth, Dhanapat Rai & Sons Publications,2018.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the classification of materials, domestic wiring materials and earthing. **L1**
- Analyze the properties of different electrical materials **L2**
- Apply where the materials are applicable based on properties of materials **L3**
- Design and develop Residential wiring, go down wiring and earthing. **L4**
- `Understand the characteristics of materials **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE75b- DIGITAL SIGNAL PROCESSORS AND APPLICATIONS

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Provide the basic knowledge of different DSP Processors.
- Interfacing Memory and I/O Peripherals to different Programmable DSP Devices
- Operation of the ADC and programming modes
- Introduction to Field Programmable Gate Arrays
- Provide the basic knowledge of different DSP Processors.

UNIT – I: **10 Hrs**

Introduction to the TMSLF2407 DSP Controller: Brief Introduction to Peripherals - Types of Physical Memory - Software Tools

C2XX DSP CPU and instruction set: Introduction to the C2xx DSP Core and Code Generation - The Components of the C2xx DSP Core - Mapping External Devices to the C2xx Core and the Peripheral Interface -System Configuration Registers –Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction Set

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to understand the basic concepts of DSP controller **L1**
- Able to understand the Assembly language programming **L2**

UNIT – II: **10 Hrs**

Parallel and Serial Data Transfer: Pin Multiplexing (MUX) and General Purpose I/O Overview - Multiplexing and General Purpose I/O Control Registers - Using the General Purpose I/O Ports, Serial Communication

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Pin Multiplexing and GPIO pins **L1**
- Analyze the serial Communication concepts **L2**
- Understand the concept of control Registers **L3**

UNIT – III: **10 Hrs**

Interrupt system of TMS320LF2407: Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers - Initializing and Servicing Interrupts in Software, real time control with interrupts

The analog-to-digital converter (ADC): ADC Overview - Operation of the ADC and programming modes

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Interrupts **L1**
- Analyze the concept of Analog to digital converter **L2**

UNIT – IV: **10 Hrs**

Event Managers (EVA, EVB): Overview of the Event Manager (EV) - Event Manager Interrupts - General Purpose (GP) Timers- Compare Units - Capture Units and Quadrature Encoded Pulse (QEP) Circuitry - General Event Manager Information – PWM Signal Generation with Event Managers and interrupts, Measurement of speed with Capture Units, Implementation of Space Vector Modulation with DSP TMSLF2407A

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Event Manager and Interrupts **L1**
- Apply the concept of Space Vector Modulation with processor **L2**

UNIT – V: **10 Hrs**

Field Programmable Gate Arrays: Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA , Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP)- HDL programming –overview of Spartan 6 & ISE Design Suite, Implementation of PWM technique with SPARTAN-6 FPGA

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Field Programmable Gate Arrays. **L1**
- Apply the concept of HDL programming and PWM technique implementation **L2**

Text Books:

1. Hamid A. Tolyat, "DSP based Electromechanical Motion Control"-CRC press, 2004
2. Wayne Wolf,,,FPGA based system design", Prentice hall, 2004

Reference Books:

1. Application Notes from the website of Texas Instruments
2. Spartan-6 FPGA Configurable Logic Block, 2010
3. Xilinx Spartan 6 Data sheets

Course Outcomes:

At the end of this Course the student will be able to

- Write Assembly Language Programs for the Digital Signal Processors **L1**
- Configure and use Digital Input / Output lines and ADCs **L2**
- Configure and use Interrupts and Event Managers for PWM generation **L3**
- Employ DSPs & **L4**
- FPGAs for the real time control of Power Electronic Controllers **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE75c- IOT APPLICATIONS IN ELECTRICAL ENGINEERING

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To learn about a few applications of Internet of Things
- To distinguish between motion less and motion detectors as IOT applications
- To know about Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- To understand about applications of IOT in smart grid
- To introduce the new concept of Internet of Energy for various applications

UNIT – I: SENSORS **10 Hrs**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic principles of sensors and their classification **L1**
- To learn about various motion less sensors **L2**

UNIT – II: Occupancy and Motion detectors **10 Hrs**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about Capacitive occupancy **L1**
- To understand about Motion detectors **L2**

UNIT – III: MEMS **10 Hrs**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about the basic concept of MEMS **L1**
- To know about electrostatic actuation **L2**

UNIT – IV: IOT FOR SMART GRID **10 Hrs**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

Learning Outcomes:

At the end of this unit, the student will be able to

- To get exposure fundamental applications of IoT to Smart grid **L1**
- To learn about driving factors of IoT in Generation level **L2**

UNIT – V: IOE - Internet of Energy **10 Hrs**

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IOE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid.

Learning Outcomes:

At the end of this unit, the student will be able to

- To get exposed the new concept of internet of energy **L1**
- To learn about architecture of IOE **L2**

Text Books:

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD SundaramShriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

Course Outcomes:

At the end of this Course the student will be able to

- To get exposed to recent trends in few applications of IoT in Electrical Engineering **L1**
- To understand about usage of various types of motionless sensors **L2**
- To understand about usage of various types of motion detectors **L3**
- To get exposed to various applications of IoT in smart grid **L4**
- To get exposed to future working environment with Energy internet **L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75a – SPECIAL TYPE OF VEHICLES

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the various types of special vehicles.
- Familiarize with the function of graders.
- Identify the applications of haulage vehicles and lift truck
- Understand the functions of scarifiers and scrapers
- Discuss the specifications of special purpose vehicles

UNIT – I: TRACTORS & CRANES AND EXCAVATORS **8 Hrs**

TRACTORS : General description, specification and functions, light, medium and heavy wheeled tractors, crawler tracks mounted / wheeled - Bull dozers, tilt dozers and angle dozers, front end loaders, factors affecting efficiency of output of tractors, simple problems, merits and demerits.

CRANES AND EXCAVATORS: General description, specifications and functions, excavator mounted cranes, mobile cranes with strut and cantilever type jibs, tractor towed and tractor mounted cranes. General description, specification and functions, classification based on attachments, face shovel, drag shovel, hoe, drag-line and grab or clam shell, advantages and limitations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various types of tractors **L1**
- Calculate the efficiency of output of tractors **L4**
- Discuss the functions of cranes and excavators **L2**
- Recall the advantages and limitations of cranes and excavators **L2**

UNIT – II: GRADERS **6Hrs**

Description, specification of tractor towed graders and motor graders, classification and functions of graders, functional details of spreading, mixing, ditching, bank sloping, snow removal, stripping, scarifying, and finishing, elementary details of transmission system (coupling, clutches, gear box, driving axles, propeller shafts), running gear and operating equipment air braking system; hydraulic system and its components, steering system of lights, medium and heavy graders, merits and limitations of graders.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the terms spreading, mixing, ditching, back sloping, scarifying. **L2**
- Discuss elementary details of transmission system **L2**
- Demonstrate the hydraulic system and its components. **L3**
- List the merits and limitations of graders. **L2**

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UNIT – III: HAULAGE VEHICLES AND LIFT TRUCKS **6Hrs**

General description, specification and functions, self-propelled and tractor towed haulage vehicles and pneumatic – tires, dumpers – front tipping; trucks – rear tipping, tractor towed semi-trailers and trailers (rear and side tipping, bottom dumping). General description, specification and functions, fork lift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks - Applications in industry, advantages and disadvantages.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the importance of haulage vehicles and trucks in industries. **L2**
- Select haulage vehicles for a given application **L6**
- Illustrate the function of fork lift trucks. **L3**

UNIT – IV: Rooters, Scarifiers And Scrapers **6 Hrs**

General description, specification and functions, tractor towed rooters and scarifiers - Heavy duty, light duty. General description, specification and functions, tractor towed and motorized scrapers, scraper work in cutting, cambering, side hill cutting, spreading on embankments, compaction of fill merits and demerits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the specifications of rooters **L2**
- Categorize Heavy duty and light duty scarifiers **L4**
- Recall the merits and demerits of scrapers. **L1**

UNIT – V: Compaction Vehicles And Other Special Purpose Vehicles **6Hrs**

General description, specification and functions, smooth wheeled rollers, pneumatic tired rollers, agricultural Rollers, sheep's foot rollers, vibrating compactors. General description, specification and functions, Ambulance, oil tankers, surveillance vehicle, television recording mobile UNIT, reefer vehicle, double decker bus, vestibule bus, fire fighting vehicle.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various types of special purpose vehicles. **L1**
- Choose the rollers for a given application. **L1**
- Discuss the function of compactors. **L2**
- Explain the importance of special purpose vehicles in the society. **L2**

Text Books:

1. Peurifoy R L "Construction Planning, Equipment and Methods", Tata McGraw-Hill, NewDelhi, 2002.
2. Ian Graham, "Off-Road vehicles", Heinemann Library, 2008.

Reference Books:

1. Wong J "Terramechanics and Off-Road Vehicle Engineering", Butterworth-Heinemann, 2009.
2. Roninson E G, "Motor Graders", MIR Publications, Moscow, 1985.
3. Rodhiev and Rodhiev, "Tractors and Automobiles", MIR Publishers, Moscow, 1984.
4. Greenwich and Soreking, "Tractors", MIR Publishers, Moscow, 1967.

Course Outcomes:

At the end of this Course the student will be able to

- Classify excavators based on attachments. **L2**
- Understand the importance of graders. **L2**
- Identify the various types of fork lift attachments. **L2**
- Recall the advantages and disadvantages of special purpose vehicles. **L1**

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75b - SIX SIGMA AND LEAN MANUFACTURING

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the students, the basic concepts of six sigma and lean manufacturing.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of cellular manufacturing and 5S.
- Understand the importance of Quality standards in manufacturing.

UNIT – I: Introduction to Six-Sigma **8 Hrs**

Probabilistic models-Six Sigma measures-Yield-DPMO-Quality level-Reliability function using Six-Sigma-MTTF using Six Sigma-Maintenance free operating period- Availability using Six-Sigma-Point availability-Achieved availability-Operational Availability-Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of probabilistic models **L2**
- Determine the reliability function using six-sigma **L3**
- Explain about MTTF using six sigma concepts **L2**
- Illustrate the examples of availability using sigma **L2**

UNIT – II: The Elements of Six Sigma and their Determination **6Hrs**

The Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)-Six sigma approach-Six sigma and the 1.5 σ shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- List the quality measurement techniques **L1**
- Discuss the process capability index (Cp).
- Compare the Cpk Approach and Six Sigma
- Explain about different statistical quality control methods
- State the relationship of control charts and six sigma **L2**

UNIT – III: Introduction To Lean Manufacturing **6Hrs**

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate the basic elements of lean manufacturing **L2**
- List the various lean manufacturing tools. **L1**
- Describe the principles of lean manufacturing **L2**
- Compare conventional manufacturing and lean manufacturing system **L2**

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UNIT – IV: Cellular Manufacturing, JIT, TPM **6 Hrs**

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of cellular manufacturing L2
- Indentify the types of layouts. L3
- Describe the concepts of JIT and TPM L2
- Demonstrate the pillars of TPM L2
- Create the cell layout. L6

UNIT – V: Set Up Time Reduction, TQM, 5S, VSM 10 **6Hrs**

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define set up time reduction. L1
- Illustrate the principles and implementation of 5S techniques. L2
- Discuss procedure and principles of value stream mapping L6
- List the various reduction approaches L1

Text Books:

1. U Dinesh Kumar, Crocker, Chitra and Harithe Saranga, Reliability and Six Sigma, Springer Publishers.
2. Sung H. Park, Six Sigma for Quality and Productivity Promotion, Asian Productivity Organization

Reference Books:

1. Sammy G. Shina, Six Sigma for Electronics Design and Manufacturing, McGraw-Hill.
2. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003.
3. Mikell P. Groover (2002) _Automation, Production Systems and CIM.
4. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.

Course Outcomes:

At the end of this Course the student will be able to

- Summarize various techniques that are related to the six-sigma and lean manufacturing L2
- Outline the concepts of cellular manufacturing, JIT and TPM L2
- Illustrate the principles and implementation of 5S techniques L2
- Discuss procedure and principles of value stream mapping L6
- Determine the reliability function using six-sigma. L3

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75c – REVERSE ENGINEERING

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about
- Introduce the concepts of reverse engineering
- Familiarize with the tools and techniques for reverse engineering
- Teach the principles of various rapid prototyping methods
- Discuss the legal aspects of reverse engineering.

UNIT – 1: Introduction **8 Hrs**

Scope and tasks of RE, Process of duplicating, Definition and use of Reverse Engineering, Reverse Engineering as a Generic Process

Learning Outcomes:

At the end of this unit, the student will be able to
- Recall the definition and use of reverse engineering. **L1**
- Identify reverse engineering as a generic process. **L2**
- List various tasks of reverse engineering. **L1**

UNIT – II: Tools and Techniques for RE **6Hrs**

Object scanning: contact scanners, noncontact scanners, destructive method, coordinate measuring machine, Point Data Processing: pre processing and post processing of captured data, geometric model development, construction of surface model, solid model, noise reduction, feature identification, model verification

Learning Outcomes:

At the end of this unit, the student will be able to
- Summarize various techniques in reverse engineering. **L2**
- Compare preprocessing and post processing of captured data. **L4**
- Explain noise reduction, feature identification and model verification. **L2**

UNIT – III: Rapid Prototyping **6Hrs**

Introduction, current RP techniques and materials, Stereo Lithography, Selective Laser Sintering, Fused Deposition Modelling, Three-dimensional Printing, Laminated Object Manufacturing, Multi – jet Modelling, Laser-engineered Net Shaping, Rapid Prototyping, Rapid Tooling, Rapid Manufacturing

Learning Outcomes:

At the end of this unit, the student will be able to
- Identify the developments in the rapid prototyping techniques **L2**
- Classify rapid prototyping techniques. **L2**
- List the advantages and disadvantages of rapid prototyping methods. **L1**

UNIT – IV: Integration **6 Hrs**

Cognitive approach to RE, Integration of formal and structured methods in reverse engineering, Integration of reverse engineering and reuse.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the cognitive approach to reverse engineering. **L2**
- Discuss the integration of formal and structured methods in reverse engineering. **L2**

UNIT – V: Legal Aspects of Reverse Engineering **6Hrs**

Legal Aspects of Reverse Engineering: Introduction, Copyright Law.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the legal aspects of reverse engineering **L2**
- Understand the concepts of copyright law. **L2**

Text Books:

1. Biggerstaff T. J., "Design Recovery for Maintenance and Reuse", IEEE Corporation, 1991.
2. Katheryn, A. Ingle, "Reverse Engineering", McGraw-Hill, 1994.

Reference Books:

1. Aiken Peter, "Data Reverse Engineering", McGraw-Hill, 1996.
2. Linda Wills,"Reverse Engineering" ,Kluiver Academic Publishers, 1996.
3. Donald R. Honsa , "Co-ordinate Measurement and reverse engineering", American Gear Manufacturers Association, 1996.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the importance of reverse engineering. **L2**
- Make use of tools and techniques of reverse engineering. **L3**
- Identify the applications of rapid prototyping techniques. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75d – ENERGY AUDITING

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the concepts of energy scenario and need for energy policy for industries in India.
- Familiarize with the Energy Audit concepts and its approaches.
- Teach the principles and objectives of the Energy management.

UNIT – I: General Aspects **8 Hrs**

Review of energy scenario in India, General Philosophy and need of Energy Audit and Management, Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportunities, Energy performance contracts, Fuel and Energy substitution, Need for Energy Policy for Industries, National & State level energy Policies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the fundamental aspects of energy scenario in India. **L2**
- List the various national and state level energy policy. **L1**
- Identify the basic elements and measurements of energy audit. **L3**
- Summarize the evaluation of energy conserving balances **L2**

UNIT – II: Energy Audit Concepts **6Hrs**

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies -Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize various concepts of energy audit. **L2**
- Compare various energy management approaches. **L4**
- Explain Bench marking and energy performance in energy auditing. **L2**

UNIT – III: Principles and Objectives of Energy Management **6Hrs**

Design of Energy Management Programmes - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Monitoring and targeting, some case study and potential energy savings.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the developments of energy management systems **L2**
- Explain the importance of energy management **L2**
- List the various duties of energy manager **L1**

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UNIT – IV: Thermal Energy Management **6 Hrs**

Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery -Thermal insulation - Heat exchangers and heat pumps – HVC industries-Building Energy Management.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of energy conservation in boilers **L2**
- Identify the thermal energy components **L3**
- Illustrate the applications of FBC boilers **L2**

UNIT – V: Electrical Energy Management **6Hrs**

Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC- FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of supply side methods to minimize supply. **L2**
- Explain the reactive power management. **L2**
- Identify the energy conservation methods in motors, pumps and fan systems. **L3**
- List the energy efficient motors. **L2**

Text Books:

1. Murphy, W. R., Energy Management, Elsevier, 2007.
2. Smith, C. B., Energy Management Principles, Pergamum, 2007
3. Handbook of Energy Audit, Sonal Desai, Mcgraw Hill Education Private Ltd.,

Reference Books:

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.
3. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley a. Interscience publication)
4. Industrial Energy Management and Utilisation –L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)
5. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
6. Energy Conservation guide book Patrick/Patrick/Fardo (Prentice hall1993)

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts of energy audit and energy management **L2**
- Explain different types of energy audit, maximizing and optimizing system efficiency. **L3**
- Summarize energy management systems, prepare and present energy audit report **L5**
- Identify energy saving potential of thermal and electrical systems **L3**
- Discuss Energy audit instruments, Procedures and Techniques. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75e – INTRODUCTION TO COMPOSITE MATERIALS

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

UNIT – I: Introduction to composites **8 Hrs**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the fundamentals of composites. L2
- Classify the composites based on matrix and structure. L2
- Identify the practical applications of composites. L3
- Summarize the properties and advantages of reinforcement materials L2

UNIT – II: Polymer matrix composites **6Hrs**

Polymers - Polymer matrix materials – PMC processes - hand layup process – spray up process – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMC's.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of polymer matrix composites. L2
- Identify the polymer matrix composites. L3
- Explain various process used in making the polymer matrix composites L2
- Discuss the auto clave based methods. L6

UNIT – III: Metal matrix composites **6Hrs**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMC's.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline the various types of metal matrix composite L2
- Explain liquid state processes and solid state processes in MMCs preparation L2
- Demonstrate In-situ processes L2
- Identify the properties and applications of MMCs L2

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UNIT – IV: Ceramic matrix composites **6 Hrs**

Ceramic matrix materials – properties – processing of CMCs – Sintering - Hot pressing – Infiltration – Lanxide process – In-situ chemical reaction techniques – sol-gel polymer pyrolsis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize the various types of ceramic matrix materials. **L2**
- Explain the sintering, hot pressing, infiltration and lanxide process **L2**
- Contrast between cold and hot isostatic pressing. **L2**
- Examine the properties and applications of CCMs. **L3**

UNIT – V: Advances in composites **6Hrs**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications.

Characterization of composite materials - Mechanical Properties, Thermal Properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the advantages and disadvantages of carbon matrix **L2**
- Identify composites for aerospace applications **L3**
- Apply chemical vapour deposition of carbon on carbon fibre perform **L3**
- Select the carbon - carbon composites. **L1**
- Classify various bio- degradable composites **L3**

Text Books:

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

Reference Books:

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong, Fundamentals of Composite Manufacturing, SME, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bioplastics & Bio-composites for Engineering applications, John Wiley publications.

Course Outcomes:

At the end of this Course the student will be able to

- Identify the practical applications of composites. **L3**
- Identify the polymer matrix composites. **L3**
- Classify of bio- degradable composites. **L2**
- Outline the various types of ceramic matrix materials. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME75f – CUSTOMER RELATIONSHIP MANAGEMENT

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- Introduce basic concepts and principles of customer relationship management (CRM).
- Familiarize with appreciate the role and changing face of CRM as an IT enabled function.
- Describe concept of managing and sharing customer data.
- Explain the principles of CRM links in e-Business.
- Expose the students on Enterprise resource planning (ERP),supply chain management (SCM) and Supplier relationship management (SRM).

UNIT – 1: CRM concepts **8 Hrs**

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of customer relationship management **L2**
- Define customer relationship management (CRM) **L1**
- Illustrate the service level agreements (SLAs) **L2**

UNIT – II: CRM in Marketing **6Hrs**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling & Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing. - CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of one-to-one relationship marketing **L2**
- Develop the skills related to predict the behaviour and retention of the customer **L6**
- Discus about customer profitability and value modeling. **L6**
- Illustrate the various methods for CRM and customer service **L2**

UNIT – III: Sales Force Automation **6Hrs**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM).

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of CRM links in e-Business. **L2**
- Discus E-commerce and customer relationship on the internet. **L6**
- Describe Enterprise resource planning (ERP), Supply chain management (SCM). **L2**
- Explain terms supplier relationship management and partner relationship management. **L2**

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UNIT – IV: Analytical CRM **6 Hrs**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use - Data Warehousing and Data Mining concepts - Data analysis - Market Basket Analysis (MBA), Click stream Analysis, Personalization and Collaborative Filtering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain how to manage and sharing the customer data **L2**
- List the various ethics and legalities of customer database use **L1**
- Describe various data warehousing and data mining concepts **L3**
- Discus about market basket analysis (MBA) **L6**

UNIT – V: CRM Implementation **6Hrs**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define success factors for implementing the customer relationship management. **L1**
- Define functionalities of CRM. **L1**
- Explain the functions of CRM development team. **L2**
- Compare Home grown and out-sourced approaches. **L2**

Text Books:

1. Alok Kumar Rai, Customer Relationship Management Concept & Cases, Prentice Hall Of India Private Limted, New Delhi. 2011.
2. S. Shanmugasundaram, Customer Rela Tionship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.

Reference Books:

1. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.
2. Jagdish Seth, Et Al, Customer Rela Tionship Management.
3. V. Kumar & Werner J., Customer Rela Tionship Management, Willey India, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Summarizes the how CRM works in industries. **L2**
- Discus about market basket analysis (MBA). **L6**
- Develop the skills related to predict the behaviour and retention of the customer. **L6**
- Explain the concepts of customer relationship management. **L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC75a-EMBEDDED SYSTEMS & IOT

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- To understand the basics of Embedded Systems and IOT.
- To learn the architecture and programming of ARM Microcontroller.
- To be able to work with Raspberry Pi using Python Programming.
- To know about the IOT standards, communication technologies and protocols.
- To implement real time projects using the tools and techniques of IOT Platform.

UNIT – I:

Introduction to Embedded Systems and Internet of Things (IOT): Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Applications of Embedded Systems and IOT, Design Methodology for IOT Products

Learning Outcomes:

At the end of this unit, the student will be able to

- Gain knowledge on basics of embedded systems and IOT Architectures. **L1**
- Understand the design methodology and applications of embedded systems and IOT. **L2**

UNIT – II:

ARM Microcontrollers Architecture and Programming: Architecture, Instruction set, Programming ports, Timer/Counter, Serial communication, interrupts in C, Introduction ARM mBed platform.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the architecture and programming of ARM Microcontrollers. **L2**
- Work with ARM Microcontrollers in implementing real time projects. **L6**

UNIT – III:

Fundamentals of Python Programming & Raspberry Pi: Introduction to python programming, Working with functions, classes, REST full Web Services, Client Libraries, Introduction & programming Raspberry Pi3, Integrating Input Output devices with Raspberry Pi3.

Learning Outcomes:

At the end of this unit, the student will be able to

- Write programs using Python to implement the given task. **L6**
- Use Raspberry Pi3 for integrating Input & Output devices. **L3**

UNIT – IV:

IOT Technologies, Standards and Tools: Fundamental characteristics and high level requirements of IOT, IOT Reference models; Introduction to Communication Technologies & Protocols of IOT: BLE, Wi-Fi, LORA, 3G/4G Technologies and HTTP, MQTT, COAP protocols; Relevant Practicals on above technologies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the characteristics and high level requirements to design new IoT devices. **L2**
- Summarize different Communication Technologies & Protocols of IoT. **L2**

UNIT – V:

IOT Platform, Cloud Computing Platforms for IoT Development: IOT Platform Architecture (IBM Internet of Things & Watson Platforms); API Endpoints for Platform Services; Devices Creation and Data Transmission; Introduction to NODE-RED and Application deployment.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn how to use API Endpoints for Platform Services, Devices Creation and Data Transmission. **L1**
- To implement real time projects using the tools and techniques of IoT Platform. **L6**

Text Books:

1. ArsheepBahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st Edition, VPT, 2014.
2. K.V.K.K.Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", 1st Edition, Dreamtech Publication, 2014.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2013

Reference Books:

1. Jonathan W Valvano, "Embedded Microcomputer Systems: Real-Time Interfacing", 3rd Edition, Thomson Engineering, 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", 2nd Edition, Wiley Publications, 2012.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basics of Embedded Systems and IOT. **L2**
- Correlate the architecture and programming of ARM Microcontroller. **L4**
- Work with Raspberry Pi using Python Programming. **L6**
- Summarize IOT standards, communication technologies and protocols. **L2**
- Implement real time projects using the tools and techniques of IOT Platform. **L6**

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19AEC75b-ELECTRONIC INSTRUMENTATION

(Open Elective-III)

L	T	P	C
2	0	0	2

Course Objectives: The objectives of the course are to make the students learn about

- To know about the performance characteristics of instruments and measurement of electrical quantities.
- To understand the construction, working and applications of different types of CRO"s.
- To analyze the working of different types of bridges.
- To study the working of signal & function generators.
- To analyze the working of transducers in measuring physical parameters

UNIT – I:

Measuring Instruments: Introduction, Errors in Measurement, Accuracy, Precision, Resolution and Significant figures. Basic PMMC Meter- construction and working, DC and AC Voltmeters- Multirange, Range extension, DC Ammeter, Multimeter for Voltage, Current and resistance measurements.

Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V–T, V–F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multimeters, Digital frequency meters, Digital measurement of time.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn about the performance characteristics of the instruments. **L1**
- Understand the working of different types of ammeters, voltmeters and multimeters. **L2**

UNIT – II:

Oscilloscopes: Introduction, Block diagram of CRO, Basic principle of CRT, CRT Construction and features, vertical amplifiers, horizontal dPeflection system- sweep, trigger pulse, delay line, sync selector circuits. Dual beam and dual trace CROs, Sampling and Digital storage oscilloscopes.

Learning Outcomes:

At the end of this unit, the student will be able to

- Grasp the construction and working of different types of oscilloscopes. **L1**
- Use CRO to measure the amplitude, frequency, phase and time period of given signals. **L3**

UNIT – III:

Bridges: DC Bridges for Measurement of resistance - Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wien Bridge, Errors and precautions in using bridges.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the construction and working of different types of bridges. **L2**
- Measure parameters like resistance, capacitance, and inductance using bridges. **L3**

UNIT – IV:

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the working and applications of signal generators. **L2**
- Gain knowledge on the working and applications of function generators. **L1**

UNIT – V:

Transducers: Introduction, Types of Transducers, Electrical transducers, Selecting a transducer, Resistive transducer, Strain gauges, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Temperature transducers-RTD, LVDT.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic working principle and applications of transducers. **L2**
- Measure physical parameters using different types transducers. **L3**

Text Books:

1. H.S.Kalsi, "Electronic Instrumentation", Third edition, Tata McGraw Hill, 2010.
2. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 6th Edition, 2010.

Reference Books:

1. A.K. Sawhney, Dhanpat Rai & Co., "A course in Electrical and Electronic Measurements and Instrumentation", 9th Edition, 2010.
2. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Know about the performance characteristics of instruments and measurement of electrical quantities. **L1**
- Understand the construction, working and applications of different types of CRO"s. **L2**
- Compare the working of different types of bridges. **L2**
- Learn the working of signal & function generators. **L1**
- Analyze the working of transducers in measuring physical parameters. **L4**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC75c-BASICS OF VLSI DESIGN

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To give exposure to different steps involved in the fabrication of ICs and electrical properties of MOS devices.
- To know the design rules in drawing the layout of any logic circuit.
- To design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
- To learn the concepts scaling and designing building blocks of data path of any system using gates.
- Understand the design and operation of basic programmable logic devices.

UNIT – I:

MOS Technology: Introduction to IC Technology. The IC Era, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, nMOS and CMOS Fabrication processes.

Basic Electrical Properties of MOS Circuits: I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Transconductance and Output Conductance, nMOS Inverter, Determination of Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, CMOS Inverter.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different steps involved in the fabrication of ICs and electrical properties of MOS devices. **L2**
- Analyze the operation of NMOS, CMOS and BiCMOS inverters. **L4**

UNIT – II:

MOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly CMOS rules, Layout Diagrams-A Brief Introduction, Symbolic Diagrams-Translation to Mask Form.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the VLSI design flow and stick diagrams. **L1**
- Understand the design rules in drawing the layout of any logic circuit. **L2**

UNIT – III:

Basic Circuit Concepts: Sheet Resistance. Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, standard unit of capacitance, area Capacitance calculations, the Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different types of logics in gate level design. **L2**
- Learn and compare different performance parameters in gate level design. **L1**

UNIT – IV:

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.

Sub System Design and Layout: Switch logic, Gate logic, Examples of Structured Design, parity generator, multiplexers, and grey to binary code converter.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appreciate the importance, models and limitations of scaling. **L1**
- Explain the building blocks of data path of any system using gates. **L1**

UNIT – V:

Programmable Logic Devices: Read only memories, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Complex programmable logic devices, Field programmable gate arrays.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain different programmable logic devices. **L1**
- Compare the performance parameters and applications of different programmable logic devices. **L2**

Text Books:

1. Kamran Eshraghian. Douglas, A. Pucknell and Sholeh Eshraghian, "Essentials of LSI Circuits and Systems", Prentice Hall of India Private Limited, 2005 Edition.
2. Neil H.E.WESTE, David Harris andAyan Banerjee, "CMOS VLSI Design A Circuits and systems perspective", Pearson Education, 2006 Third Edition

Reference Books:

1. Richa Jain and Amrita Rai, "Principles of VLSI and CMOS Integrated Circuits", S.Chand and Company Limited. First edition.2012.
2. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition.

Course Outcomes:

At the end of this Course the student will be able to

- Understand different steps involved in the fabrication of ICs and electrical properties of MOS devices. **L2**
- Know the design rules in drawing the layout of any logic circuit. **L1**
- Compare different types of logic gates using CMOS inverter and their transfer characteristics. **L2**
- Learn the concepts to design building blocks of data path of any system using gates. **L1**
- Gain knowledge about basic programmable logic devices and testing of CMOS circuits. **L1**

IV B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS75a-MOBILE APPLICATION DEVELOPMENT

Open Elective-III

L	T	P	C
2	0	0	2

Course Objectives:

- Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

UNIT – 1: **8 Hrs**

Introduction Android Programming: What is Android, Activities, Linking Activities Using Intents, Fragments, Calling Built – in Applications using Intents, Displaying Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L2**
- demonstrate their skills of using Android software development tools **L2**

UNIT – II: **8 Hrs**

Android User Interface: Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Listening for UI Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to develop software with reasonable complexity on mobile platform. **L3**
- demonstrate their ability to deploy software to mobile devices **L3**

UNIT – III: **8 Hrs**

Designing User Interface with Views: Basic Views, Picker Views, Using List Views to Display Long Lists.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to debug programs running on mobile devices **L4**
- demonstrate their ability to deploy software to mobile devices **L4**

UNIT – IV: **7 Hrs**

Displaying pictures and menus with views and Data Persistence: Views to Display pictures, menus with views, additional views, saving and loading user preferences, persisting data to files, creating and using databases.

Learning Outcomes:

At the end of this unit, the student will be able to

1. demonstrate their skills of using Android software development tools **L4**
2. demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

UNIT – V: **08Hrs**

Content Providers: Sharing data in android, using a content provider, creating your own content providers.

Messaging and Networking: SMS Messaging, Sending E-Mail, Networking

Location-Based Services: Displaying Maps, Getting Location Data.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to deploy software to mobile devices **L5**
- demonstrate their ability to debug programs running on mobile devices **L5**

Text Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India
2. Beginning Swift Programming, Wei-Meng Lee, December 2014, ISBN: 978-1-119-00931-3

Reference Books:

1. Enterprise J2ME: Developing Mobile Java Applications, Michael Juntao Yuan, Pearson Education, 2004.
2. Android Application Development for Java programming by James C. Sheusi, Cengage Learning
3. Android A Programmers Guide by Jerome DiMargio, TMH.

Course Outcomes:

At the end of this Course the student will be able to

1. demonstrate their understanding of the fundamentals of Android operating systems **L3**
2. demonstrate their skills of using Android software development tools **L4**
3. demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

IV B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS75b-REAL TIME OPERATING SYSTEMS AND APPLICATIONS

Open Elective-III

L	T	P	C
2	0	0	2

Course Objectives:

COURSE OBJECTIVES:

The objective of this course is to

- develop an understanding of various Real Time systems Application
- obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- get in-depth hands-on experience in designing and developing a real operational system.

UNIT – 1: Introduction **8 Hrs**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Learning Outcomes:

At the end of this unit, the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L1**
- Distinguish characterstics of structural testing methods **L2**

UNIT – II: Real Time Scheduling **8 Hrs**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems..

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L3**
- Discuss about the functional and system testing methods **L3**

UNIT – III: Resources Sharing **8 Hrs**

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L4**
- Demonstrate various issues for object oriented testing. **L4**
-

UNIT – IV: Real Time Communication **7 Hrs**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols..

Learning Outcomes:

At the end of this unit, the student will be able to

- Distinguish characterstics of structural testing methods. **L5**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L4**

UNIT – V:Real Time Operating Systems and Databases **08Hrs**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases..

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L5**
- Demonstrate various issues for object oriented testing. **L5**

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. . Real Time Systems – Mall Rajib, Pearson Education.
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Course Outcomes:

At the end of this Course the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L3**
- Distinguish characterstics of structural testing methods. **L4**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L5**
- Discuss about the functional and system testing methods. **L5**

IV B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ACS75c-FUNDAMENTALS OF BLOCKCHAIN AND APPLICATIONS

Open Elective-III

L	T	P	C
2	0	0	2

Course Objectives:

1. To study fundamental concepts in software testing.
2. To discuss various software testing issues and solutions in software unit test, integration and system testing.
3. To expose the advanced software testing topics, such as object--oriented software testing methods.

UNIT – 1: Introduction **8 Hrs**

Grasping,Blockchain Fundamentals, Tracing Blockchain's Origin,The shortcomings of current transaction systems, The emergence of bitcoin , 5 The birth of blockchain, Revolutionizing the Traditional Business, Network Exploring a blockchain application, Recognizing the key business benefits, Building trust with blockchain.

Learning Outcomes:

At the end of this unit, the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L1**
- Distinguish characterstics of structural testing methods. **L2**

UNIT – II: Blokchain working **8 Hrs**

Taking a Look at How Blockchain Works,Why It's Called "Blockchain", What Makes a Blockchain Suitable for Business, Shared ledger, Permissions Consensus, Smart contracts, Identifying Participants and Their Roles, Fundamentals of Blockchain.

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible **L3**
- Discuss about the functional and system testing methods **L3**

UNIT – III: Business with Blockchain **8 Hrs**

Propelling Business with Blockchains, Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business, Networks Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L4**
- Demonstrate various issues for object oriented testing. **L4**

UNIT – IV: Blockchain in Action **7 Hrs**

Blockchain in Action: Use Cases, Financial Services, Commercial financing, Trade finance, Cross-border transactions, Insurance, Government Supply Chain Management Healthcare, Electronic medical records, Healthcare payments pre-authorization, The Internet of Things (IoT).

Learning Outcomes:

At the end of this unit, the student will be able to

- Distinguish characterstics of structural testing methods. **L5**

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L4**

UNIT – V:Hyperledger **10 Hrs**

Hyperledger, a Linux Foundation Project, Hyperledger Vision, Hyperledger Fabric, How Can IBM Help Developers Innovate With Blockchain?, Offering an easily accessible cloud and development platform, Individualized attention and industry expertise.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L5**
- Demonstrate various issues for object oriented testing. **L5**

Text Books:

1. Fundamentals of Blockchain., RavindharVadapalli

Reference Books:

1. Block chain Technology Concepts and Applications, Kumar Saurabh, Ashutosh Saxena

Course Outcomes:

At the end of this Course the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L3**
- Distinguish characterstics of structural testing methods. **L4**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L5**
- Discuss about the functional and system testing methods. **L5**

OE – III

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME70 – METROLOGY AND MEASUREMENTS LAB

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to make the students learn about

- To experiment with measuring equipments used for linear and angular measurements.
- To find common types of errors in measurement equipment.
- To experiment with different types of sensors, transducers and strain gauges equipment.
- To make use of thermocouples for measurement of temperature.

List of Experiments

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine using dial indicators
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Study and calibration of Mcleod gauge for low pressure.
3. Calibration of transducer or thermocouple for temperature measurement.
4. Calibration of LVDT transducer for displacement measurement.
5. Calibration of capacitive transducer for angular measurement.
6. Calibration of photo and magnetic speed pickups for the measurement of speed.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

Section C:

1. Experiment on static and dynamic balancing.
2. Experiment on universal governor.
3. Experiment on CAM analysis machine.
4. Study of Inversion of Four Bar Mechanism.

Course Outcomes:

At the end of this Course the student will be able to

- Apply different instruments to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness. **L3**
- Measure effective diameter of thread profile **L5**
- Conduct different machine alignment tests **L6**
- Measure temperature, displacement, and pressure **L3**

Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME77 – CAD and CAM Lab

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To write program for CAD modeling.
- To learn part programming and program generation from a CAD model.
- To analyze structural and thermal related problems.
- Machining of various parts on CNC Lathe, Milling and Drilling machines.
- To programme an industrial robot for pick and place operation.

List of Experiments

1. Write program for translation, scaling and rotation.
2. Write program for generating spline, Bezier and B-spline.
3. Write program for sweep surfaces and surface of revolution.
4. Blend surfaces using any software.
5. Create wireframe, surface and solid models.
6. Assembling of simple machine component.
7. Analysis of a truss member under loading.
8. Static Analysis of beam
9. Analysis of a components considering conduction and convection
10. Dynamic analysis of stepped bar.
11. Introduction to CNC Machines and G-Code, M-Codes
12. CNC part programming for operations face turning and step turning.
13. CNC part programming for operations taper turning and threading.
14. CNC part programming for vertical milling operations.
15. CNC part programming for drilling and pocketing operations.
16. Development of APT programming for 2D objects
17. Programmings for Robot pick and place.

Course Outcomes:

At the end of this Course the student will be able to

- Generate CAD models. **L3**
- Analyze structural and thermal related problems. **L6**
- Write programs for various machining operations. **L6**
- Operate an industrial robot for pick and place operation. **L5**

Head
Mechanical Engineering Department,
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PULIVENDULA - 516 390.

Jawaharlal Nehru Technological University Anantapur College of Engineering

Pulivendula –516 390 (A.P) India

B.Tech. in Mechanical Engineering

Course Structure and Syllabi under R20 Regulations

Effective from AY 2021-22

MECHANICAL ENGINEERING

Semester –0			
S.No	**Course Name**	**Category**	**L-T-P-C**
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-0-0
5	Proficiency Modules & Productivity Tools	ES	2-0-0-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-0-3-0
8	Human Values & Professional Ethics	MC	3-0-3-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-0-2-0
10	Concepts of Programming	ES	2-0-0-0

B.Tech I Year I Semester

Semester –1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20ABS05	Linear Algebra and Calculus	BS	3-0-0	3
2	20ABS01	Engineering Physics	BS	3-0-0	3
3	20AME02	Material Science	ES	3-0-0	3
4	20ABEE01	Basic Electrical & Electronics Engineering	ES	3-0-0	3
5	20AME04	Engineering Workshop	ES	0-0-3	1.5
6	20ACS05	IT Workshop	ES	0-0-3	1.5
7	20ABS02	Engineering Physics Lab	BS	0-0-3	1.5
8	20AME03	Material Science Lab	ES	0-0-3	1.5
9	20ABEE02	Basic Electrical & Electronics Engineering lab	ES	0-0-3	1.5
				Total	**19.5**

B.Tech I Year II Semester

Semester – 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20ABS06	Differential Equations and Vector Calculus	BS	3-0-0	3
2	20ABS07	Engineering Chemistry	BS	3-0-0	3
3	20AHS01	Communicative English	HS	3-0-0	3
4	20ACS10	C Programming	ES	3-0-0	3
5	20AME01	Engineering Graphics	ES	1-0-2	2
6	20AME05	Computer Aided Drafting Lab	ES	0-0-2	1
7	20AHS02	Communicative English Lab	HS	0-0-3	1.5
8	20ABS08	Engineering Chemistry lab	BS	0-0-3	1.5
9	20ACS11	C Programming Lab	ES	0-0-3	1.5
				Total	**19.5**

BOS Chairman *Vice-Principal* *Principal*

B.Tech II Year I Semester

Semester – 3					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20ABS13	Complex Variables, Transforms & Applications to PDE	BS	3-0-0	3
2	20AME06	Mechanics of materials	PC	3-0-0	3
3	20AME08	Fluid mechanics and hydraulic machinery	PC	3-0-0	3
4	20AME10	Manufacturing Processes	PC	3-0-0	3
5	20AME12	Thermodynamics	PC	3-0-0	3
6	20ACS12	Data structures (Skill Oriented Course – I)	SC	1-0-2	2
7	20AME07	Mechanics of materials Lab	PC	0-0-3	1.5
8	20AME09	Fluid mechanics and hydraulic machinery lab	PC	0-0-3	1.5
9	20AME11	Manufacturing processes lab	PC	0-0-3	1.5
10	20ABS09	Environmental Science	MC	3-0-0	0
11	20AMC01	NSS activities	MC	0-0-2	0
				Total	**21.5**

B.Tech II Year II Semester

Semester – 4					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20ABS15	Numerical Methods, Probability and Statistics	BS	3-0-0	3
2	20ACS21	Internet of Things (IOT)	ES	3-0-0	3
3	20AME13	Thermal Engineering	PC	3-0-0	3
4	20AME14	Theory of Machines	PC	3-0-0	3
5	20AHS03	Universal Human Values	MC	3-0-0	3
6		Humanities Elective I	HE	3-0-0	3
	20AHS04	Managerial Economics & Financial Analysis			
	20AHS05	Entrepreneurship & Incubation			
7	20AME19	Computer aided machine drawing(Skill Oriented Course – II)	SC	1-0-2	2
8	20AME18	Mechanical Engineering Workshop	PC	0-0-3	1.5
9	20AME15	Thermal Engineering Lab	PC	0-0-3	1.5
10	20AME16	Design Thinking and Product Innovation Lab	PC	0-0-3	1.5
11	20AME17	Design thinking and product innovation	MC	3-0-0	0
				Total	**24.5**
Mandatory Community Service Project/ Internship during Summer Vacation					

- Eligible & interested students are permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Honours or a Minor from V Semester onwards.
- A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

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B.Tech III Year I Semester

Semester - 5					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20AME51	Operations Research	PC	3-0-0	3
2	20AME52	Design of Machine Members	PC	3-0-0	3
3	20AME53	Metrology and Measurements	PC	3-0-0	3
4	20AME54	Professional Elective – I	PE	3-0-0	3
	20AME54A	Design for Manufacturing			
	20AME54B	Power Plant Engineering			
	20AME54C	Non Destructive Testing			
5	20AME55	Open Elective – I	OE	3-0-0	3
6	20AHS10	Soft Skills (Skill oriented course – III)	SC	1-0-2	2
7	20AME57	Metrology and Measurements Lab	PC	0-0-3	1.5
8	20AME58	Dynamics and Machine tools Lab	PC	0-0-3	1.5
9	20AMC02	Aptitude and Reasoning Skills	MC	3-0-0	0
10	20AME59	Evaluation of Community Service Project/Internship	PR	0-0-0	1.5
				Total	**21.5**

Open Elective I (Interdisciplinary)

Branch	Subject Code	Subject
Mathematics	20ABS55A	Fuzzy Set Theory, Arithmetic and Logic
Physics	20ABS55B	Functional Nanomaterials for Engineers
Chemistry	20ABS55C	Chemistry of Energy Materials
CIVIL	20ACE55A	Basics of Civil Engineering
EEE	20AEE55A	Basics of Non-Conventional Energy Sources
ECE	20AEC55A	Fundamentals of Electronics and Communication Engineering
	20AEC55B	Transducers and Sensors
CSE	20ACS55A	Fundamentals of Internet of Things
	20ACS55B	E-Marketing
	20ACS55C	Computer Architecture and organization

Note: A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.

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B.Tech III Year II Semester

Semester - 6					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20AME61	Introduction to CAD/CAM	PC	3-0-0	3
2	20AME62	Automation & Robotics	PC	3-0-0	3
3	20AME63	Heat Transfer	PC	3-0-0	3
4	20AME64	Professional Elective – II(MOOC-I)	PE	3-0-0	3
5		Humanities Elective – II	HS	3-0-0	3
	20AHS12	Management Science			
	20AHS13	Business Environment			
6	20AME66	Computer aided design Lab	PC	0-0-3	1.5
7	20AME67	Computer aided manufacturing Lab	PC	0-0-3	1.5
8	20AME68	Heat Transfer Lab	PC	0-0-3	1.5
9	20AME60	3D Printing Practice (Skill Oriented Course – IV)	SC	1-0-2	2
10	20AHS11	Indian Constitution	MC	3-0-0	0
				Total	**21.5**

Note: Student shall register for MOOC Course in NPTEL/SWAYAM in concurrence with the department before commencement of semester. The advanced courses should opt which is not repetitive regular courses and syllabus.

B.Tech IV Year I Semester

Semester - 7					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20AME71	Professional Elective – III	PE	3-0-0	3
	20AME71A	Automobile Engineering			
	20AME71B	Finite Element Methods			
	20AME71C	Total Quality Management			
2	20AME72	Professional Elective – IV	PE	3-0-0	3
	20AME72A	Tool Design			
	20AME72B	Refrigeration & Air Conditioning			
	20AME72C	Production and Operations Management			
3	20AME73	Professional Elective –V	PE	3-0-0	3
	20AME73A	Mechatronics & MEMS			
	20AME73B	Design of Hydraulics and Pneumatics			
	20AME73C	Geometric dimensioning and tolerances			
4	20AME75	Open Elective – II	OE	3-0-0	3
5	20AME76	Open Elective – III	OE	3-0-0	3
6	20AME77	Open Elective – IV (MOOC-I)	OE	3-0-0	3
7	20AME70	Industrial Automation (Skill oriented course – V)	SC	1-0-2	2
8	20AME79	Evaluation of Internship	PR	--------	3
				Total	**23**

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Open Elective II (Interdisciplinary)

Branch	Subject Code	Subject Name
Mathematics	20ABS65A	Numerical Techniques
Physics	20ABS65B	Materials Characterization Techniques
Chemistry	20ABS65C	Polymers and their applications
CIVIL	20ACE65A	Environmental Impact Assessment
EEE	20AEE65A	Energy Conservation and Management
ECE	20AEC65A	Introduction to Microcontrollers & Applications
	20AEC65B	Principles of Digital Signal Processing
CSE	20ACS65A	Machine Learning Applications
	20ACS65B	Object Oriented Programming
	20ACS65C	Web Design

Open Elective III (Interdisciplinary)

Branch	Subject Code	Subject Name
Mathematics	20ABS75A	Mathematical Modeling
Physics	20ABS75B	Sensors and Actuators for Engineering Applications
Chemistry	20ABS75C	Chemistry of Nano-materials and applications
CIVIL	20ACE75A	Disaster Management and Mitigation
EEE	20AEE75A	IOT Applications in Electrical Engineering
ECE	20AEC75A	Fundamentals of Image Processing
	20AEC75B	Basics of VLSI Design
CSE	20ACS75A	Applications of AI
	20ACS75B	Mobile Application Development

B.Tech IV Year II Semester

Semester - 8					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	20AME89	Full Internship & Project work	PR	---------	12
				Total	**12**

Courses offered for Honours degree

S.No.	Course Code	Course Title	Offered in Semester	Prerequisite if any	Contact Hours per week		Credits
					L	T	
1	20AMEH01	Advanced Automotive Electronics	V		3	1	4
2	20AMEH02	Application of Computational Fluid Dynamics	VII		3	1	4
3	20AMEH03	Mechanics and manufacturing of Composite materials	VI		3	1	4
4	20AMEH04	Applications of Optimization Techniques	VI		3	1	4
5	20AMEH05	MOOC Course	V				2
6	20AMEH06	MOOC Course	VII				2

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Title of the Minor Degree
(Disciplines to which the Minor is offered)

S. No	Branch	Name of the Minor degree	Course Code	Course Title	Offered in Semester	Contact Hours per week L	T	P	Credits
1	ME	3D Printing	20AMEM07	Materials science for Engineers	V	3	1	0	4
2			20AMEM08	Computer Aided Machine Drawing	V	3	1	0	4
3			20AMEM09	3D Printing materials	VI	3	1	0	4
4			20AMEM10	Applications of 3D Printing	VII	3	1	0	4
5			20AMEM11	MOOC Course	VI				2
6			20AMEM12	MOOC Course	VII				2
1	ME	Robotics and Automation	20AMEM13	Introduction to Robotics	V	3	1	0	4
2			20AMEM14	Industrial Automation	V	3	1	0	4
3			20AMEM15	Hydraulic and Pneumatic circuits	VI	3	1	0	4
4			20AMEM16	Programming and control of Robot	VII	3	1	0	4
5			20AMEM17	MOOC Course	VI				2
6			20AMEM18	MOOC Course	VII				2
1	ME	Industrial Engineering	20AMEM19	Production Planning and Control	V	3	1	0	4
2			20AMEM20	Marketing Management	VI	3	1	0	4
3			20AMEM21	Customer Relationship Management	VI	3	1	0	4
4			20AMEM22	Six Sigma & Lean Manufacturing	VII	3	1	0	4
5			20AMEM23	MOOC Course	V				2
6			20AMEM24	MOOC Course	VII				2
1	CE	Construction Technology	20ACEM01	Building Materials	V	3	1	0	4
2			20ACEM02	Building Construction	V	3	1	0	4
3			20ACEM03	Building planning and Drawing	VI	3	1	0	4
4			20ACEM04	Surveying	VI	3	1	0	4
5			20ACEM05	MOOC Course	VII				2
6			20ACEM06	MOOC Course	VII				2
1	EEE	Electrical Systems	20AEEM01	Basic Electric Circuits and Analysis	V	3	1	0	4
2			20AEEM02	Principles of Electrical Measurements	V	3	1	0	4
3			20AEEM03	Basics of Power Electronics and Devices	VI	3	1	0	4
4			20AEEM04	Fundamentals of Control Systems	VI	3	1	0	4
5			20AEEM05	MOOC Course	VII				2
6			20AEEM06	MOOC Course	VII				2
1	ECE	Electronics & Communication Engineering	20AECM01	Electronic Circuits	V	3	1	0	4
2			20AECM02	Digital Electronics	V	3	1	0	4
3			20AECM03	Principles of Communications	VI	3	1	0	4
4			20AECM04	Electronic Instrumentation	VI	3	1	0	4
5			20AECM05	MOOC Course	VII				2
6			20AECM06	MOOC Course	VII				2
1	CSE	Web Design & Development	20ACSM01	User Interface Design	V	3	1	0	4
2			20ACSM02	Advanced Java Script	VI	3	1	0	4
3			20ACSM03	Content Management & Distributed systems	VI	3	1	0	4
4			20ACSM04	Mongo DB	VII	3	1	0	4
5			20ACSM05	MOOC Course	V				2
6			20ACSM06	MOOC Course	VII				2

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1	CSE	Data Science	20ACSM07	Data Science	V	3	1	0	4
2			20ACSM08	Data Analytics using Python and Lab	V	3	0	2	4
3			20ACSM09	Data Visualization	VII	3	1	0	4
4			20ACSM10	Machine Learning	VI	3	1	0	4
5			20ACSM11	MOOC Course	VI				2
6			20ACSM12	MOOC Course	VII				2

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF MATHEMATICS
I B.TECH – I SEMESTER (R20)
(Common to all Branches of Engineering)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Linear Algebra and Calculus	3	0	-	3

COURSE OBJECTIVES	
1	This course will illuminate the students in the concepts of calculus and linear algebra.
2	To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications

COURSE OUTCOMES	
CO1	Develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO2	Utilize mean value theorems for real life problems
CO3	Familiarize with functions of several variables which is useful in optimization
CO4	Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2 and 3- dimensional coordinate systems.
CO5	Students will learn the utilization of special functions.

SYLLABUS

Unit I: Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by echelon form, Normal form, solving system of non-homogeneous and homogeneous linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix.

Unit II: Infinite series and Mean Value Theorems

Infinite series:

Series, Convergence and divergence, Geometric series, Integral test, P- series, comparison test, ratio test, root test.

Mean Value Theorems:

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem (without proof). Expansions of functions: Taylor's and Maclaurin's series, indeterminate forms and L-Hospital rule (Limits).

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Mathematics

Unit III: Multivariable calculus

Functions of several variables – Limit and Continuity, Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers for three variables.

Unit IV: Multiple Integrals

Double integrals, change of order of integration, areas enclosed by plane curves, Triple Integrals, Volume of solid as double integral and as triple integral, change of variables in double integral and Triple integral.

Unit V: Special Functions- Beta and Gamma functions

Beta and Gamma functions and their properties, relation between beta and gamma functions. Derichlet's integral and its applications (Areas and Volumes of solids).

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

References:

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc-Grawhill publishing company Ltd., New Delhi.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA

B.Tech. I Year Syllabus (R20 Regulation)

Engineering Physics

(Civil & Mechanical Branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications.
3	To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications
4	To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications. Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nano materials, their properties and applications in modern emerging technologies are elicited.
5	To familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application.
6.	To enlighten the periodic arrangement of atoms in crystals, Bragg's law and to provide fundamentals related to structural analysis through powder diffraction method, SEM and TEM.

Unit-I: Wave Optics **12hrs**

Interference- Principle of superposition – Interference of light –Interference by wavefront and amplitude division - Interference in thin films (Reflection Geometry) – Colours in thin films – Newton's Rings – Determination of wavelength of light source and refractive index of liquid.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit - Diffraction grating – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction (Qualitative) - Nicol's Prism - Half wave and Quarter wave plates with applications.

Unit Outcomes:

The students will be able to

- **Explain** the need of coherent sources and the conditions for sustained interference (L2)
- **Identify** engineering applications of interference (L3)
- **Analyze** the differences between interference and diffraction with applications (L4)
- **Illustrate** the concept of polarization of light and its applications (L2)
- **Classify** ordinary polarized light and extraordinary polarized light (L2)

Unit-II: Lasers and Fiber optics **8hrs**

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – CO_2 laser – Semi conductor Laser - Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Fiber optic communication system – Losses in optical fibers – Applications.

Unit Outcomes:

The students will be able to

- **Understand** the basic concepts of LASER light Sources (L2)
- **Apply** the concepts to learn the types of lasers (L3)
- **Identifies** the Engineering applications of lasers (L2)
- **Explain** the working principle of optical fibers (L2)
- **Classify** optical fibers based on refractive index profile and mode of propagation (L2)
- **Identify** the applications of optical fibers in various fields (L2)

UNIT III: Engineering Materials **12hrs**

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Orientation polarizations (Qualitative), Ionic and Electronic Polarizations – Lorentz internal field – Clausius-Mossotti equation – Dielectric breakdown and Loss – Piezoelectricity and Ferro electricity.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, Para Ferro, Ferri & Antiferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Nanomaterials- Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **Summarize** various types of polarization of dielectrics (L2)
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
- **Apply** the concept of polarization to materials like piezoelectric and ferroelectrics (L3)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2)
- **Explain** the applications of dielectric and magnetic materials (L2)
- **Apply** the concept of magnetism to magnetic devices (L3)
- **Identify** the nano size dependent properties of nanomaterials (L2)
- **Illustrate** the methods for the synthesis and characterization of nanomaterials (L2)
- **Apply** the basic properties of nanomaterials in various Engineering branches (L3).

Unit-IV: Acoustics and Ultrasonics **08hrs**

Acoustics- Introduction – Requirements of acoustically good auditorium – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magnetostriction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Pulse echo system through transmission and reflection modes – Applications.

Unit Outcomes:

The students will be able to

- **Explain** how sound is propagated in buildings (L2)
- **Analyze** acoustic properties of typically used materials in buildings (L4)
- **Recognize** sound level disruptors and their use in architectural acoustics (L2)
- **Identify** the use of ultrasonics in different fields (L3)

Unit-V: Crystallography and Characterization Techniques **8hrs**

Crystallography- Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC & FCC – NaCl Crystal - Miller indices – Separation between successive (hkl) planes.

Characterization Techniques: X-Ray Diffraction: Bragg's law – Bragg's X-ray Diffractometer – Crystal structure determination by Laue method – Electron microscopy: Scanning Electron Microscope – Transmission Electron Microscope.

Unit Outcomes:

The students will be able to

- **Classify** various crystal systems (L2)
- **Identify** different planes in the crystal structure (L3)
- **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L4)
- **Apply** powder method to measure the crystallinity of a solid (L4)
- **Analyze** the crystal structure using electron microscopes (L4)

Text books:

1. Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy S.Chand Publications, 11th Edition (2019).
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018).
2. Solid State Physics, A J Dekker, Macmillan India Limited (Publisher) (2000)
3. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers (2018).
3. Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
4. Engineering Physics by B.K. Pandey and S. Chaturvedi, Cengage Learning(2018)
5. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press(2016)
6. University Physics by H.D.Young and R.A. Freedman,Pearson(2017)

COURSE OUTCOMES	
CO1	**Study** the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
CO2	**Identify** the wave properties of light and the interaction of energy with the matter (L3). **Asses** the electromagnetic wave propagation and its power in different media (L5).
CO3	**Understands** the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3) **Elucidates** the importance of nano materials along with their engineering applications. (L5)
CO4	**Explain** the basic concepts of acoustics and ultrasonics. (L2) **Apply** the concept of NDT to material testing. (L3)
CO5	**Study** the important properties of crystals like the presence of long-range order, periodicity and structure determination using X-ray diffraction technique (L5) and **Analyze** the crystal structure using electron microscopes (L4)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA
DEPARTMENT OF MECHANICAL ENGINEERING
I YEAR II SEMESTER

Subject Code	Title of the Subject	L	T	P	C
	Material Science	3	0	0	3

COURSE OBJECTIVES	
1	To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
2	To Explain the methods to change the properties of materials through heat treatment processes.
3	To Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
4	To Familiarize properties and applications of ceramics, polymers and composite materials.
5	To Demonstrate the fundamental properties of nano-materials and their applications.

UNIT I: **10 Hours**

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Distinguish metals and alloys. (L4)
- Make use of the principles of construction of binary phase diagrams. (L3)
- Identify various invariant reactions in binary phase diagrams. (L3)
- Explain the concept of metallography in studying the microstructures of metals and alloys. (L2)

UNIT II: **8 Hours**

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe_3Calloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

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Learning Outcomes:

At the end of this unit the student will be able to

- Understand the importance of steel and iron - iron carbide phase diagram. (L2)
- Explain the influence of heat treatment in modification of properties of steels. (L2)
- Develop a heat treatment cycle based on properties required. (L3)
- Explain the principles of surface hardening methods. (L2)

UNIT III: **8 Hours**

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels.
Classification of alloys steels. Micro structure, properties and applications of alloy steels-stainless steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

Learning Outcomes:

At the end of this unit the student will be able to

- Classify various types of steels, their properties and applications. (L2)
- Identify various types of cast irons, their properties and applications. (L3)
- Compare steels and cast irons and their limitations in applications. (L3)

UNIT IV: **8 Hours**

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the importance of non-ferrous metals and alloys in engineering applications. (L2)
- Demonstrate various properties and applications of non-ferrous alloys. (L4)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

UNIT V: **8 Hours**

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterial's.

Learning Outcomes:

At the end of this unit the student will be able to

- Explain the properties of ceramics and their applications. (L2)

- Summarize the properties of polymers and composites and their use. (L2)
- Interpret the properties of Nano materials and their applications. (L2)
- Identify the difference between the micro and Nano scale materials and their uses. (L3)

Course Outcomes:

After completing the course, the student will be able to

- Explain the principles of binary phases. (L2)
- Apply heat treatment to different applications. (L3)
- Select steels and cast irons for a given application. (L3)
- Utilize nonferrous metals and alloys in engineering. (L3)
- Choose composites for various applications. (L3)
- Assess the properties of Nano-scale materials and their applications. (L2)

TextBook:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.

References:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA
YSR (KADAPA) Dist 516 390, (A.P) INDIA

I B.Tech – II Sem (ME) LTPC
I B Tech - I SEM (CSE)

3 0 0 3

Basic Electrical & Electronics Engineering

Part A: Basic Electrical Engineering

~~(Civil, Mechanical, CSE)~~

Course Objectives:

1. To introduce basics of electric circuits.
2. To teach DC and AC electrical circuit analysis.
3. To explain working principles of transformers and electrical machines.
4. To impart knowledge on low voltage electrical installations

Unit 1 DC & AC Circuits:

Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

Unit Outcomes: Able to

- Recall Kirchoff laws (L1)
- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

Unit 2 DC & AC Machines:

Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only]

Unit Outcomes: Able to

- Explain principle and operation of DC Generator & Motor.
- Perform speed control of DC Motor (L2)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor / DC motor

Unit 3 Electrical Installations:
Components of LT Switchgear: Switch fuse unit (SFU),MCB,ELCB,MCCB,Tpes of wires and cables,Earthing. Types of batteries,important Characteristics for Batteries. Elementary Calculations for energy consumption,power factor improvement and battery backup

Unit Outcomes: Able to

- Explain principle and operation of protecting equipments.
- Come to know different types of batteries and their usage.

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. C. Suresh
9. [illegible]
10. [illegible]

I B.Tech I Sem

COURSE NO. - Basic Electrical & Electronics Engineering

(Common to Mechanical, CSE)

L	T	P	C
3	0	0	3

Part B: Basic Electronics Engineering

Course Objectives:

- To provide comprehensive idea about working principle, operation and applications of PN junction & zener diodes, BJT, FET, MOSFET and operational amplifier
- To introduce fundamentals of digital electronics
- To educate on principles of various communication systems
- To teach efficacy of electronic principles which are pervasive in engineering applications

UNIT I ANALOG ELECTRONICS

Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: photodiode, phototransistor, LCD and LED.

BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications.

Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

Unit Outcomes:

- Describe operation and characteristics of diodes and transistors
- Make use of diodes and transistors in simple, typical circuit applications
- Understand operation of basic op-amp circuits

UNIT II DIGITAL ELECTRONICS

Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems, combinational circuits - adders, multiplexers, decoders; introduction to sequential circuits, flip flops, shift register, binary counter.

Unit Outcomes:

- Explain different logic gates using truth table
- Distinguish combinational and sequential circuits
- Analyze various combinational circuits such as adders, multiplexers and decoders
- Understand functionality of flip-flops, shift registers and counters

UNIT III COMMUNICATION AND DATA ACQUISITION SYSTEMS

Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach). Data Acquisition System, D/A and A/D converters, Data loggers, Digital Transducer.

Unit Outcomes:

- Describe basic elements of a communication system
- Understand functioning of various communication systems
- Explain the need for Data Acquisition Systems.

TEXT BOOKS:

1. D.P. Kothari, I.J. Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education (India) Private Limited
2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

REFERENCES:

1. R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education, Reprint 2012.
2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th EDn., 2008.
3. H S Kalsi, Electronic Instrumentation, Tata McGraw Hill Education (India) Private Limited.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA
DEPARTMENT OF MECHANICAL ENGINEERING
I YEAR I SEMESTER (CIVIL, MECH, CSE)

Subject Code	Title of the Subject	L	T	P	C
	Engineering Workshop	0	0	3	1.5

COURSE OBJECTIVES	
1	To bring awareness about workshop practices for Engineers.
2	To familiarize how wood working operations can be performed.
3	To teach the practices for sheet metal operations.
4	To develop the technical skills related to fitting and electrical wiring.

COURSE OUTCOMES	
CO1	**Apply** wood working skills in real world applications.
CO2	**Apply** fitting operations in various applications.
CO3	**Build** different parts with metal sheets in real world applications.
CO4	**Demonstrate** soldering and brazing.
CO5	**Apply** basic electrical engineering knowledge for house wiring practice.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2								1
CO2	3	2	2	2								1
CO3	2	3	2	1								1
CO4	2	3	2	1	1	1						1
CO5	3	2	2	1	1	1						1

1. Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint
d) Wood Turning Operation

2. Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing & Riveting

3. Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fitting b) Dovetail fitting c) Contour Fitting
d) Bicycle tire puncture and change of two wheeler tyre.

4. Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two way switch c) Godown lighting d) Tube light

e) Three phase motor f) Soldering of wires

Textbooks:

1. K.Venkata Reddy., Workshop Practice Manual, 6/e BS Publications.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2/e, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2/e, PHI 2010.

IT - Workshop
(CSE, CIVIL & MECH)

B. Tech – I Semester | **L-T-P-C** **0-0-3-1.5**

Course Objectives:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Course Outcomes:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

Preparing your Computer (2 weeks)

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer, Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Productivity tools (6 weeks)**

Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 5: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 6: Presentations : creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Optional Tasks:

Task 7: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material
- Air conditioner
- UPS and Inverter

- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

References:

1. "Introduction to Computers", Peter Norton, Mc Graw Hill
2. "LaTeX Companion" – Leslie Lamport, PHI/Pearson.
3. "MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
4. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
5. "Networking your computers and devices", Rusen, PHI
6. "Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
B.Tech I Year Syllabus (R20 Regulation)
Engineering Physics Laboratory
(Civil & Mechanical Branches)

L	T	P	C
0	0	3	1.5

Course Objectives:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the particle size.
- Illustrates the magnetic and dielectric materials applications.
- Identifies the various sensor applications.

Note: - In the following list of experiments, out of 15 experiments any 10 experiments must be performed in a semester.

List of Engineering Physics Experiments

1. Determination of the thickness of the wire using wedge shape method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the thickness of the wire using wedge shape method (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
2. Determination of the radius of curvature of the lens by Newton's ring method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the radius of curvature of the lens (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
   Plots the square of the diameter of a ring with no. of rings (L3)
3. Determination of wavelengths of various spectral lines of mercury source using diffraction grating in normal incidence method
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the wavelength of the given source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)
4. Determination of dispersive power of prism.
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the refractive index and dispersive power of the given prism (L2)
   Identifies the formation of spectrum due to dispersion. (L2)
5. Determination of wavelength of LASER light using diffraction grating.
   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the wavelength of laser source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)
6. Determination of particle size using LASER.
   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the Particles size using laser (L2)
   Identifies the application of laser (L2)
7. To determine the numerical aperture and acceptance angle of an optical fiber
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)
   Identifies the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications. (L2)
8. Determination of dielectric constant by charging and discharging method.
   Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the dielectric constant of the given substance. (L2)
Identifies the significance of dielectric constant in various devices. (L2)

9. Study of variation of Magnetic field along the axis of a current carrying coil – Stewart-Gee's Method.
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the magnetic field along the axis of a circular coil carrying current. (L2)
   Plots the intensity of the magnetic field of circular coil carrying current with distance (L3)
10. Measurement of magnetic susceptibility by Gouy's method
    Experimental outcomes:
    Operates various instruments and connect them as per the circuit. (L2)
    Estimate the magnetic susceptibility of the given material. (L2)
    Identifies the significance of magnetic susceptibility in various engineering applications. (L2)
11. Study of B-H curve of Ferromagnetic material
    Experimental outcomes:
    Operates various instruments and connect them as per the circuit. (L2)
    Estimate the hysteresis loss, coercivity and retentivity of the ferromagnetic material. (L2)
    Classifies the soft and hard magnetic material based on B-H curve. (L2)
    Plots the magnetic field H and flux density B (L3)
12. Determination of ultrasonic velocity in liquid (Acoustic grating)
    Experimental outcomes:
    Operates various instruments. (L2)
    Estimate the velocity of ultrasonic waves in liquids. (L2)
    Illustrates the basic applications of ultrasonics. (L3)
13. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
    Experimental outcomes:
    Operates various instruments. (L2)
    Estimate the rigidity modules of a given wire (L2)
    Plots length of the pendulum (l) with time period T^2 (L3)
14. Sonometer: Verification of the three laws of stretched strings
    Experimental outcomes:
    Operates various instruments. (L2)
    Estimate the linear density of a given wire (L2)
    Identify the frequency of tuning fork (L3)
15. Determination of losses in optical fiber.
    Experimental outcomes:
    Operates various instruments and connect them as per the circuit. (L2)
    Estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)
    Identifies the significance of losses in optical fiber and its engineering applications. (L2)

Course Outcomes:

The students will be able to

- **Operate** various optical instruments (L2)
- **Estimate** wavelength of laser and particles size using laser(L2)
- **Evaluate** the acceptance angle of an optical fiber and numerical aperture (L3)
- **Estimate** the susceptibility and related magnetic parameters of magnetic materials (L2)
- **Plot** the intensity of the magnetic field of circular coil carrying current with distance (L3)
- **Determine** magnetic susceptibility of the material and its losses by B-H curve (L3)
- **Apply** the concepts of ultrasonics by acoustic grating (L2)

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA
DEPARTMENT OF MECHANICAL ENGINEERING
I YEAR II SEMESTER

Subject Code	Title of the Subject	L	T	P	C
	Material Science Lab	0	0	3	1.5

COURSE OBJECTIVES	
1	To understand microstructure of engineering materials.
2	To explain grain boundary layers and grains size of different engineering materials.
3	To examine the hardenability of steels.
4	To examine the hardness of ceramics, super alloys, Nanomaterial's and polymer materials.
5	To understand the microstructure of the non metals.

List of Experiments:

1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.
9. Study of microstructure of super alloy and Nanomaterial's.
10. Find the hardness of ceramics, super alloys, Nanomaterial's and polymeric materials (one sample on each)

Course Outcomes:

The student is able to

- Identify various microstructures of steels and cast irons. (L3)
- Visualize grains and grain boundaries. (L3)
- Evaluate hardness of treated and untreated steels. (L4)
- Summarize the importance of hardening of steels. (L2)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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I B.Tech – II Sem (ME)

I B.Tech – I SEM (CSE)

L T P C

0 0 3 1.5

([redacted])Basic Electrical & Electronics Engineering Lab

([redacted], Mechanical, CSE, CSSE, IT and Food Technology)

Part A: Electrical Engineering Lab

Course Objectives:

1. To Verify Kirchoff's laws
2. To verify Superposition theorem.
3. To learn performance characteristics of DC Machines.
4. To perform open circuit & Short Circuit test on 1- Phase Transformer.
5. To Study the I – V Characteristics of Solar PV Cell

List of experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Open circuit characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Brake test on 3 - Phase Induction Motor.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

Course Outcomes: Able to

1. Verify Kirchoff's Laws & Superposition theorem.
2. Perform testing on AC and DC Machines.
3. Study I – V Characteristics of PV Cell

Part B: Electronics Engineering Lab

Course outcomes:

- Describe construction, working and characteristics of diodes, transistors and operational amplifiers (L2)
- Demonstrate how electronic devices are used for applications such as rectification, switching and amplification (L2)
- Build different building blocks in digital electronics using logic gates (L3)
- Explain functionality of flip-flops, shift registers and counters for data processing applications (L2)
- Explain functioning of various communication systems (L2)

B.Tech I Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ABEE02 - Basic Electrical and Electronics Engineering Lab

(Common to Mechanical and CSE)

L	T	P	C
0	0	3	1.5

PART 2: ELECTRONICS ENGINEERING LAB

Course Objectives: The objectives of the course are to make the students learn about

- To learn the construction, working and characteristics of diodes, transistors and operational amplifiers.
- To demonstrate the applications of electronic devices like rectification, switching and amplification.
- To build different building blocks in digital electronics using logic gates.
- To explain the functionality of flip-flops, shift registers and counters.
- To understand the functioning of various communication systems.

Any Six experiments to be done

LIST OF EXPERIMENTS:

1. Draw and study the characteristics of Semi-conductor diode and Zener Diode
2. Draw and study the input and output characteristics of Transistor in Common Emitter configuration
3. Draw and study the static and transfer characteristics of FET in Common Source Configuration
4. Construct half wave and full wave rectifier circuits. Find ripple factor and plot their output waveforms with and without filters
5. Study the application of Op-amp as an Inverting amplifier, Non-inverting amplifier, Voltage follower, Summer and Subtractor
6. Realization of logic gates, AND, OR, NOT, NAND, NOR, XOR
7. Realization of Adders, Multiplexers and Decoders using logic gates.
8. Realization of flip-flops using logic gates.
9. D/A converter and A/D converter.

Course Outcomes:

At the end of this Course the student will be able to

- Describe construction, working and characteristics of diodes, transistors and operational amplifiers. **L1**
- Demonstrate how electronic devices are used for applications such as rectification, switching and amplification. **L1**
- Build different building blocks in digital electronics using logic gates. **L6**
- Explain the functionality of flip-flops, shift registers and counters for data processing applications. **L1**
- Understand the functioning of various communication systems. **L2**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF MATHEMATICS
I B.TECH – II SEMESTER (R20)
(Common to all Branches of Engineering)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Differential Equations and Vector Calculus	3	0	-	3

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and vector calculus
2	To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES	
CO1	Solve the linear differential equations related to various engineering fields
CO2	Solve the differential equations reducible to linear, and finds the relevant applications.
CO3	Identify solution methods for partial differential equations that model physical processes
CO4	Interpret the physical meaning of different operators such as gradient, curl and divergence
CO5	Estimate the work done against a field, circulation and flux using vector calculus and also to establish the relations between them using vector integral theorems.

SYLLABUS

UNIT I: Differential Equations

First order and first degree differential equations – Formation, Exact, Linear and Bernoulli equations. Applications to Newton's law of cooling and law of natural growth and decay.

Non-homogeneous Linear Differential Equations of second Higher Order with constant coefficients with RHS terms of the type $e^{ax+b}, \sin(ax+b), \cos(ax+b)$, polynomials in x, $e^{ax}V(x)$, $xV(x)$ where $V(x)$ is a function of x, Method of variation of parameters.

UNIT II: Equations Reducible to Linear Differential Equations with constant coefficients and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients.

Applications: Mass spring system and L-C-R Circuit problems.

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UNIT III: Partial Differential Equations

Linear partial differential equations of first order, non-linear PDEs of first order (standard forms). Solutions to homogenous linear partial differential equations with constant coefficients, Rules for finding the complementary function and the particular integral.

UNIT IV: Vector differential Calculus

Scalar and vector point functions, Del applied to scalar point functions: Gradient, Del applied to vector point functions: Divergent and Curl and their properties.

Del applied to twice to point functions and Del applied to products of point functions (Identities).

UNIT V: Vector integral Calculus

Line integral- Circulation -work done - potential function, Surface integral-flux, volume integral.

Vector integral theorems: Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem (all theorems without proof) and related problems.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

References:

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc-Grawhill publishing company Ltd., New Delhi.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
4. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA

B.Tech – I Yr II Sem (R20)

L T P C
3 0 0 3

Engineering Chemistry
(MECH and CIVIL)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

Unit 1: Water Technology (8 hrs)

Introduction: hardness of water and units, Estimation of hardness of water by EDTA Method - Boiler troubles – Priming, foaming, scale and sludge, Caustic embrittlement, Municipal water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, ion-exchange processes – desalination of brackish water - reverse osmosis (RO) and electrodialysis.

Learning outcomes:

The student will be able to

- **list** the differences between temporary and permanent hardness of water (L1)
- **explain** the principles of reverse osmosis and electro dialysis. (L2)
- **compare** quality of drinking water with BIS and WHO standards. (L2)
- **illustrate** problems associated with hard water - scale and sludge. (L2)
- **explain** the working principles of different Industrial water treatment processes (L2)
-

Unit 2: Electrochemistry and Applications: (10 hrs)

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zinc-air, Na-air batteries, Secondary cells – Nickel-Cadmium (NiCd),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry corrosion, Pilling Bedworth rule and Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper)..

Learning Outcomes:

At the end of this unit, the students will be able to

- **apply** Nernst equation for calculating electrode and cell potentials (L3)
- **recall** working and importance of batteries(L1)
- **apply** Pilling Bedworth rule for corrosion and corrosion prevention (L3)
- **demonstrate** the corrosion prevention methods and factors affecting corrosion (L2)

- **compare** primary and secondary batteries and their applications (L2)

Unit 3: Polymers and Fuel Chemistry: (12 hrs)

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC and Bakelite, Calculation of molecular Weight of polymer by weight average and number average methods, Poly dispersity Index

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol, Calculation of Molecular Wt of Polymer by Wt Avg. and Number Avg methods, poldispersity Index.

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, **Liquid Fuels** refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio-fuels(Coal gas, Biogas).

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** different types of polymers and their applications (L2)
- **find** various alternate fuels and its importance (L1)
- **solve** the numerical problems based on Calorific value(L3)
- **select** suitable fuels for IC engines (L3)
- **explain** calorific values, octane number, refining of petroleum and cracking of oils (L2)

UNIT-4 Advanced Engineering Materials (8 hrs)

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

Refractories- Classification, Properties, Factors affecting the refractory materials (Refractoriness, Refractory under load, Porosity, Refractive index, Dimensional stability) and Applications.

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.

Building materials- Portland Cement, Rapid Hardening Cement, Quick Setting Cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** the constituents of Composites and its classification (L2)
- **recall** properties of refractories and lubricants (L1)
- **identify** the factors affecting the refractory material(L3)
- **illustrate** the functions and properties of lubricants (L2)
- **demonstrate** the phases and reactivity of concrete formation (L2)
- **identify** the constituents of Portland cement (L3)

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- **enumerate** the reactions at setting and hardening of the cement (L3)

Unit 5: Surface Chemistry and Applications: (10 hrs)

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (Chemical methods - double decomposition, reduction, hydrolysis and oxidation; electrical disintegration or Bredig's Arc method), chemical and electrochemical methods (sol-gel method, Thermally activated chemical vapor deposition method) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid-gas interface, solid-liquid interface, adsorption isotherm- Langmuir, Freundlich, BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors.

Learning Outcomes:

At the end of this unit, the students will be able to

- **summarize** the concepts of colloids, micelle and nanomaterials (L2)
- **explain** the synthesis of colloids with examples (L2)
- **select** suitable methods for synthesis of Nanometals (L1)
- **outline** the preparation of nanomaterials and metal oxides (L2)
- **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis (L2)

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand Publication, New Delhi 2012..

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
3. K. Sesha Maheswaramma and Mridula Chugh, Engineering Chemistry, Pearson Publication Pvt. Ltd.
4. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

Course Outcomes:

At the end of the course, the students will be able to

- **demonstrate** the corrosion prevention methods and factors affecting corrosion (L2)
- **explain** the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers. (L2)
- **find** important properties of various engineering materials, polymers, colloids and its applications(L1)
- **explain** calorific values, octane number, refining of petroleum and cracking of oils (L2)
- **explain** the setting and hardening of cement and concrete phase (L2)
- **summarize** the concepts of colloids, micelle and nanomaterials (L2).

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JNTUA COLLEGE OF ENGINEERING :(AUTONOMOUS), PULIVENDULA

I B.TECH

COMMUNICATIVE ENGLISH (R20)

(Common to All Branches of Engineering)

L	T	P	C
3	0	0	3

1. INTRODUCTION:

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language.* component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

2. COURSE OBJECTIVES

1	Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
2	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
3	Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

3. COURSE OUTCOMES

CO1	Retrieve the knowledge of basic grammatical concepts.
CO2	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken and the improve the fluency of English..
CO3	Apply grammatical structures to formulate sentences and correct word forms
CO4	Analyze discourse markers to speak clearly on a specific topic in informal discussions
CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
CO6	Create a coherent paragraph interpreting a figure/graph/chart/table.

4. SYLLABUS:

UNIT –I

***Reading*: What Is My Name? —P Sathyavathi**

- ***Writing:*** Paragraph writing
- ***Listening***: Listening for theme-main
- ***Functional English***: Greeting, taking leave and introducing oneself and others
- ***Grammar:*** Parts of speech- Nouns –classification-usages- Pronouns - classifications-usages-
- ***Vocabulary*:** Homonyms- Homophones- Homographs

Non Detailed Study: Listening Skills from **English and Soft Skills**

UNIT-II

***Reading* : The Kitchen — Vimala**

- ***Writing*** : Essay Writing –Descriptive Essays
- ***Listening*** : Listening for theme -1
- ***Functional English***: Making requests
- ***Grammar:*** Types of sentences- Question Tags
- ***Vocabulary*** : Synonyms - Antonyms

Non detailed Study: Teamwork Skills from **English and Soft Skills**

UNIT-III

***Reading* : Adivasis — Kancha Ilaiah**

- ***Writing*** : Statement of Purpose
- ***Listening:*** Listening for main ideas
- ***Functional English:*** Inviting -Apologizing
- ***Grammar:***– Kinds of verbs – Auxiliaries- Tenses,
- ***Vocabulary*** : Prefixes –Suffixes – One-word substitutes

Non detailed Study: Assertive Skills from **English and Soft Skills**

UNIT-IV

***Reading*: The Bet – Anton Chekhov**

- ***Writing:*** Letter Writing –Official letters-business Letters-Application Letters
- ***Listening***: Listening for details
- ***Functional English:*** Interrupting - Asking for and giving opinions
- ***Grammar:*** Adjectives- Conjunctions- Articles – Active & Passive Voice
- ***Vocabulary***: Phrasal verbs -Idioms

Non detailed Study: Learning Skills from **English and Soft Skills**

UNIT-V

Reading **: The Gift of the Magi - O. Henry**

- ***Writing:*** Information Transfer
- ***Listening*** : Listening for opinions
- ***Functional English*** : Asking for the time and directions
- ***Grammar:*** Prepositions- Reported Speech
- ***Vocabulary*** : Commonly confused words

Non detailed Study : Emotional Intelligence Skills from **English and Soft Skills**

5. Prescribed Text books:

[1] **Detailed text: English for Fluency**, K Purushottam, Orient Black Swan,2013.

[2] **Non detailed text: English and Soft Skills,** S P Dhanavel, Orient Black Swan 2013Edition.

6. REFERENCES:

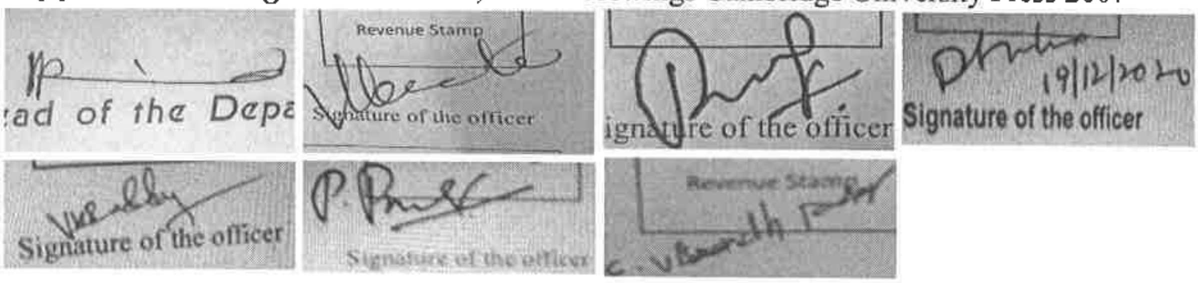
[1] **A Practical Course in Effective English Speaking Skills.** J.K.Gangal, PHI, New Delhi.2012

[2] **Fundamentals of Technical Communication,** Meenakshi Raman, Oxford University Press,2015.

[3] **Spoken English,** R.K. Bansal & JB Harrison, Orient Longman,2013, 4Th edition.

[4] **Murphy's English Grammar** with CD, Murphy, Cambridge University Press,3 Rd edition.

[5] **Advanced English Grammar** , Martin Hewings Cambridge University Press 2007



B.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS10 - C-Programming

(Mechanical)

L	T	P	C
3	0	0	3

Course Objectives:

- To make the student understand problem solving techniques
- Students will be able to understand the syntax and semantics of C programming language and other features of the language

UNIT – I: Fundamentals of Computers **8hrs**

Fundamentals of Computers: What is Computer, Applications of Computers, Evaluation of Computers, Generations of Computers, Basic I/O Devices, Computer Software, Types of computer, Software Development Methodology, Top-Down Vs Bottom –Up Approaches, Problem Solving, Fundamental Techniques to Solve The Problem, Representation of a solution to a Problem, Developing a computer program, Number Systems.

Fundamentals of C: An Overview of C, A Brief History of C , C Is a Middle-Level Language , C Is a Structured Language ,C Is a Programmer's Language Compilers Vs. Interpreters , The Form of a C Program, The Library and Linking, Separate Compilation, Compiling a C Program, C's Memory Map

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand the fundamentals of computer.(L1) **L1**
- To learn fundamentals of C.(L1) **L1**

UNIT – II Expressions & Operators **8hrs**

Expressions: The Basic Data Types, Modifying the Basic Types, Identifier Names, Variables, The Four C Scopes, Type Qualifiers, Storage Class Specifiers,, Variable Initializations, Constants.

Operators: The Assignment Operator, Arithmetic Operators, The Increment and Decrement Operators, Relational and Logical Operators, Bitwise Operators, The ? Operator, The & and * Pointer Operators, The Compile-Time Operator sizeof, The Comma Operator, The Dot (.) and Arrow (–>) Operators, The [ ] and ( ) Operators, Precedence Summary, Expressions, Statements.

Learning Outcomes:

At the end of this unit, the student will be able to

- To learn how to use expressions in C.(L2) **L2**
- To learn about operators(L2) **L2**
- To learn how to use Conditional, unconditional and Iteration Statements in C programs.(L2) **L2**

UNIT – III: Arrays and Strings **8hrs**

Arrays and Strings: Single-Dimension Arrays, Generating a Pointer to an Array, Passing Single Dimension Arrays to Functions , Strings, Two-Dimensional Arrays, Multidimensional Arrays, Indexing Pointers, Array Initialization, Variable-Length Arrays, A Tic-Tac-Toe Example.

Console I/O: Reading and Writing Characters, Reading and Writing Strings. Formatted Console I/O: printf( ), scanf( ), Suppressing Input.

Functions: The General Form of a Function, Understanding the Scope of a Function, Function Arguments, argc and argv— Arguments to main( ), The return Statement ,What Does main( )Return? , Recursion, Function Prototypes, Declaring Variable Length Parameter Lists, The "Implicit int" Rule, Old Style Vs. Modern Function Parameter Declarations, The inline Keyword.

Learning Outcomes:

At the end of this unit, the student will be able to

- To learn arrays and strings in C.(L3) **L3**
- To learn about Console I/O in C.(L3) **L3**

UNIT – IV: Pointers **7hrs**

Pointers: What Are Pointers?, Pointer Variables, The Pointer Operators, Pointer Expressions, Pointer Assignments, Pointer Conversions, Pointer Arithmetic, Pointer Comparisons, Pointers and Arrays, Arrays of Pointers, Multiple Indirection, Initializing Pointers, Pointers to Functions, C's Dynamic Allocation Functions, Dynamically Allocated Arrays, restrict-Qualified Pointers, Problems with Pointers.

Structures, Unions, Enumerations, and typedef: Structures , Arrays of Structures, A Mailing List Example**,** Passing Structures to Functions, Structure Pointers, Arrays and Structures within Structures.

Unions, Bit-Fields, Enumerations, Using sizeof to Ensure Portability, typedef.

Learning Outcomes:

At the end of this unit, the student will be able to

- To learn about pointers.(L3) **L3**
- To learn about Structures, Unions, Enumerations, and typedef.(L3) **L3**

UNIT – V: File I/O

File I/O: Standard C Vs. Unix File I/O, Streams and Files, File System Basics, fread( ) and fwrite( ), Using fread( ) and fwrite( ), fseek( ) and Random-Access, fprintf( ) and fscanf( ), The Standard Streams, The Console I/O Connection, Using freopen( ) to Redirect the Standard Streams.

The Preprocessor and Comments: The Preprocessor, #define, #error, #include, Conditional Compilation Directives, #undef, Using defined, #line, #pragma, The # and ## Preprocessor Operators,Predefined Macro Names,Comments, Single-Line Comments.

Learning Outcomes:

At the end of this unit, the student will be able to

- To learn about File I/O.(L4) **L4**
- To learn The Preprocessor and Comments in C.(L5) **L4**

Text Books:

1. **Computer Fundamentals and C Programming"** :Dr. P. Chenna Reddy, Professor of CSE, JNTUA College of Engg, Pulivendula, YSR District, Andhra Pradesh, INDIA. (unit-I)
2. **"The Complete Reference C":** Fourth Edition Herbert Schildt Osborne/McGraw-Hill.(Unit-2,3,4,5).

Reference Books:

1. "Programming in C", Pradip Dey, Manas Ghosh, Oxford Higher Education
2. "Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson.
3. "Programming in C", Reema Thareja, Oxford Higher Education.
4. "Computer Fundamentals and C Programming", First Edition, Dr.P.Chenna Reddy, Available at: www.pothi.com.
5. "Data Structure and Program Design in C", Second Edition, Kruse, Tondo, Leung, Mogalla, Pearson.
6. "Programming with C", R.S. Bichkar, University Press.
7. "Computer Science A Structured Programming Approach Using C", Third Edition, Fourouzan & Gilberg, Cengage Learning
8. "Programming with C", Byron Gottfried, Third Edition, Schaum's Outlines, 3rd edition, 2010, Mc Graw Hill.

Course Outcomes:

At the end of this Course the student will be able to

- Student can effectively apply problem solving techniques in designing the solutions for a wide-range of problems(L2) **L2**
- Student can choose appropriate data structure and control structure depending on the problem to be solved (L3) **L3**
- Student can modularize the problem and also solution(L4) **L4**

B.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME01 - ENGINEERING GRAPHICS

(Common to CIVIL,MECHANICAL & CSE)

L	T	P	C
1	0	2	2

Course Objectives:

- To bring awareness that Engineering Drawing is the Language of Engineers.
- To familiarize how industry communicates technical information.
- To teach the practices for accuracy and clarity in presenting the technical information.
- To develop the engineering imagination essential for successful design.
- To train the usage of 2D and 3D modeling

UNIT – 1: Introduction to Engineering Graphics **6 Hrs**

Principles of Engineering Graphics and their significance – Conventions in drawing – Lettering – BIS conventions.

(a) Conic sections including the rectangular hyperbola – general method only.
(b) Cycloids, Epicycloids and Hypocycloids.
(c) Involutes

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand basic principles of engineering graphics (L2)
- Identify the various BIS conventions (L3)
- Draw conic sections used in engineering graphics (L3)
- Draw cycloids and involutes (L3)

UNIT – II: Projection of Points, Lines and Planes **7 Hrs**

Projection of points in any quadrant, Lines inclined to one and both planes, Finding true lengths, Angle made by line. Projections of regular plane surfaces.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of projections. (L2)
- Find the true lengths of line when the line inclined to both the planes. (L5)
- Draw projections of regular plane surfaces (L3)

UNIT – III: Projections of Solids **7Hrs**

Projections of Solids : Projections of regular solids inclined to one and both planes by rotational and auxiliary views method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify 2D projections of regular solids (L1)
- Draw projections of regular solids when inclined to both the planes. (L3)

UNIT – IV: Sections of Solids **7 Hrs**

Section planes and sectional view of right regular solids – Prism, Cylinder, Pyramid and Cone. True shapes of the sections.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use section plane to show the sectional view of regular solids. (L3)
- Draw sectional view of prism and cylinder (L3)
- Draw true shape of sections.(L3)

UNIT – V: Development of Surfaces: **7 Hrs**

Development of surfaces of right regular solids – Prism, Cylinder, Pyramid, Cone and their sectional parts

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand basics of development of surfaces (L1)
- Draw development of surface of prism and cylinder(L3)
- Draw development of surface of cone and their sectional parts(L3)

Text Books:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Draw various curves applied in engineering. (L3)
- Show projections of Lines, planes and solids. (L1)
- Draw the sections of solids and development of surfaces of solids. (L3)
- Use computers as a drafting tool. (L3)
- Draw isometric and orthographic drawings. (L3)

B.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME05 - COMPUTER AIDED DRAFTING LABORATORY

(MECHANICAL)

L	T	P	C
0	0	2	1

Course Objectives:

- To instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- To train the usage of 2D and 3D modeling.
- To instruct graphical representations of machine components.

Section 1 : Introduction to Computer Aided Drafting

Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

Dimensioning principles and conventional representations.

Section 2 : Orthographic Projections

Systems of projections, conventions and application to orthographic projections - simple objects.

Section 3 : Isometric Projections

Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- **Apply** Engineering Drawing skills to draw basic 2 D and 3 D Drawings. (L3)
- **Show** Dimensions and annotations using CAD tools for different machine components. (L5)
- **Draw** the orthographic projections using CAD tools (2D) (L4)
- **Use** computers as a drafting tool. (L6)
- **Draw** different parts of the machine in three dimensional view using various CAD tools (3D - Isometric Views).(L4)

JNTUA COLLEGE OF ENGINEERING :(AUTONOMOUS), PULIVENDULA
I B.TECH
COMMUNICATIVE ENGLISH LABORATORY (R20)
(Common to All Branches of Engineering)

L	T	P	C
0	0	3	1.5

Course Objectives

- students will be exposed to a variety of self-instructional, learner friendly modes of language learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions, public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes

- CO1: Listening and repeating the sounds of English Language
- CO2: Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- CO3: Apply communication skills through various language learning activities
- CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- CO5: Evaluate and exhibit acceptable etiquette essential in social and professional settings
- CO6: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

1. Phonetics-Importance -Introduction to Sounds of Speech
2. Vowels and Consonants Sounds
3. Phonetic Transcription

Learning Outcomes

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information
- learn different professional registers and specific vocabulary to describe different persons, places and objects

Unit 2

1. Word Stress & Intonation
2. Communication skills
3. Role Play & JAM

Learning Outcomes
At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics
- participate in debates and speak clearly on a specific topic using suitable discourse markers

Unit 3

1. Describing people/objects/places
2. Speeches for Special Occasions
3. Etiquettes of Telephonic Communication

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

Unit4

1. Group Discussions
2. Debates
3. Interviews Skills

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- Able to transfer information effectively
- understand non-verbal features of communication

Unit 5

1. Resume writing & Practicing
2. Oral Presentations
3. Writing Video Speeches as it is & Book reviews – oral and written

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

Suggested Software

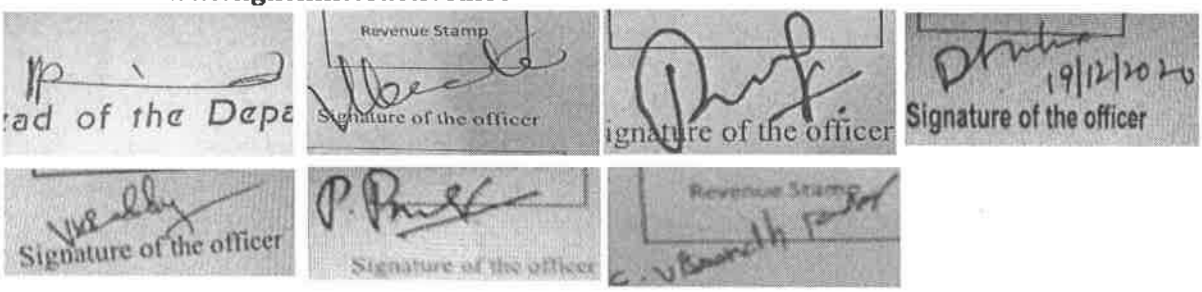
- Orell
- Walden Infotech
- Young India Films

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

- www.esl-lab.com
- www.englishmedialab.com
- **www.englishinteractive.net**



JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA

B.Tech – I Yr II Sem (R20)(R20) **L T P C**

0 0 3 1.5

Engineering Chemistry Lab

(MECH and CIVIL)

Course Objectives:

- To Verify the fundamental concepts with experiments

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of dissolved oxygen by Winklers method.
3. Estimation of Copper by EDTA method.
4. Determination of Strength of an acid in Pb-Acid battery.
5. Estimation of Ferrous Iron by dichrometry.
6. Preparation of a polymer- Bakelite .
7. Determination of percentage of Iron in Cement sample by colorimetry.
8. Estimation of Calcium in port land Cement.
9. Preparation of nanomaterials by precipitation.
10. Adsorption of acetic acid by charcoal.
11. Determination of percentage Moisture content in a coal sample.
12. Determination of Viscosity of lubricating oil by Redwood Viscometer 1.
13. Determination of Viscosity of lubricating oil by Redwood Viscometer 2.
14. Determination of Calorific value of gases by Junker's gas Calorimeter

Course Outcomes:

At the end of the course, the students will be able to

- **determine** the cell constant and conductance of solutions (L3)
- **prepare** advanced polymer materials (L2)
- **determine** the physical properties like surface tension, adsorption and viscosity (L3)
- **estimate** the Iron and Calcium in cement (L3)
- **calculate** the hardness of water (L4)
- **find** calorific values of various fuels, hardness of water samples (L1)

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B.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

<u>20ACS11 - C-Programming Laboratory</u>

(Mechanical)

L	T	P	C
0	0	3	1.5

Course Objectives:

- 1. Introduce the internal parts of a computer, and peripherals.
- 2. Introduce the Concept of Algorithm and use it to solve computational problems
- 3. Identify the computational and non-computational problems
- 4. Teach the syntax and semantics of a C Programming language
- 5. Demonstrate the use of Control structures of C Programming language
- 6. Illustrate the methodology for solving Computational problems

List of Experiments:

1. Assemble and disassemble parts of a Computer
2. Design a C program which reverses the number
3. Design a C program which finds the second maximum number among the given list of numbers
4. Construct a program which finds the k^{th} smallest number among the given list of numbers.
5. Design an algorithm and implement using C language the following exchanges
   $a \leftarrow b \leftarrow c \leftarrow d$
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.
7. Implement the C program which computes the sum of the first n terms of the series
   Sum = $1 - 3 + 5 - 7 + 9$
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.
9. Design an algorithm and implement using a C program which finds the sum of the Infinite series $1 - x^2/2! + x^4/4! - x^6/6! + ...$

10 Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1.

11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa.
12. Develop an algorithm which computes the all the factors between 1 to 100 for a given Number and implement it using C.
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n.
14. Design a C program which reverses the elements of the array.
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The starts for each number should be printed horizontally
16. Implement the sorting algorithms
    a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort.
17. Illustrate the use of auto, static, register and external variables
18. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers.
19. Design a C program which sorts the strings using array of pointers.

Learning Outcomes:

At the end of this unit, the student will be able to

- 1. Identify the different peripherals, ports and connecting cables in a PC (L2) **L2**
- 2. Illustrate the working of a Computer (L3) **L3**
- 3. Select the components of a Computer in the market and assemble a computer (L4) **L3**
- 4. Solve complex problems using language independent notations (L3) **L3**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

II Year B.Tech. I-Sem (R20)

20ABS13 - COMPLEX VARIABLES, TRANSFORMS & APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS

(Common for MECH & CIVIL)

L	T	P	C
3	0	0	3

Course Objectives: This course aims at providing the student

- To acquire the knowledge on the calculus of functions of complex variables. (L2)
- To acquire the knowledge on Laplace transforms and its applications in solving ordinary differential equations. (L3)
- To expand the given function in Fourier series in a given interval. (L3)
- Evaluate improper integrals of complex functions using Residue theorem. (L3)
- To analyze the solutions of partial differential equations. (L4)

UNIT – 1: Complex Variables – Differentiation:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations in Cartesian and Polar coordinates (without proof), analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method. Properties of elementary functions of exponential, trigonometric, hyperbolic, and logarithm.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand functions of Complex variable and its properties. L2
- Find derivatives of complex functions. L3
- Understand the analyticity of complex functions. L2

UNIT – II: Complex Variables – Integration:

Line integral-Contour integration, Cauchy's integral theorem (with proof), Cauchy Integral formula, generalized Cauchy Integral formula (All theorems without Proof).

Power series expansions: Taylor's series and Laurent's series (without proof); zeros of analytic functions, singularities.

Residues: Evaluation of residue by formula and by Laurent's series, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi-circle with f(z) not having poles on real axis).

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the integration of complex functions. L2
- Apply Cauchy's integral theorem and Cauchy's integral formula. L3
- Understand singularities of complex functions. L2
- Evaluate improper integrals of complex functions using Residue theorem. L3

UNIT – III: Laplace Transforms:

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Laplace transforms and finds the Laplace transforms of elementary functions. L2
- Find the Laplace transforms of general functions using its properties. L3
- Understand Laplace transforms of special functions (Unit step function, Unit Impulse & Periodic). L2
- Apply Laplace transforms to solve Differential Equations. L3

UNIT – IV: Fourier series:

Fourier Series : Fourier coefficients (Euler's formulae) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand finding Fourier series expression of the given function. L2
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function. L3
- Expand the given function in Fourier series given in Half range interval. L3

UNIT – V: Partial Differential Equations & Applications:

Solution of PDEs by Method of separation of variables –Solutions of one dimensional wave equation, one dimensional heat equation and Laplace equation in two dimensions under initial and boundary conditions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the method of separation of variables. L2
- Solve applications of Partial Differential Equations. L3

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", McGraw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the analyticity of complex functions and conformal mappings. L1
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours. L3
- Understand the usage of Laplace Transforms. L2
- Evaluate the Fourier series expansion of periodic functions. L3
- Formulate/solve/classify the solutions of Partial differential equations and also find the solution of one dimensional wave equation and heat equation. L4

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B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME06 - MECHANICS OF MATERIALS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the concepts of different stresses, strains and their relationships.
- Discuss the principal stresses and components of stress on different planes under different loads.
- Explain maximum shear force and bending moment of different beams under different loading conditions.
- Demonstrate bending stress and shear stress distribution of various cross sections of beams and to predict the maximum slope deflection of beams.
- Impart strain energy due to axial, bending, and torsion loading, and to solve statically indeterminate problems using Castigliano's theorem.
- Focus on the stresses and deformations of the springs.
- Familiarize the Euler's concept of buckling in columns & struts

UNIT – I: Stresses and Strains & Principal stresses and strains **10 Hrs**

Stresses and Strains: Types of stresses and strains, stress-strain relations, stress-strain diagram for ductile and brittle materials. Axial loaded bars of uniform and varying cross section, compound bars, thermal stresses. Relation between three elastic moduli.

Principal stresses and strains: Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

Learning Outcomes:

At the end of this unit, the student will be able to

- Determine stresses and deformations due to axial loads in simple members. **L3**
- Analyze stresses compound bars due to temperature raise. **L4**
- Correlate the elastic constants of materials. **L3**
- Construct the Mohr's circle for calculating principal stresses. **L3**
- Analyze principal stresses in biaxial state of loading. **L4**

UNIT – II: Analysis of Beams & Deflection of Beams **10 Hrs**

Analysis of Beams: Types of beams and loads, shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of load-concentrated load, UDL, linearly distributed variable load, point of contra flexure, relation between shearing force and bending moment.

Deflection of Beams: Differential equations of the deflection curve, Slope and deflection: using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams.

Learning Outcomes:

At the end of this unit, the student will be able to

- Draw the shear force and bending moment diagrams in beams subject to bending loading. **L3**
- Evaluate the maximum shear force and bending moment and their location in beams. **L4**
- Compute the slope and deflection in beam under different loading. **L3**
- Distinguish various approaches for calculating slope and deflection. **L4**

UNIT – III: Bending Stresses & Shear Stresses **8 Hrs**

Bending Stresses: Flexural equation, bending stress distribution and efficiency of various cross sections of beams- circle, rectangle, triangle, I and T.

Shear Stresses: Shear stress distribution for different cross sections of beams- circle, rectangle, triangle, I and T.

Energy Methods: Strain energy, resilience. Deflection under single and several loads, Castigliano's theorem.

Learning Outcomes:

At the end of this unit, the student will be able to

- Determine bending stresses in beams under different loading. **L4**
- Demonstrate the shear stress and bending moment distribution in different cross sections of beams. **L4**
- Explain the difference between strain energy, resilience, elastic strain energy and modulus of toughness. **L2**
- Apply the Castigliano's theorem for beams. **L3**

UNIT – IV: Torsion of Circular Shafts & Spring **8 Hrs**

Torsion of Circular Shafts: Theory of pure torsion, transmission of power in solid and hollow circular shafts, comparison of strengths of solid and hollow shafts, shafts in series and parallel, combined bending and torsion.

Springs: Deflection of closed coil helical springs under axial force and axial couple, Leaf springs, simple problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze circular shafts subjected to twisting couple. **L4**
- Determine stresses in shafts subjected to combined loads **L4**
- Determine angle of twist in shafts. **L4**
- Determine stresses and deformations in helical and leaf springs. **L5**

UNIT – V: Columns and struts & Thin Cylinders **8 Hrs**

Columns and struts: Analysis of columns to evaluate buckling loads with different boundary conditions, Euler's formula and its limitations, Rankine's formula, columns under eccentric load.

Thin Cylinders: Introduction, Thin cylinder subjected to internal pressure, expression for circumferential stress and longitudinal stress, effect of internal pressure on the dimensions of a thin cylindrical shell, Thin spherical shells, Volumetric strain, simple problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Determine buckling load in compressive members. **L4**
- Apply concepts of elastic stability of columns. **L3**
- Assess hoop and longitudinal stresses in thin cylinders. **L3**
- Calculate volumetric strain. **L3**

Text Books:

1. F.P. Beer, E.R. Johnston, Jr&John.T. DeWolf, Mechanics of Materials, 7/e, Tata McGraw-Hill, 2016.
2. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.

Reference Books:

1. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the concepts of stress and strain to machine numbers. **L3**
- Determine, shear forces, and bending moments in beams. **L4**
- Find the slope and deflection in beams **L4**
- Estimate the stress in machine members such as shafts and springs **L4**
- Apply Castigliano's theorem to determine displacements in beams. **L3**
- Analyze columns for buckling loads **L4**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME08 - FLUID MECHANICS AND HYDRAULIC MACHINERY

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart the knowledge of fluid properties and their behavior in static and dynamic states.
- To acquaint mathematical techniques to fluid flow problems.
- To familiarize solution methods in one dimensional viscous flow of different cases.
- To introduce the concepts of boundary layer.
- To teach working principle of hydraulic machinery.

UNIT – I: Definition of fluid & Fluid Kinematics **8 Hrs**

Definition of fluid: Continuum, velocity field, stress field, Newton's law of viscosity, Properties - compressibility, surface tension, vapour pressure, manometry.

Fluid Kinematics: Methods of Analysis – System and control volume, differential and integral, Kinematics – stream tube, stream function, potential function, vortex motion, free and forced vortices, continuity equation, Classification of flows – steady and unsteady, uniform and nonuniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, internal and external flows.

Learning Outcomes:

At the end of this unit, the student will be able to

- Interpret the properties of fluid and their application. L2
- Select appropriate method for analyzing fluid flow problems. L1
- Understand principles of continuity in fluid motions. L2

UNIT – II: Fluid Dynamics **12 Hrs**

Fluid Dynamics: Momentum equation and Bernoulli's equation, Measurement of flow – Venturimeter, orifice meter and pitot tube, stagnation properties, Exact flow solution – Couette and Poisuielle flow, concept of boundary layer, measures of controlling boundary layer thickness, Turbulence – Reynolds Number.

Darcy Weisbach equation – friction factor, minor losses, Moody's diagram.

Learning Outcomes:

At the end of this unit, the student will be able to

- Convert conservation laws into flow governing equations. L3
- Apply Bernoulli's principle for determining flow in measuring devices. L3
- Solve governing equations for solutions of simple fluid flow problems. L3
- identify importance of boundary layer and advantages of control L3
- judge factors influencing laminar and turbulent flow L4

UNIT – III: Dimensional analysis **8 Hrs**

Dimensional analysis: Fundamental and derived dimensions, Rayleigh method, Buckingham theorem, dimensionless groups, application of dimensional groups, model testing and similitude, types of similarity - geometric, kinematic and dynamic, model testing methods.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compute major and minor losses in pipe flows. L3
- Solve for forces exerted by the fluid through impulse momentum equation. L3
- Employ suitable scaling laws for converting model to prototype. L3
- Use similitude principle to test prototypes of machines. L3

UNIT – IV: Impact of Jets & Hydraulic Turbines **10 Hrs**

Impact of Jets: Impulse momentum equation, Hydrodynamic force of jet striking stationary and moving vanes, flat and curved vanes, centrally and tangentially, series of vanes, radial vanes, velocity triangles, work done and efficiency

Hydraulic Turbines: Classification of hydraulic turbines – Impulse and Reaction turbines, Pelton, Francis and Kaplan turbines, working principles, Unit and specific quantities, performance curves.

Learning Outcomes:

At the end of this unit, the student will be able to

- Estimate forces exerted by jet on blades. **L4**
- Classify turbines based on principle of operation. **L2**
- Calculate various efficiencies of turbines. **L2**
- Select suitable turbine for operating conditions. **L3**

UNIT – V: Rotodynamic Pumps & Positive displacement Pumps **8Hrs**

Rotodynamic Pumps: Classification – mixed, axial, construction, principle and application. Centrifugal Pumps: working principle, work done by impeller, performance curves – Cavitation.

Positive displacement Pumps: Working –gear pump, vane pump, rotary piston pump, and Reciprocating pump – Working, Slip, Indicator diagrams, Air vessels.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain construction and operation of different pumps. **L2**
- Classify pumps based on principle of operation. **L2**
- Calculate efficiencies of pumps. **L3**
- Identify pump suitable for an application. **L3**

Text Books:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. S K Som, Gautam Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017.

Reference Books:

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
2. Yunus Cengel, John Cimbala, Fluid Mechanics, McGraw Hill Education, 2017.
3. Jagdish Lal, Hydraulic Machines Including Fluidics, Metropolitan Book Co. Pvt. Ltd., 2016.

Course Outcomes:

At the end of this Course the student will be able to

- Interpret the behavior under static and dynamic conditions. **L2**
- Analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows. **L4**
- Apply boundary layer flows for laminar and turbulent regimes. **L3**
- Explain Reynolds stresses and its application. **L3**
- Compare working of different fluid machinery and their design parameters. **L2**
- Explain different types of pumps and their application. **L2**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME10 - MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Working principle of different metal casting processes and gating system.
- Classification of the welding processes, working of different types of welding processes and welding defects.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

UNIT – I: Introduction **8 Hrs**

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Solidification of casting: Concept, solidification of pure metal and alloy; Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Selection of suitable manufacturing process for a given product. L3
- Understand the steps involved in metal casting, pattern making. L2
- Apply the knowledge of designing gating systems, risers. L3
- Compare the working of various metal casting processes. L4
- Identify the various casting defects. L3

UNIT – II: Metal Forming **10 Hrs**

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming;

Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging, analysis of forging and forging defects.

Rolling: Principle, types of rolling mill and products, roll passes, forces and analysis of rolling and power requirements;

Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare cold working and hot working processes. L4
- Explain the working of rolling mills. L2
- Evaluate the forces and power in rolling and extrusion processes. L5
- Summarize the working of various extrusion processes. L2
- Identify the principles of forging, tools and dies. L3
- Summarize the various operations of Sheet metal forming. L2

UNIT – III: Metal Joining Processes **8 Hrs**

Metal Joining Processes: Classification of welding processes, types of welds and welded joints, V-I characteristics of arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding, Oxy Acetylene Gas Welding, Resistance Welding, Thermit Welding, applications, advantages, and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding, Welding defects: causes and remedies. Soldering and brazing: Types and their applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the working of various welding processes. **L2**
- Compare V-I characteristics of different welding processes. **L4**
- Summarize the applications, advantages of various welding processes. **L2**
- Identify the defects in welding. **L3**

UNIT – IV: Plastics and ceramics **8 Hrs**

Plastics: Types, properties and their applications, processing of plastics: extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts. **L2**
- Explain the steps in making ceramics parts. **L2**
- Explain the steps in manufacturing of powder metallurgy parts. **L2**
- Demonstrate the application of plastic, ceramics and power metallurgy. **L2**

UNIT – V: Unconventional Machining Processes **10 Hrs**

Unconventional Machining Processes: Introduction and classification of unconventional machining processes, Principles and process parameters of Abrasive jet machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM), and Electrical discharge machining (EDM). Principle and processes parameters of Electro – chemical machining (ECM), Laser beam machining (LBM), Plasma arc machining (PAM) and Electron beam machining (EBM).

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different unconventional machining processes. **L3**
- Evaluate process parameters of EDM, ECM, LBM, PAM and AJM. **L5**
- Apply various unconventional machining processes. **L3**

Text Books:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Hajra Choudhury S.K, Elements of Workshop Technology Vol 1: Manufacturing Processes, 15/e, Media Promoters and Publishers Pvt. Ltd., 2013.
4. Jagadeesha T "Unconventional machining processes

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate different metal casting processes and gating systems. **L2**
- Classify working of various welding processes. **L2**
- Evaluate the forces and power requirements in rolling process. **L5**
- Apply the principles of various forging operations. **L3**
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. **L1**
- Identify different unconventional processes and their applications. **L3**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME12 - THERMODYNAMICS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Familiarize steam properties to understand working of steam power plants.
- Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines.

UNIT – I: Introduction **10 Hrs**

Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

First law of Thermodynamics: Work transfer, Heat transfer, Comparison of Work and Heat transfers. first law of thermodynamics, First Law applied to a process and a cycle, Energy - a property, Internal Energy and Enthalpy, PMM I. Limitations of first law, corollaries – first law applied to non-flow and flow process- limitations of first law of thermodynamics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify thermodynamic systems, properties and their importance in solving engineering problems. **L3**
- Explain energy balance for closed systems and open systems. **L4**
- Solve simple thermodynamics problems. **L3**

UNIT – II: Second Law of Thermodynamics **8 Hrs**

Kelvin –Planck statement and Clausius statement and their equivalence, corollaries –perpetual motion machines of second kind – reversibility and irreversibility, cause of irreversibility – Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply second law of thermodynamics in design of heat engine, refrigerator and heat pump. **L3**
- Explain the efficiency of thermodynamic systems. **L2**
- Enumerate the causes for poor performance of thermodynamic systems. **L3**

UNIT – III: Entropy, Availability and Irreversibility **8 Hrs**

Entropy: Clausius inequality –Concept of Entropy – entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply entropy affects to estimate the performance of systems. **L3**
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process. **L4**
- Explain thermo-economics. **L3**

UNIT – IV: Properties of Steam and use of Steam Tables & Thermodynamic relations 8Hrs

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart.

Thermodynamic Relations: Maxwell relations, Tds equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply properties of steam to design steam systems. **L3**
- Examine steam systems using conservation equations. **L4**
- Evaluate the performance of steam systems.
- Explain the importance of TdS equations. **L4**
- Relate specific heats, internal energy, enthalpy and Joule-Thomson coefficient in standard form. **L4**

UNIT – V: Air Standard Cycles & Vapour Power Cycles 8Hrs

Air Standard Cycles: Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles.

Vapour Power Cycles: Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output of Rankine cycle.

Learning Outcomes:

At the end of this unit, the student will be able to

- To analyze the performance of thermodynamic gas and vapour power cycles. **L4**
- To apply thermodynamic principles for compression and expansion processes **L3**

Text Books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015.
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.
4. R.K. Rajput., Thermal Engineering, 6/e, Laxmi publications, 2010.
5. E.Radhakrishnan "

Course Outcomes:

At the end of this Course the student will be able to

- Explain the importance of thermodynamic properties related to conversion of heat energy into work. **L3**
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. **L3**
- Utilize steam properties to design steam based components. **L4**
- Compare thermodynamic relations and air standard cycles. **L4**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME07- MECHANICS OF MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To conduct uni-axial tension test on Steel, Aluminium, Copper and Brass.
- To perform compression tests on spring and wood.
- To determine elastic constants of materials using flexural and torsion tests.
- To find hardness of given metals.

List of Experiments

1. Study the stress – strain relations of (a) Mild Steel and (b) Tor Steel by conducting tension/compression test on U.T.M.
2. Study the stress – strain relation of (a) Copper and (b) Aluminium (c) other materials by conducting tension /compression test.
   Find the compressive and shear strength of wood and shear strength of GI sheet by conducting relevant tests.(http://sm-nitk.vlabs.ac.in/exp7/index.html)
3. Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper.
4. Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel and aluminium.
   Find the spring index and modulus of rigidity of the material of a spring by conducting compression and tensile tests. (http://sm-nitk.vlabs.ac.in/exp15/index.html)
5. Determine the Young's modulus of the material by conducting deflection test on a simply supported, propped cantilever and continuous beams.
6. Find impact strength of a given material by conducting a) Charpy test and b) Izod test.
7. Determine the deflection in leaf spring.
8. Measure the increase in diameter in cylindrical and spherical shells subjected to internal hydraulic pressure.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the stress-strain behavior of different materials. **L2**
- Identify the difference between compression and tension testing. **L4**
- Evaluate the hardness of different materials. **L6**
- Correlate the elastic constants of the materials. **L4**
- Explain the relation between elastic constants and hardness of materials. **L1**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME09 - FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students

- Explain the application of Bernoulli's equation in internal flows.
- Familiarize with the performance of turbines and pumps.
- Develop skill for measurement of pressure in external flows.

List of Experiments

1. Free and Forced vortex apparatus.
2. Calibration of Venturimeter / Orifice meter.
3. Resistance characteristics of pipes – friction factor.
4. Minor losses in pipes – sudden contraction/bends/valves.
5. Impact of a jet on flat and curved plates.
6. Performance characteristics of single and multi – stage centrifugal pump.
7. Performance characteristics of reciprocating pump.
8. Performance characteristics of Pelton wheel turbine.
9. Performance characteristics of Francis turbine.
10. Performance characteristics of Kaplan turbine
11. Bernouli's Experiment (https://eerc03-iiith.vlabs.ac.in/exp/bernoullis/)
12. Reynold's Experiment (https://eerc03-iiith.vlabs.ac.in/exp/reynolds/)

Course Outcomes:

At the end of this Course the student will be able to

- Explain the devices used for measuring flow. **L2**
- Compute major losses in pipes. **L5**
- Illustrate the operating parameters of turbines. **L4**
- Explain the working of different types of pumps. **L2**
- Explain the devices used for measuring flow. **L2**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME11 - MANUFACTURING PROCESSES LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students

- Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

List of Experiments

Section 1 : METAL CASTING

a) Gating Design and pouring time and solidification time calculations.
b) Sand Properties Testing – Exercise for Strength and Permeability.
c) Molding, Melting and Casting for ferrous/ non ferrous materials.

Section 2: WELDING

a) TIG Welding.
b) MIG Welding.
c) Friction stir welding
d) Any other Special Welding Processes.

Section 3: Forming Process

a) Press Tool: Blanking and Piercing operation with different dies.
b) Closed die forging.

Section 4: UNCONVENTIONAL MACHINING PROCESSES

a) Electro Discharge Machining (EDM)/ Wire cut EDM.
b) Plasma arc cutting / Abrasive jet machining (AJM).
c) Additive manufacturing with reverse engineering.

Course Outcomes:

At the end of this Course the student will be able to

- Fabricate different types of components using various manufacturing techniques. **L6**
- Adapt unconventional manufacturing methods. **L6**

B.Tech II Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS12 - DATA STRUCTURES

(Mechanical)

L	T	P	C
1	0	2	2

Course Objectives: The objectives of the course are to make the students

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To Understand basic concepts about stacks, queues, lists, trees and graphs.
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

UNIT-I Stacks and Queues

Stacks & Queues: stacks, Queues, circular Queue using arrays, Single ended and double ended priority queues

Linked List: single linked list, sparse matrices, double linked list, additional list operations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the basic types for data structure, implementation and application. **L1**
- Know the strength and weakness of different data structures. **L1**

UNIT-II Trees

Introduction, Binary tree, Binary tree traversals , Additional binary tree operations, Threaded binary trees, Binary search trees, Selection trees, Counting binary trees.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use the appropriate data structure in context of solution of given problem. **L4**
- Develop programming skills which require to solve given problem. **L5**

UNIT-III Graphs & Sorting:

Graphs: The graph abstract data type, Elementary graph operations, Minimum cost spanning trees, transitive closure.

Sorting: Motivation, Insertion sort, Quick sort, Merge sort , Heap sort, selection sort.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze algorithms and a algorithm correctness. **L5**
- Summarize searching and sorting techniques **L4**

UNIT –IV Hashing & Heaps

Hashing: Introduction, Static hashing, dynamic hashing,.

Heaps: Min Heap, Max Heap **,** Binominal Heaps, Fibonacci Heaps, Pairing Heaps, Symmetric Min-Max Heaps, and Interval Heaps.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe stack, queue and linked list operation. **L6**
- Knowledge of tree and graphs concepts. **L3**
- Design correct programs to solve problems. **L5**

UNIT-V Efficient binary search trees
Efficient binary search trees: AVL Trees, Splay Trees, M- Way search trees, B-Trees, B+ -Trees.

Learning Outcomes:
At the end of this unit, the student will be able to

- Choose efficient data structures and apply them to solve problems. **L3**
- Analyze the efficiency of programs based on time complexity. **L4**
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs. **L6**

Text Books:

1. Sahni Horowitz "Fundamentals of Data structures in C" 2/e, Universities Press, 2008.
2. Reema Thareja, " Data Structures Using C" 2/e, Oxford, 2014.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA
DEPARTMENT OF CHEMISTRY
II B.TECH – I/II SEMESTER Mandate Course (MC)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
	Environmental Science	3	0	-	0

COURSE OBJECTIVES	
1	To make the student understand multi disciplinary nature of environment and its components.
2	To investigate the relationship between human life and environment from scientific prospective.
3	To impart knowledge to the students about fundamental concepts of Ecosystem and Biodiversity
4	Necessasity of analyzing regional, national and global environmental problems
5	To understand and apply the fundamentals of Environmental science to important local, regional, national and global environmental problems and potential issues

COURSE OUTCOMES	
CO1	Solve the environmental problems based fundamental concepts of Environmental Science.
CO2	Describe the structure and function of significant environmental systems
CO3	Differentiate Natural and Polluted environment and asses its impact different on the environmental components.
CO4	Apply the Pyramid of number, mass and Energy, Demonstrate about Renweable energy resources. Illustrate the Forest ecosystem, Discuss about Grass and Net biomass productivity
CO5	Differentiate between Forest and desert Ecosystems, Critically evaluate arguments regarding environmental issues. Illustrate the Food chain and food web, Identify the applications of rain water harvesting, Interpret advantages of In-situ and Ex-situ conservation of biodiversity

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Bos Chairman
Chemistry

SYLLABUS

UNIT-I:

i) Multidisciplinary nature of environmental studies

The **Multidisciplinary** nature of environmental studies Definition; Scope and importance, Need for public awareness.

ii) Natural Resources:

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT-II:

i) Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem: -

a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

ii) Biodiversity and its Conservation

Introduction-Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III:

Environmental Pollution:

Definition - Causes, effects and control measures of: -

a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution

e. Noise pollution f. Thermal pollution g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV:

BoS Chairman
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Social Issues and the Environment

From Unsustainable to Sustainable development. Urban problems related to energy.
Water conservation, rain water harvesting, watershed management.
Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation.
Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.
Issues involved in enforcement of environmental legislation. Public awareness.

UNIT-V:

i) Human Population and the Environment

Population growth, variation among nations. Population explosion-Family welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. - Women and Child Welfare. Role of information Technology in Environment and human health.
- Case Studies.

ii) Field Work

- Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Text Books:

1. Shashi Chawla, A Text Book of Environmental Studies, Mc Graw Hill Education, 4th edtion, 2014

2. De A.K., Environmental Chemistry, Wiley Eastern Ltd , 2012

Reference Books

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).

2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

3. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

4. Anubha Kaushik and C.P.Kaushik, Basics of Environment and Ecology, New Age International Publishers, 4th Edition, 2012.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
II Year B.Tech. II-Sem (R20)
20ABS15 - NUMERICAL METHODS, PROBABILITY AND STATISTICS
(Common to CIVIL, ME, EEE & CSE)

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize the students with numerical methods of solving the non-linear equations, interpolation, differentiation, integration, and ordinary differential equations.
- To impart knowledge in basic concepts and few techniques in probability and statistics in various applications in engineering.

UNIT – 1: Solution to algebraic and transcendental equations& Interpolation:
Solution of algebraic and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.
Learning Outcomes:
At the end of this unit, the student will be able to

- find approximate roots of the an equation by using different numerical methods L2
- explain various discrete operators and find the relation among operators L2
- apply Newton forward and backward formulas for equal and unequal intervals L3

UNIT – II: Numerical differentiation, integration & Solution of Initial Value Problems to Ordinary Differential Equations of first order:
Numerical Differentiation and Numerical integration: Numerical differentiation using Newton's forward & backward interpolation formulae; Numerical Integration by trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.
Numerical Solutions of Ordinary differential equation: Solution by Taylor's series, Picard's method of successive approximations, Euler's method, modified Euler's method and Runge-Kutta method of fourth order.
Learning Outcomes:
At the end of this unit, the student will be able to

- find integration of a function by different numerical methods L3
- solve ordinary differential equations using different numerical schemes L3

UNIT – III: Probability & Random Variables:
Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem.
Random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties. (All concepts without proofs)
Learning Outcomes:
At the end of this unit, the student will be able to

- explains the basic concepts of probability theory and elementary theorems on probability. L2
- applies the knowledge of discrete random variable and continuous random variable and the respective probability distributions. L3

UNIT – IV: Testing of hypothesis:
Formulation of hypothesis, critical region, level of significance. Large sample tests: test for single proportion, difference of two proportions, test for single mean and difference of two means.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of testing of hypothesis L2
- apply the concept of hypothesis testing for large samples L3

UNIT – V: Small Sample Tests:

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for independence of attributes and goodness of fit.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply the concept of testing hypothesis for small samples L3
- apply the concept of hypothesis testing for large samples and estimate the goodness of fit L3

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008
3. S.S.Sastry, "Introductory methods of Numerical Analysis", 5th edition, PHI, 2012.
4. Advanced Engineering Mathematics, R K Jain and S R K Iyengar, Narosa Publishing House, New Delhi.

Reference Books:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons publications, 2012.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. P. Kandasamy, K. Thilagavathy, S. Gunavathy, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

Course Outcomes:

At the end of this Course the student will be able to

- apply different methods to find roots of the equations and find approximate the solutions of ordinary differential equations **L3**
- apply the Laplace transform for solving differential equations **L3**
- explain the concepts of probability and their applications **L3**
- apply discrete and continuous probability distributions in practical problems **L4**
- use the statistical inferential methods based on small and large sampling tests **L3**

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B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS21 - INTERNET OF THINGS (IOT)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- the interconnection and integration of the physical world and the cyber space.
- design & develop IoT Devices.

UNIT – I: Fundamentals of IoT **10 Hrs**

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe what IoT is and how it works today **L2**
- Recognise the factors that contributed to the emergence of IoT **L4**

UNIT – II: IoT and M2M **8 Hrs**

M2M, IoT vs M2M, SDN and NFV for IoT, IoT system Management with NETCONF-YANG.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and program IoT devices **L4**
- Use real IoT protocols for communication **L5**

UNIT – III: IoT Design Methodology **8 Hrs**

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

Learning Outcomes:

At the end of this unit, the student will be able to

- Secure the elements of an IoT device **L3**
- Design an IoT device to work with a Cloud Computing infrastructure. **L4**

UNIT – IV: Sensors and Connectivity **8 Hrs**

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols.

Learning Outcomes:

At the end of this unit, the student will be able to

- Transfer IoT data to the cloud and in between cloud providers. **L4**
- Define the infrastructure for supporting IoT deployments. **L2**

UNIT – V: IoT Applications **8Hrs**

IoT application for industry-Future factory concepts, Brownfield IoT, Smart objects, Smart applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the application areas of IoT. **L2**
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks. **L3**
- Understand building blocks of Internet of Things and characteristics. **L2**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.

Reference Books:

1. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
3. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", mcgraw-Hill, 2013.
4. Charalampos Doukas, "Building Internet of Things With the Arduino", Second Edition, 2012.
5. Dr. John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the application areas of IoT. **L2**
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks. **L3**
- understand building blocks of Internet of Things and characteristics. **L2**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME13 - THERMAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- To familiarize the developments in IC engines.
- To teach combustion process in SI and CI engines.
- To introduce different types of compressors.
- To familiarize concepts of thermodynamics cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

UNIT – I: IC Engines **10 Hrs**

IC Engines: Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.

Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking, pre-ignition. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking. Fuel requirements and fuel rating.

Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of IC Engines.

Learning Outcomes:

At the end of this unit, the student will be able to
- understand working of IC engines on the basis of thermodynamic cycles. **L2**
- estimate engine performance. **L5**
- identify the effects of abnormal combustion in IC engines. **L3**

UNIT – II: Air compressors **12 Hrs**

Reciprocating Compressor: Single stage reciprocating compressors, work done, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.

Rotary Compressor: Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor.

Learning Outcomes:

At the end of this unit, the student will be able to
- classify different types of air compressors. **L2**
- compare the performance of different types of air compressors **L2**

UNIT – III: Gas turbines & Jet propulsion: **10Hrs**

Gas turbines: Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for maximum pressure ratio and optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating.

Jet propulsion: Introduction and working principle of ramjet, turbojet, turbofan, turboprop and pulse jet engines,

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain concepts of vapour power cycle used in steam power plant. **L2**
- Evaluate the cycles used in gas turbines. **L5**
- Outline the jet propulsion system **L2**

UNIT – IV: Nozzles and Steam Turbines **12 Hrs**

Nozzles: Type of nozzles - air and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - nozzle efficiency.

Steam Turbines: Classification of steam turbines -impulse turbine and reaction turbine - compounding in turbines - velocity diagrams in impulse and reaction turbines, efficiency, degree of reaction - governing of turbines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare the performance of nozzles, used in turbines. **L4**
- Classify steam turbines and applications. **L2**
- Analyse the performance of steam turbines under different operating conditions. **L5**

UNIT – V: Refrigeration and Air Conditioning **10Hrs**

Refrigeration: Bell-Coleman cycle - vapour compression cycle, effect of vapour condition on COP of VCR, -vapour absorption cycle, properties of common refrigerants

Principles of Psychrometry and Air Conditioning: Psychometric terms, psychometric processes and air conditioning systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline the operation of refrigerators. **L2**
- Identify different refrigerants and applications. **L3**
- Use properties of moist air in calculations for air-conditioning system. **L5**

Text Books:

1. Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017.
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014.
3. K.K.Ramalingam, Thermal Engineering, 2/e, Scitech Publications (India) Pvt Ltd,2011.

Reference Books:

1. Cengal Y.A and Boles M.A, Thermodynamics: An Engineering Approach, 5/e, McGraw-Hill, 2006.
2. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010.
3. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008.
4. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014.
5. P.L.Ballaney, Thermal Engineering, 2/e, Khanna, 2005.
6. Rajput R. K."Thermal Engineering" 10/e, Laxmi Publications,2018.

Course Outcomes:

At the end of this Course the student will be able to

- Explain working of IC engines with combustion process. **L2**
- Select compressors for different applications. **L1**
- Use T-s diagram in vapour power and gas power cycles. **L3**
- Explain the basic principles of steam turbines. **L2**
- Select appropriate refrigerant for different applications. **L1**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME14 - THEORY OF MACHINES

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

UNIT – I: Simple Mechanisms **10 Hrs**

Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Description of mechanisms with lower pairs- straight line mechanisms: Peaucellier, Watt's linkage, Universal Joint – steering gear mechanisms: Ackerman and Davis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Contrast the difference between machine and structure. **L2**
- Identify different types of kinematic pairs, kinematic chains. **L3**
- Find degrees of freedom for different mechanisms. **L1**
- Identify the inversions of four bar mechanism. **L3**
- Explain the difference between Davis and Ackerman steering gear mechanisms. **L2**

UNIT – II: Kinematic analysis of mechanism: **12 Hrs**

Kinematic analysis of mechanism: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, relative velocity method, acceleration analysis of mechanisms - tangential and normal acceleration- Coriolis component of acceleration.

Learning Outcomes:

At the end of this unit, the student will be able to

- Calculate the velocities and acceleration of various links in a mechanism. **L4**
- Determine instantaneous centers for a given mechanism. **L4**

UNIT – III: Gyroscope & Gears **10Hrs**

Gyroscope: Principle of gyroscope, gyroscopic effect on aeroplane, ship, car and two wheeler, simple problems.

Gears: Introduction and classification of gears, Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing, spur gear, length of path of contact, contact ratio and interference/undercutting in gears, methods of avoiding interference in gears – minimum number of teeth in gear and pinion, rack and pinion.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of gyroscopic couple. **L2**
- Analyze the effects of gyroscopic couple on an aeroplane, ship and road vehicles. **L4**
- Explain the different gear profiles and parameters **L2**
- Identify different types of gears and application. **L3**

UNIT – IV: Balancing of Rotating masses & Cams **12 Hrs**

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams – Uniform velocity, simple harmonic, UARM and cycloidal motions - cam profile determination - cams with knife edge, Roller and flat face followers- radial and offset followers. cams with specified contour- circular and tangent cams.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of balancing. **L2**
- Analyze balancing problems in rotating engines. **L4**
- Explain the working of cams and followers. **L2**
- Analyze the different motions in cam and followers. **L4**

UNIT – V: Turning Moment Diagrams and Flywheels & Vibrations **10Hrs**

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and its proportions - fly wheels for punching press.

Vibrations: Introduction, degree of freedom, types of vibrations, free or natural vibrations - Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems.

Transverse vibrations- Dunkerley's method - critical speed.

Learning Outcomes:

At the end of this unit, the student will be able to

- Formulate equations of motion and solve for single degree of freedom system with damping **L6**
- Estimate natural frequency of vibratory systems. **L5**
- Explain concept of vibration isolation and transmissibility. **L2**

Text Books:

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. Thomas bevan " The Theory of Machines. 3/e, CBS Publishers & Distributors, 2014.
3. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. Jagdish Lal " Theory of Mechanisms & Machines" metropoliten book & Co, 1987.

Course Outcomes:

At the end of this Course the student will be able to

- Understand different mechanisms and their inversions. **L2**
- Calculate velocity and acceleration of different links in a mechanism. **L4**
- Apply the effects of gyroscopic couple in ships, aero planes and road vehicles. **L3**
- Evaluate unbalance mass in rotating machines. **L5**
- Analyze free and forced vibrations of single degree freedom systems. **L4**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AHS04 - MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to all Branches)

L	T	P	C
3	0	0	3

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting.
- To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost.

UNIT – I

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the nature and scope of Managerial Economics and its importance. **L1**
- Understand the concept of demand and its determinants. **L2**

UNIT – II

Theory of Production: Production Function- Isoquants and Isocosts, MRTS, Cobb-Douglas Production function.

Cost Analysis: Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break even analysis -Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the production function, Input-Output relationship and different cost concepts. **L1**
- Apply the least-cost combination of inputs. **L2**

UNIT – III

Introduction to Markets: Market structures: Types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition.

Pricing Policies: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Bundling Pricing, and Peak Load Pricing. Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model, Smart market mechanism model.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the price output relationship in different markets. **L1**
- Evaluate price-output relationship to optimize cost, revenue and profit. **L2**

UNIT – IV

Types of Industrial Organization: Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types.

Capital Budgeting: Introduction to capital, Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples of capital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems).

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the concept of capital budgeting and its importance in business. **L1**
- Contrast and compare different investment appraisal methods. **L2**

UNIT – V

Introduction to Financial Accounting: Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts (with simple adjustments) - Limitations of Financial Statements.

Interpretation and analysis of Financial Statement: Ratio Analysis – Liquidity ratios, Profitability ratios and solvency ratios – Preparation of changes in working capital statement and fund flow statement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Know the concept, convention and significance of accounting. **L1**
- Apply the fundamental knowledge of accounting while posting the journal entries. **L2**

Text Books:

1. **J.V. Prabhakar Rao**: Managerial Economics and Financial Analysis, Maruthi Publications, 2011.
2. **Prof. C.Viswanatha Reddy:** 'Financial Accounting-1' Himalaya Publishing House, Newdelhi.

Reference Books:

1. **A R Aryasri** - Managerial Economics and Financial Analysis, TMH 2011.
2. **Suma damodaran**- Managerial Economics, **Oxford** 2011.
3. **S.A. Siddiqui & A.S. Siddiqui**, Managerial Economics and Financial Analysis, New Age International Publishers, 2011.
4. **N. Appa Rao. & P. Vijaya Kumar**: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi, 2011.

Course Outcomes:

At the end of this Course the student will be able to

- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. **L1**
- Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives. **L2**
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. **L3**
- Evaluate the capital budgeting techniques. **L4**
- Students can analyze how to invest their capital and maximize returns. **L5**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AHS05 - ENTERPRENUARSHIP AND INNOVATION MANAGEMENT

(Common to all Branches)

L	T	P	C
3	0	0	3

Course Objectives:

- To enable students understand the opportunities available to start a business.
- To impart knowledge about various sources of support (Financial and Non-financial) available to start an enterprise.

UNIT – 1: FUNDAMENTALS OF ENTREPRENEURSHIP

Fundamentals of Entrepreneurship – Evolution and Theories of Entrepreneurship – Characteristics of Entrepreneurs –Myths of Entrepreneurship – Kakinada Experiment -Elements of leadership –Role of Entrepreneurs in Indian economy – Social and Ethical Perspectives of Entrepreneurship - Corporate entrepreneurship – Social Entrepreneur, women Entrepreneurship

- Opportunities & challenges.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define entrepreneurship and the characteristics of an entrepreneur. **L1**
- Explain the significance of entrepreneurship in the economic development of a nation. **L2**

UNIT – II: IDEATION AND EVALUATION OF BUSINESS IDEAS

Opportunity identification – Ideations process - Sources of business ideas – Role of creativity – Sources of Innovation - Business Idea Evaluation - Product/ Service design – Design Thinking - Customer Value Proposition (CVP) – Business models.

Case study: Business cases of OYO, Paytm and Flipkart/ Smartmart.

Activity: Idea generation in groups and CVP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Select the right business ideas. **L1**
- Explain the business idea evaluation process **L2**

UNIT – III: Business Organizations and Venture Establishment

Forms of business organisations/ownership – Techno-economic feasibility assessment – Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas – Challenges & Pitfalls in selecting new venture.

Activity: Preparation of business plan (draft).

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall different forms of business organizations. **L1**
- Develop business canvas. **L2**

UNIT – IV: Introduction to Innovation

Creativity, Invention and innovation, Types of Innovation, Relevance of Technology for Innovation, The Indian innovations and opportunities.

Learning Outcomes:

At the end of this unit, the student will be able to

- Able to develop new ideas to discover new ways of looking problems and opportunities. **L1**
- Apply technology to innovation. **L2**

UNIT – V: Promoting and managing innovation

Innovators and Imitators, Patents, Trademarks, Intellectual Property, Exploring, Executing, Leveraging and renewing innovation, Enhancing Innovation Potential & Formulating strategies for Innovation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Intellectual Property Licensing. **L1**
- Summarize the importance of IPR. **L2**

Text Books:

1. Robin Lowe and Sue Marriott, Enterprise: Entrepreneurship and Innovation Concepts, Contexts and Commercialization.
2. John Bessant and Joe Tidd, Innovation and Entrepreneurship.

Reference Books:

1. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
2. Peter F. Drucker, Innovation and Entrepreneurship.
3. EDII "Faculty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.
4. Philips, Bonefiel and Sharma (2011), Social Entrepreneurship, Global vision publishing house, New Delhi.

Course Outcomes:

At the end of this Course the student will be able to

- Choose entrepreneurship as an alternative career. **L1**
- Distinguish between corporate and social entrepreneurs. **L2**
- Examine and build customer value proposition. **L3**
- Analyze feasibility of business ideas. **L4**
- Compare various supports schemes provided by GOI. **L5**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME18 - MECHANICAL ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To familiarize moulding and casting skills.
- To train on different types welding joints.
- To develop assemble or disassembly skills.
- To make plastic components.
- To familiarize with use of power tools.

UNTI I: FOUNDRY PRACTICE: (2 Sessions).

i. a) Determination of average grain size for sand sample using sieve shaker.
b) Preparation of a green sand mould using single piece pattern.

ii. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

UNIT II: WELDING PRACTICE: (2 Sessions).

i. Lap joint, butt joint and T joint using arc welding.

ii. a) Lap joint using resistance spot welding.
b) Lap and butt joints using gas welding.
c) simple rivet joint.
d) Welding rod efficiency test.
e) Soldering of wires.

f) Glass cutting practice.

UNIT III: ASSEMBLING/DISASSEMBLING PRACTICE: (3 Sessions).

i. Bicycle.
ii. Clutch and carburetor.
iii. Two wheeler engine.

UNIT IV: MANUFACTURE OF A PLASTIC COMPONENT (2 Sessions).

i. Use of injection moulding machine.
ii. FRP composite using hand layup method.
iii. Joining of plastic components.

Session 5: DESIGN AND MANUFACTURE ANY TWO DOMESTIC UTILITY PRODUCTS WITH ANY MATERIAL (2 Sessions).

Session 6: USE OF POWER TOOLS STUDY (2 Sessions)

Course Outcomes:

At the end of this Course the student will be able to

- Make moulds for sand casting. **L6**
- Develop different weld joints. **L6**
- Assemble or disassemble of machine components. **L5**
- Make plastic components. **L6**
- Use power tools for different applications. **L3**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
II YEAR II SEMESTER
20AME15 - THERMAL ENGINEERING LAB
(MECH)

L	T	P	C
0	0	3	1.5

Course Objectives:

- Understand the functioning and performance of I.C. Engines
- To find heat losses in various engines

List of Experiments

1. Demonstration of diesel and petrol engines by cut models.
2. Valve timing diagram of 4-stroke diesel engine.
3. Port timing diagram of 2-stroke petrol engine.
4. Performance of 2-stroke single cylinder petrol engine.
5. Morse test on multi cylinder petrol engine.
6. Performance of 4-stroke single cylinder diesel engine.
7. Performance of two stage reciprocating air compressor.
8. Performance of Refrigeration system.
9. Performance of Air conditioning system.
10. Assembly and disassembly of diesel and petrol engines.
11. Performance of heat pump.
12. Performance of variable compression ratio of petrol engine.
13. Demonstration of heat pipe

Course Outcomes:
At the end of this Course the student will be able to

- explain different working cycles of engine (L2)
- describe various types of combustion chambers in IC engines(L3)
- illustrate the working of refrigeration and air conditioning systems (L5)
- evaluate heat balance sheet of IC engine. (L6)

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME16 - DESIGN THINKING AND PRODUCT INNOVATION LAB

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- Acquire practical knowledge on 3D Printing technology.
- Design the various measuring instruments like temperature, humidity, smart lighting system etc,.

List of Experiments

1. 3D Printing
   a. To develop a CAD model and simulate in CAE environment.
   b. To develop tooling and make a physical prototype.
2. To design a device for measurement of Temperature.
3. To design a device for measurement of Humidity.
4. To design a device for Water Level Indicator.
5. To design a Smart Lighting system.
6. To design Automatic Car Wiper.
7. Design of simple pneumatic and hydraulic circuits using basic components.
8. Design of pneumatic circuit for speed control of double acting cylinders.
9. Design a hydraulic circuit by using Flow Control Valves for simple application.
10. Design and Simulation of a Hydraulic Shaper.
11. Design and Simulation of a Hydro Electric Circuit for simple application.

Course Outcomes:

At the end of this Course the student will be able to

- Fabricate different types of components using 3D Printing technology. **L6**
- Design various measuring instruments like temperature, humidity, smart lighting system etc,. **L6**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME16 - DESIGN THINKING AND PRODUCT INNOVATION

((MC) Non credit course)

L	T	P	C
3	0	0	0

Course Objectives: The objectives of the course are to make the students learn about

- To bring awareness on innovative design and new product development.
- To explain the basics of design thinking.
- To familiarize the role of reverse engineering in product development.
- To train how to identify the needs of society and convert into demand.
- To introduce product planning and product development process.

UNIT – I: Science to Engineering & Physics to Engineering **8 Hrs**

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.

Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, and electrical induction in engineering products.

Learning Outcomes:

At the end of this unit, the student will be able to

- Relate the principles of science to engineering. L2
- Explain simple mechanics motion and force transmission. L2
- Identify the laws of physics applied to engineering products. L3

UNIT – II: Historical Development **8 Hrs**

Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify innovation in early mechanical designs. L2
- Explain development of electrical equipment. L2
- List out the developments in computing machines. L4
- Summarize innovations in communication systems. L2

UNIT – III: Systematic approach to product development **8 Hrs**

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the steps in the design process. L2
- Apply systematic approach in design. L3
- Develop strategies for new product development. L3

UNIT – IV: Reverse engineering in product development **8 Hrs**

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, and study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand reverse engineering methods in product development. **L2**
- Use new materials to improve the product. **L2**
- Apply electronic controls to improve the product acceptability. **L3**
- Summarize the safety and environmental factors in new product design. **L2**
- Understand 3D printing in manufacturing. **L2**

UNIT – V: Study of Product Development **8 Hrs**

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, and smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the needs for new product development in agriculture. **L3**
- Develop simple electrical gadgets. **L3**
- Explain the principles in design electrical vehicles and drones. **L2**

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010.

Reference Books:

1. An AVA Book, "Design Thinking", AVA Publishing, 2010.
2. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
3. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Summarize the importance of basic sciences in product development. **L2**
- Explain the historical developments in mechanical, electrical, communications and computational engineering. **L3**
- Apply systematic approach to innovative designs. **L3**
- Identify new materials and manufacturing methods in design. **L3**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME18 - MECHANICAL ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To familiarize moulding and casting skills.
- To train on different types welding joints.
- To develop assemble or disassembly skills.
- To make plastic components.
- To familiarize with use of power tools.

UNTI I: FOUNDRY PRACTICE: (2 Sessions).

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b) Lap and butt joints using gas welding.
c) simple rivet joint.
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e) Soldering of wires.

f) Glass cutting practice.

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i. Bicycle.
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iii. Joining of plastic components.

Session 5: DESIGN AND MANUFACTURE ANY TWO DOMESTIC UTILITY PRODUCTS WITH ANY MATERIAL (2 Sessions).

Session 6: USE OF POWER TOOLS STUDY (2 Sessions)

Course Outcomes:

At the end of this Course the student will be able to

- Make moulds for sand casting. **L6**
- Develop different weld joints. **L6**
- Assemble or disassemble of machine components. **L5**
- Make plastic components. **L6**
- Use power tools for different applications. **L3**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME19 - COMPUTER AIDED MACHINE DRAWING

(SC-II)

L	T	P	C
1	0	2	2

Course Objectives: The objectives of the course are to make the students

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.

The following contents are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling, bushed pin-type flange coupling, universal joint, Oldhams' coupling.

The following contents to be done by any 3D software package

Sectional views: Creating solid models of complex machine parts and create sectional views.

Assembly drawings: (Any four of the following using solid model software)

Piston, connecting rod, Eccentric, Screw jack, Plumber block, Pipe vice, Clamping device, Tail stock, Air Cock, Machine vice and Carburetor.

Manufacturing drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Books:

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.
2. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.

Reference Books:

1. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
2. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the conventional representations of materials and machine components. **L6**
- Model riveted, welded and key joints using CAD system. **L5**
- Create solid models and sectional views of machine components. **L6**
- Generate solid models of machine parts and assemble them. **L5**
- Translate 3D assemblies into 2D drawings. **L6**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA
YSR(KADAPA) Dist. 516 390, (A.P) INDIA
COURSE STRUCTURE (R20)

Mechanical Engineering

SEMESTER - I					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20ABS05	Linear Algebra And Calculus	BS	3-0-0	3
2.	20ABS01	Engineering Physics	BS	3-0-0	3
3.	20AME02	Material Science	ES	3-0-0	3
4.	20ABEE0	Basic Electrical & Electronics Engineering	ES	3-0-0	3
5.	20AME04	Engineering Workshop	ES	0-0-3	1.5
6	20ACS05	IT Workshop	ES	0-0-3	1.5
7.	20ABS02	Engineering Physics Lab	BS	0-0-3	1.5
8.	20AME03	Material Science Lab	ES	0-0-3	1.5
9.	20ABEE0	Basic Electrical And Electronics Engineering	ES	0-0-3	1.5
				Total	**19.5**

SEMESTER – II					
S.No	**Course Cde**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20ABS06	Differential Equations And Vector Calculus	BS	3-0-0	3
2.	20ABS07	Engineering Chemistry	BS	3-0-0	3
3.	20AHS01	Communicative English	HS	3-0-0	3
4.	20ACS10	C Programming	ES	3-0-0	3
5	20AME0	Engineering Graphics	ES	1-0-2	2
6.	20AME0	Computer Aided Drafting Lab	ES	0-0-2	1
7.	20AHS02	Communicative English Lab	HS	0-0-3	1.5
8.	20ABS08	Engineering Chemistry Lab	BS	0-0-3	1.5
9.	20ACS11	C Programming Lab	ES	0-0-3	1.5
10.	20AHS03	Universal Human Values	MC	3-0-0	0.0
				Total	**19.5**

SEMESTER - III					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20ABS13	Complex Variables, Transforms And Applications To PDE	BS	3-0-0	3
2.	20AME0	Mechanics Of Materials	PC	3-0-	3
3.	20AME0	Fluid Mechanics And Hydraulic Machinery	PC	3-0-	3
4.	20AME1	Manufacturing Processes	PC	3-0-	3
5.	20AME1	Thermodynamics	PC	3-0-	3
6.	20AME0	Mechanics Of Materials Laboratory	PC	0-0-	1.5
7.	20AME09	Fluid Mechanics And Hydraulic Machinery Laboratory	PC	0-0-3	1.5
8.	20AME1	Manufacturing Processes Laboratory	PC	0-0-	1.5
9.	20ACS1	Data Structures (Skill Oriented Course - I)	SC	1-0-	2
10.	20ABS09	Environmental Science (Mandatory Non-Credit Course)	MC	3-0-0	0
				Total	**21.5**

SEMESTER - IV					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20ABS15	Numerical Methods, Probability And Statistics	BS	3-0-0	3
2.	20ACS21	Internet Of Things (IOT)	ES	3-0-	3
3.	20AME13	Thermal Engineering	PC	3-0-	3
4.	20AME14	Theory Of Machines	PC	3-0-	3
5.	20AHS04 20AHS05	Humanities Elective 1 **i.** Managerial Economics And Financial Analysis **ii.** Entrepreneurship And Innovation Management	HS	3-0-0	3
6.	20AME18	Mechanical Engineering Workshop	PC	0-0-	1.5
7.	20AME15	Thermal Engineering Laboratory	PC	0-0-	1.5
8.	20AME16	Design Thinking And Product Innovation Laboratory	PC	0-0-3	1.5
9.	20AME19	Computer Aided Machine Drawing (Skill Oriented Course - II)	SC	1-0-2	2
10.	20AME17	Design Thinking And Product Innovation (Mandatory Non-Credit Course)	MC	3-0-0	0
11.	20AMC01	NSS Activities	MC	0-0-	0
				Total	**21.5**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME19 - COMPUTER AIDED MACHINE DRAWING

(SC-II)

L	T	P	C
1	0	2	2

Course Objectives: The objectives of the course are to make the students

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
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Shaft coupling, bushed pin-type flange coupling, universal joint, Oldhams' coupling.

The following contents to be done by any 3D software package

Sectional views: Creating solid models of complex machine parts and create sectional views.

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Reference Books:

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2. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the conventional representations of materials and machine components. **L6**
- Model riveted, welded and key joints using CAD system. **L5**
- Create solid models and sectional views of machine components. **L6**
- Generate solid models of machine parts and assemble them. **L5**
- Translate 3D assemblies into 2D drawings. **L6**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AHS03 - UNIVERSAL HUMAN VALUES

(Common to all branches)

L	T	P	C
3	0	0	0

Course Objectives:

- Exposure to the value of life, society and harmony.
- Leading towards holistic perspective based on self-exploration about themselves (human being), family, and society and nature/existence.
- Bringing transition from the present state to Universal Human Order.
- Instill commitment and courage to act.
- Know about appropriate technologies and management patterns.

UNIT –I : HUMAN VALUES **12 Hrs**

Importance of UHV- Morals-Values –Ethics- definitions and differences-Integrity-Work Ethic-Service learning –Respect for others –Caring and Sharing – Honesty – self confidence-Courage-Co Operation –Commitment – Empathy –Character-Spirituality- Moral dilemmas.

Learning Outcomes:

At the end of this unit, the student will be able to

Understand the concept of morals, Ethics. **L1**

Able to analyse Moral dilemmas. **L2**

UNIT – II: PERSONALITY DEVELOPMENT **12 Hrs**

Concept Of Personality- Types-Determinants-Intrapersonal Skills-meaning-types- Techniques - Interpersonal Skills- meaning-types- Techniques-SWOT Analysis -Building Right Attitude.- Communication skills-Non Verbal Communication skills.

Learning Outcomes:

At the end of this unit, the student will be able to

Analysing SWOT. **L1**

Knowing about self personality. **L2**

UNIT – III : ENGINEERING AS EXPERIMENTATION **12 Hrs**

Engineering as an Experimentation-Engineers as Responsible Experimenters -Codes Of Ethics and Industrial Standards-Case Study: The Challenger-Confidentiality-Conflicts of Interests-Risk and Analysis methods-Safety and Safety Measures.

Learning Outcomes:

At the end of this unit, the student will be able to

Understand the concept of Ethics in industry. **L1**

Able to assesment safety standards. **L2**

UNIT – IV : FAMILY AND SCOCIETY **12 Hrs**

Family -Importance –Types-Functions-Influences and generation gap- Premarital counseling-Good family-Characteristics-Building a healthy family- Parents and Children -Honouring Parents-Society Definition—Types-Roles-Responsibilities-Social Evils-reasons-remedies.

Learning Outcomes:

At the end of this unit, the student will be able to

Development of a holistic perspective based on self-exploration about themselves. **L1**

Strengthening of self-reflection. **L2**

UNIT – V : GLOBAL ISSUES **12 Hrs**

Globalization: Globalization-MNCs-Technology-Cross culture issues- Environmental Ethics-Disasters- global pandemics-Computer Ethics and Net Etiquettes -Human and Employee Rights-Weapons Development -Ethics and Research-Intellectual Property Rights(IPR).

Learning Outcomes:

At the end of this unit, the student will be able to

Understand various cross culture issues. **L1**

Identifying Employee Rights. **L2**

Text Books:

1. **"Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.**
2. **Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.**
3. **"Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.**
4. **"Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana Maruthi Publications.**
5. **"Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.**

Reference Books:

1. **"Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication.**
2. **"Professional Ethics and Human Values" by Prof.D.R.Kiran.**

Course Outcomes:

At the end of this Course the student will be able to

- Define terms like Natural Acceptance, Happiness and Prosperity. **L1**
- Know about appropriate technologies and management patterns Understand awareness of oneself, and ones surroundings (family, society, nature). **L2**
- Apply what they have learnt to their own self in different day-to-day settings in real life. **L3**
- Relate human values with human relationship and human society. **L4**
- Justify the need for universal human values and harmonious existence. **L5**

B.Tech II Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME16 - DESIGN THINKING AND PRODUCT INNOVATION

((MC) Non credit course)

L	T	P	C
3	0	0	0

Course Objectives: The objectives of the course are to make the students learn about

- To bring awareness on innovative design and new product development.
- To explain the basics of design thinking.
- To familiarize the role of reverse engineering in product development.
- To train how to identify the needs of society and convert into demand.
- To introduce product planning and product development process.

UNIT – I: Science to Engineering & Physics to Engineering **8 Hrs**

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.

Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, and electrical induction in engineering products.

Learning Outcomes:

At the end of this unit, the student will be able to

- Relate the principles of science to engineering. L2
- Explain simple mechanics motion and force transmission. L2
- Identify the laws of physics applied to engineering products. L3

UNIT – II: Historical Development **8 Hrs**

Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify innovation in early mechanical designs. L2
- Explain development of electrical equipment. L2
- List out the developments in computing machines. L4
- Summarize innovations in communication systems. L2

UNIT – III: Systematic approach to product development **8 Hrs**

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

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- Explain the steps in the design process. L2
- Apply systematic approach in design. L3
- Develop strategies for new product development. L3

UNIT – IV: Reverse engineering in product development **8 Hrs**

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, and study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand reverse engineering methods in product development. **L2**
- Use new materials to improve the product. **L2**
- Apply electronic controls to improve the product acceptability. **L3**
- Summarize the safety and environmental factors in new product design. **L2**
- Understand 3D printing in manufacturing. **L2**

UNIT – V: Study of Product Development **8 Hrs**

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, and smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the needs for new product development in agriculture. **L3**
- Develop simple electrical gadgets. **L3**
- Explain the principles in design electrical vehicles and drones. **L2**

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010.

Reference Books:

1. An AVA Book, "Design Thinking", AVA Publishing, 2010.
2. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
3. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Summarize the importance of basic sciences in product development. **L2**
- Explain the historical developments in mechanical, electrical, communications and computational engineering. **L3**
- Apply systematic approach to innovative designs. **L3**
- Identify new materials and manufacturing methods in design. **L3**

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME51-OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart the basic concepts of modelling, models and statements of the operations research.
- Formulate and solve linear programming problem/situations.
- Model strategic behaviour in different economic situations.
- To solve transportation problems to minimize cost.
- Apply Queuing theory to solve problems of traffic congestion, counters in banks, railway bookings etc.

UNIT – I: Introduction to OR **8 Hrs**

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models.

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem.

Learning Outcomes:

At the end of this unit, the student will be able to

- Formulate practical problems given in words into a mathematical model. **L6**
- Quantify OR models to solve optimization problems. **L5**
- Formulate linear programming problems and appreciate their limitations. **L6**

UNIT – II: Transportation and Assignment Problems **8 Hrs**

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution – North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

Learning Outcomes:

At the end of this unit, the student will be able to

- model linear programming problems like the transportation. **L3**
- solve the problems of transportation from origins to destinations with minimum time and cost. **L6**

UNIT – III: Game theory & Job Sequencing: **8 Hrs**

Game theory: Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Job Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify strategic situations and represent them as games. **L3**
- solve simple games using various techniques. **L6**
- solve problems of production scheduling and develop inventory policies. **L6**

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UNIT – IV: Queuing Theory & Inventory Control **8 Hrs**

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

Inventory Control: Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

Learning Outcomes:

At the end of this unit, the student will be able to

- model a dynamic system as a queuing model to compute performance measures. L3
- apply optimality conditions for single- and multiple-variable constrained and unconstrained nonlinear optimization problems. L3
- describe the functions and costs of an inventory system. L2
- determine EOQ, reorder point and safety stock for inventory systems. L2

UNIT – V: Replacement and Maintenance Analysis & DP **8 Hrs**

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Dynamic Programming (DP): Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

Learning Outcomes:

At the end of this unit, the student will be able to

- solve problems using dynamic programming. L3
- apply the concept of replacement model. L3

Text Books:

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15/e, Kedar Nath Ram Nath, 2010.
2. Taha H.A., Operations Research, 9/e, Prentice Hall of India, New Delhi, 2010.

Reference Books:

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4/e, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3/e, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2/e, Pentice Hall of India, New Delhi, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Develop mathematical models for practical problems. L3
- Apply linear programming to transportation problems. L3
- Solve games using various techniques. L3
- Solve production scheduling and develop inventory policies. L6
- Apply optimality conditions for constrained and unconstrained nonlinear problems. L3
- Apply dynamic programming methods. L3

Online Learning Resources:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME52-DESIGN OF MACHINE MEMBERS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

UNIT – I: Introduction, Design for Static and Dynamic loads **10 Hrs**

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Design for finite life. Fatigue design under combined stresses.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify materials suitable for machine elements. **L1**
- Apply codes and standards in design. **L3**
- Contrast the difference between static and dynamic loads. **L2**
- Apply failures theories in designing components subjected to static and dynamic loads. **L3**

UNIT – II: Design of Bolted and Welded Joints **8 Hrs**

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different types of joints. **L1**
- analyze stresses induced in joints subjected to different loads. **L4**
- Design different joints subjected to combined loading. **L6**

UNIT – III: Power transmission shafts and Couplings **8 Hrs**

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of muff, compression, flange and bushed pin couplings.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the functions of different keys. **L2**
- Design shafts subjected to fluctuating loads. **L6**
- Select coupling for a given application and outline the design procedure. **L3**
- Explain construction and design procedure for helical and leaf springs. **L2**

UNIT – IV: Design of Clutches, Brakes and Springs **8 Hrs**

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression. Leaf springs - Design and construction.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the difference between brake and clutch. L2
- Calculate the torque transmitting capacity in clutches. L3
- Compare different types of brakes and their applications. L4
- Explain the concepts of self-energizing and self-locking brakes. L2
- Discuss procedures to design different types of brakes. L2

UNIT – V: Design of Bearings and Gears : **8 Hrs**

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

Learning Outcomes:

At the end of this unit, the student will be able to

- Contrast the difference between sliding and rolling contact bearings. L2
- Explain the mechanics of lubrication in sliding contact bearings. L2
- Identify failures in bearings. L3
- Evaluate static and dynamic load capacity of rolling contact bearings. L5
- Explain the procedure to select bearings from manufacturer's catalogue. L3

Text Books:

1. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
2. Dr. N. C. Pandya & Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.
3. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
4. K. Mahadevan & K.Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.

Course Outcomes:

At the end of this Course the student will be able to

- Estimate safety factors of machine members subjected to static and dynamic loads. L2
- Design fasteners subjected to variety of loads. L6
- Select of standard machine elements such as keys, shafts, couplings, springs and bearings. L1
- Design clutches brakes and spur gears. L6

Online Learning Resources:

- https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-of-machine-elements-1-nptel
- https://www.digimat.in/nptel/courses/video/112105124/L01.html
- https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
- http://www.nitttrc.edu.in/nptel/courses/video/112105124/L25.html

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME53-METROLOGY AND MEASUREMENTS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the basic concepts of metrology and measurement methods.
- Demonstrate the importance of metrology in manufacturing
- Explain the concepts of transducers and its practical applications.
- Expose with various measuring instruments
- Familiarize calibration methods of various measuring instruments.

UNIT – I: Concept of measurement **10 Hrs**

Concept of Measurement: General concept-generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

Linear and Angular Measurement: Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical.

Angular measurements: Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify important parameters in metrology. **L3**
- differentiate interchangeability and selective assembly. **L4**
- select limits and tolerances for different assemblies. **L1**
- explain the principles of measurement of various comparators. **L2**
- discuss about the principles of slip gauges, micrometers and Vernier height gauges. **L2**

UNIT – II: Flatness and Surface Roughness measurement **10 Hrs**

Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Surface Roughness Measurement: Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R.M.S Value-R_a , R_z values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

Learning Outcomes:

At the end of this unit, the student will be able to

- inspect the flatness of surfaces. **L4**
- recall the terms used in surface roughness measurement. **L1**
- explain the factors affecting the surface finish in machining. **L2**
- demonstrate the application of different surface measuring instruments. **L2**

UNIT – III: Screw Thread and Gear Measurement **8 Hrs**

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-run out, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

Coordinate Measuring Machine (CMM)- Construction and features.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the errors in screw threads. **L3**

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- explain the principles of gear measuring instruments. **L2**
- select the tools and methods for measuring screw thread, gear profiles. **L1**

UNIT – IV: Measurement of Displacement and Strain **8 Hrs**

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo-electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurements of Strain: Various types of electrical strain gauges, gauge factor, method of usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque, strain gauge rosettes.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various types of transducers used for the measurement of displacement. **L1**
- explain the static and dynamic characteristics of transducers. **L3**
- classify the transducers with respect to change in resistance, capacitance and inductance. **L4**
- experiment with measurement of strain. **L3**

UNIT – V: Measurement of Force, Torque and Pressure **8 Hrs**

Measurement of Force: Direct method - analytical balance, platform balance; elastic members – load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

Measurement of Pressure: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of ceramics and their applications. **L2**
- Summarize the properties of polymers and composites and their use. **L2**
- Interpret the properties of Nano materials and their applications. **L2**
- Identify the difference between the micro and Nano scale materials and their uses. **L3**

Text Books:

1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.
3. D.S. Kumar, Mechanical Measurements & Control, Metropolitan Publishers, 5/e, 2015.

Reference Books:

1. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
2. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
3. Anand K Bewoor & Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015.

Course Outcomes:

At the end of this Course the student will be able to

- List various measuring instruments used in metrology. **L4**
- Examine geometry of screw threads and gear profiles. **L4**
- Measure force, torque and pressure. **L5**
- Calibrate various measuring instruments. **L4**

Online Learning Resources:

- https://nitsri.ac.in/Department/Mechanical%20Engineering/MEC_405_Book_2,_for_Unit_2B.pdf
- https://www.digimat.in/nptel/courses/video/112104250/L47.html
- https://www.digimat.in/nptel/courses/video/112106138/L01.html
- https://www.digimat.in/nptel/courses/video/112106179/L01.html
- https://www.youtube.com/watch?v=tczyyM4Dykc
- https://www.youtube.com/watch?v=_UsAiZmRC1M
- https://www.youtube.com/watch?v=oCkaxMI19X8

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME54a-DESIGN FOR MANUFACTURING

(Professional Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Explain the product development cycle and manufacturing issues to be considered in design.
- Familiarize manufacturing consideration in cast, forged, and weld components.
- Describe the manufacture of sheet metal components.
- Impart knowledge plastics as substitution to metallic parts.

UNIT – I: Introduction **10 Hrs**

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

Learning Outcomes:

At the end of this unit, the student will be able to

- implement various steps in design process. **L6**
- apply economical considerations at design stage. **L2**
- develop creativity attitude in designing. **L5**
- use Ashby charts for material selection. **L3**
- apply process selection charts. **L2**

UNIT – II: Machining processes: **8 Hrs**

Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

Learning Outcomes:

At the end of this unit, the student will be able to

- assign dimensional tolerances and surface roughness values.(L4) **L4**
- identify the necessity of redesigning of the components.(L3) **L3**
- summarize the design rules for machining.(L2) **L2**
- assign recommendations for machining of components.(L4) **L4**
- assign dimensional tolerances and surface roughness values.(L4) **L4**

UNIT – III: Metal Casting and Joining **8 Hrs**

Metal casting: Appraisal of various casting processes, selection of casting process - general design considerations for casting-casting tolerance- solidification, simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Learning Outcomes:

At the end of this unit, the student will be able to

- list various casting processes. **L1**
- assign tolerances for various casting processes. **L5**
- simulate sand casting design. **L4**
- prescribe pre and post treatment of welds. **L5**
- discuss the effects of thermal stresses in weld joints and brazed joints. **L2**

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UNIT – IV: Forging, Extrusion & Sheet metal work **8 Hrs**

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the difference between open and closed die forging. **L2**
- identify the problems in parting lines of dies. **L3**
- apply the design guidelines the extruded sections. **L2**
- apply the design principles for various sheet metal operations. **L2**
- utilize sheet metal effectively for blanking operations. **L3**

UNIT – V: Plastics : **8 Hrs**

Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain visco elastic and creep behavior in plastics. **L2**
- discuss various plastic molding processes. **L6**
- apply the design considerations for injection molding. **L2**
- use the design guidelines in machining of plastics. **L3**

Text Books:

1. George E Dieter and Linda Schmidt, Engineering Design, 4/e, McGraw Hill, 2015.
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5/e, PHI Learning 2011.
3. David M Anderson, Design for Manufacturability, CRC Press, 2013.

Reference Books:

1. James G Bralla, Design For Manufacturability Handbook, 2/e, McGraw Hill, 2004.
2. Dr.P.C.Sharma, Production Technology, S.Chand & Company, 2009.
3. G. Boothroyd, Product Design for Manufacture & Assembly, CRC Press, 3/e, 2010.

Course Outcomes:

At the end of this Course the student will be able to

- Design mechanical components with economical consideration. **L6**
- Select materials and machining processes. **L6**
- Identify the necessity for redesigning components out of manufacturing considerations. **L3**
- Consider the manufacturing considerations while designing cast, forged weld and sheet metal components. **L3**
- Design plastic parts with manufacturing considerations. **L6**

Online Learning Resources:

- https://nptel.ac.in/courses/112/101/112101005/
- https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_LECTURE_NOTES.pdf
- https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecture-notes/
- https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on-design-for-manufacturing.html
- https://www.youtube.com/watch?v=ofmbhbVCUqI
- https://onlinecourses.nptel.ac.in/noc21_me66/preview

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME54b-POWER PLANT ENGINEERING

(Professional Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.

UNIT – I: Introduction to the Sources Of Energy **10 Hrs**

Introduction to the Sources Of Energy - Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection and Safety Regulations.

Learning Outcomes:

At the end of this unit, the student will be able to
- Outline sources of energy, compare and selection of types of power plants. **L2**
- Explain cost factors, load and power distribution factors. **L2**
- Select tariff based on load and demand factors. **L3**
- Summarize the impact of power plant on the environment, pollution mitigation and regulations. **L2**

UNIT – II: Steam Power Plant **8 Hrs**

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process- Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System and Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO_2 Recorders.

Learning Outcomes:

At the end of this unit, the student will be able to
- Demonstrate latest high pressure boilers, power plant cycles and their improvements. **L2**
- Explain various types of coals, coal handling operations and associated systems. **L2**
- Outline and compare types of feeders, stokers, combustion systems. **L3**
- Illustrate draught, dust collector, furnace, cooling tower and heat rejection systems. **L2**
- Evaluate pollution levels from power plants, pollution control methods, and application of pollution recorders. **L4**

UNIT – III: Diesel and Gas Turbine Power Plants **8 Hrs**

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

GAS TURBINE PLANT: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages and Disadvantages Combined Cycle Power Plants.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain working principle, and compare types of diesel power plant. L2
- Outline the diesel power plant layout with its supporting equipment. L2
- Illustrate the working principle of open cycle and closed cycle gas turbine. L2
- Demonstrate combined cycle power plants with benefits and shortcomings. L2

UNIT – IV: Hydro Electric Power Plants **8 Hrs**

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects & Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

Tidal Power Generation: Single basin and double basin.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain hydrological cycle, infer flow measurements from hydrographs. L2
- Summarize working principle of hydro electric power plant. L4
- Illustrate typical layout of hydro electric power plant, and its auxiliary equipments. L2

UNIT – V: Non-Conventional Source of Energy **8 Hrs**

Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Learning Outcomes:

At the end of this unit, the student will be able to

- Demonstrate working principle of power generation from non-conventional energy sources. L2
- Explain working principle of Nuclear power plants, nuclear fuels, and reactor operations. L2
- Outline the various types of nuclear reactors, their applications and limitations. L2
- Summarize the hazards of nuclear reactors and significance of nuclear waste disposal. L2

Text Books:

1. P.K. Nag, Power Plant Engineering, 3/e, TMH, 2013.
2. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai & Co (P) Ltd, 2014.
3. Rajput, A Text Book of Power Plant Engineering, 4/e, Laxmi Publications, 2012.

Reference Books:

1. K.K.Ramalingam, Power plant Engineering, SciTech Publishers, 2013.
2. P.C. Sharma, Power Plant Engineering, S.K. Kataria Publications, 2012.

Course Outcomes:

At the end of this Course the student will be able to

- Outline sources of energy, power plant economics, and environmental aspects. L2
- Explain power plant economics and environmental considerations. L2
- Describe working components of a steam power plant. L2
- Illustrate the working mechanism of Diesel and Gas turbine power plants. L2
- Summarize types of renewable energy sources and their working principle. L2
- Demonstrate the working principle of nuclear power plants. L4

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/PPE_LECTURE_NOTES.pdf
- http://www.digimat.in/nptel/courses/video/112107291/L21.html
- https://onlinecourses.nptel.ac.in/noc19_me63/preview
- https://www.youtube.com/watch?v=iWWyI8CZhUw
- https://www.youtube.com/watch?v=D0i1E_lE_TE

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME54c-NON DESTRUCTIVE TESTING

(Professional Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

UNIT – I: Introduction to non-destructive testing **10 Hrs**

Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain non destructive testing techniques **L2**
- Summarize the basic concepts of Radiographic test **L2**
- Outline the concepts of sources of X and Gamma Rays **L2**
- Explain the radiographic techniques **L2**
- Discuss the safety aspects of industrial radiography. **L4**

UNIT – II: Ultrasonic test: **8 Hrs**

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principle of ultrasonic test. **L2**
- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. **L4**
- Discuss the characteristics of ultrasonic transducers. **L4**
- Outline the limitations of ultrasonic testing. **L2**

UNIT – III: Liquid Penetrant, Eddy Current and Magnetic Particle Test **10 Hrs**

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

Learning Outcomes:

At the end of this unit, the student will be able to

- illustrate the procedure of Liquid Penetrant, eddy current and magnetic particle tests. **L2**
- outline the limitations of Penetrant, eddy current and magnetic particle tests. **L2**
- explain the effectiveness of Penetrant, eddy current and magnetic particle tests. **L2**
- apply the applications of Magnetic particle test. **L3**

UNIT – IV: Infrared and Thermal Testing : **10 Hrs**

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- discuss the fundamentals of thermal testing. **L6**
- explain the techniques of liquid crystals, active and passive. **L2**
- illustrate thermal inspection methods. **L2**
- outline the limitations of thermal testing. **L2**
- explain the applications of honey comb and sandwich structures. **L2**

UNIT – V: Industrial Applications of NDE: **8 Hrs**

Industrial Applications of NDE: Span of NDE (Non Destructive Evaluation) Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate applications of NDE. **L2**
- Explain the applications of Railways, Nuclear and chemical industries. **L2**
- Outline the limitations and disadvantages of NDE. **L2**
- Explain the applications of NDA of pressure vessels, casting and welding constructions **L2**

Text Books:

1. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publications, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag 1983.
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, American Society for Non destructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys.

Course Outcomes:

At the end of this Course the student will be able to

- explain various methods of non-destructive testing. **L3**
- apply relevant non-destructive testing method different applications. **L3**
- explain the applications of Railways, Nuclear and chemical industries. **L2**
- outline the limitations and disadvantages of NDE. **L2**
- explain the applications of NDA of pressure vessels, casting and welding constructions. **L2**

Online Learning Resources:

- http://www.twivirtualacademy.com/online-courses/ndt/
- https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructive-testing-9872
- https://onlinecourses.nptel.ac.in/noc20_mm07/preview
- https://www.youtube.com/watch?v=dyMR58TZMbo
- https://www.youtube.com/watch?v=Wam-Ewcn3aQ
- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_NDT_LECTURE_NOTES.p
- https://lecturenotes.in/subject/390/non-destructive-testing

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

SOFT SKILLS

(Common to all branches)

L	T	P	C
1	0	2	2

Course Objectives:

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

UNIT – 1: SOFT SKILLS: INTRODUCTIUON

Soft Skills: Definition-Meaning--Importance- Why skill gap -Analysis--Personality Development vs. Soft Skills- Learning Methods.

Learning Outcomes:

At the end of this unit, the student will be able to

• Developing self-motivation, raised aspirations and belief in one's own abilities, defining and committing to achieving one's goals.	L1
• Learning to keep going when things don't go according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict	L2

UNIT – II: PERSONAL SKILLS

Intra-Personal: Definition-Meaning-Importance-SWOT analysis- Goal Setting- Emotional Intelligence- Right thinking- Problem Solving-Time management.

Inter-Personal: Definition-Meaning-Importance-Communications skills- Team Work- Negotiation Skills-Leadership skills.

Learning Outcomes:

At the end of this unit, the student will be able to

• A commitment to ethics and integrity in academic and professional relationships, within the community and the environment.	L1
• Describe how good communication with other can influence our working relationships	L2

UNIT – III: VERBAL AND NON VERBAL SKILLS

Verbal Skills: Definition and Meaning-Importance-Improving Tips for Listening, Speaking, Reading- Writing Skills.

Non Verbal Skills: Definition and Meaning-Importance- Dress Code- Facial Expressions- Eye Contact- Proxemics- Haptics -Posture -Kinetics- Para Language.

Learning Outcomes:

At the end of this unit, the student will be able to

• Compares verbal and nonverbal communication	L1
• Understand the functions of nonverbal communication	L2

UNIT – IV: FINISHING SCHOOL

Before Interview: Bridging between Campus and Corporate- Preparation of Resume-Cover Letter- Statement of Purpose-E-mail writing-Corporate Etiquettes.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• Learner will be able to prepare his/ her own Resume and Cover letter.	L1
• Learner will understand the importance of etiquettes and learn the nuances of expected behaviour within a group, a social class and society at general	L2

UNIT – V: DURING INTERVIEW

Interview Skills: Importance-Purpose- Types of interviews –Preparation for interviews - Top Questions- Body Language in Interview Room-Do's and Don'ts s of interview.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• Learner will be able to face interview questions and effectively present his /her. skills	L1
• Learner will manage how to plan and organize personal and professional life.	L2

Reference Books:

1. Sherfield, M. Robert at al ***Cornerstone Developing Soft Skills***, 4th ed. Pearson Publication, New Delhi, 2014.
2. Alka Wadkar, ***Life Skills for Success,*** Sage Publications India Private Limited; First edition (1 May 2016)
3. Sambaiah.M. ***Technical English***, Wiley publishers India. New Delhi. 2014.
4. Gangadhar Joshi, ***From Campus to Corporate,*** *Sage Text.*
5. Alex.K, ***Soft Skills,*** 3rd ed. S. Chand Publication, New Delhi, 2014.
6. Meenakshi Raman and Sangita Sharma, ***Technical Communication: Principle and Practice***, Oxford University Press. 2009.
7. Shalini Varma, ***Body Language for Your Success Mantra,*** 4th ed, S. Chand Publication, New Delhi, 2014.
8. Stephen Covey, ***Seven Habits of Highly Effective People,*** JMD Book, 2013.

Course Outcomes:	
At the end of this Course the student will be able to	
• The students will be able to assimilate and understood the meaning and importance of soft skills and learn how to develop them.	L1
• The students will understand the significance of soft skills in the working environment for professional excellence.	L2
• The students will be prepared to undergo the placement process with confidence and clarity.	L3
• The students will be ready to face any situation in life and equip themselves to handle them effectively.	L4
• The students will understand and learn the importance of etiquettes in both professional and personal life	L5

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME57-METROLOGY AND MEASUREMENTS LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To experiment with measuring equipments used for linear and angular measurements.
- To find common types of errors in measurement equipment.
- To experiment with different types of sensors, transducers and strain gauges equipment.
- To make use of thermocouples for measurement of temperature.

List of Experiments

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth Vernier callipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine using dial indicators
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bar spirit level etc.
6. Thread measurement by Two wire/Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.
9. Measurement system analysis (MSA) - Case study.

Section B:

1. Calibration of Pressure Gauges
2. Study and calibration of Mcleod gauge for low pressure.
3. Calibration of transducer or thermocouple for temperature measurement.
4. Calibration of LVDT transducer for displacement measurement.
5. Calibration of capacitive transducer for angular measurement.
6. Calibration of photo and magnetic speed pickups for the measurement of speed.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

Virtual Lab:

1. To use Vernier Callipers for the measurement of dimensions of given object.
   https://amrita.olabs.edu.in/?sub=1&brch=5&sim=16&cnt=4
2. To use Micrometer Screw Gauge for the measurement of dimensions (Length, Thickness, Diameter) of given object.
   https://amrita.olabs.edu.in/?sub=1&brch=5&sim=156&cnt=4
3. To calculate Young's modulus of elasticity of steel wire by Vernier method
   https://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=4

References:

1. Dr. R. Manikandan, Metrology and Measurements laboratory manual, Norton Press; 1/e, 2020.
2. Arul R, Metrology and Measurements Lab Manual, Notion Press; 1/e, 2020.

Course Outcomes:

At the end of this Course the student will be able to

- Apply different instruments to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness. **L3**
- Measure effective diameter of thread profile. **L5**
- Conduct different machine alignment tests. **L6**
- Measure temperature, displacement, and pressure. **L3**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME58-DYNAMICS AND MACHINE TOOLS LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To familiarize students with different types of governors, static dynamic, dynamic and cam analyser equipments.
- Familiarize the construction and working of various machine tools.
- Teach selection of parameters for different machining processes

List of Experiments

Dynamics Laboratory

1. Study of Inversion of Four Bar Mechanism.
2. Experiment on universal governor.
3. Experiment on CAM analysis machine.
4. Experiment on static and dynamic balancing.

Machine Tools Laboratory

1. Demonstration of construction and operations of general purpose machines : Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder and surface grinder.
2. Measure the characteristic features of lathe with simple step turning operation.
3. Job on step turning, taper turning, knurling, thread cutting on lathe machine.
4. Perform drilling, reaming and tapping operations.
5. Job on milling (Groove cutting/Gear cutting).
6. Job on shaper.
7. Job on slotting.
8. Job on cylindrical and surface grinding.
9. Job on grinding of tool angles.

Course Outcomes:

At the end of this Course the student will be able to

- Hands on training on universal governor, CAM analysis, static and Dynamic balancing equipments. **L3**
- explain the concept of machining with various machine tools. **L4**
- get hands on experience on various machine tools and machining operations. **L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

B.Tech. V-Sem (R20)

FUZZY SET THEORY, ARITHMETIC AND LOGIC

(Open Elective -I)

	L	T	P	C
	3	0	0	3

Course Objectives: This course aims at providing

- the basic knowledge to understand Fuzzy set theory and Arithmetic. and
- Logic, related to a real word problems of engineering, Science etc.

UNIT – 1: Classical (Crisp) Sets To Fuzzy Sets & Fuzzy Sets Versus Crisp Sets: **9 Hrs**

Classical (Crisp) Sets To Fuzzy Sets:

Introduction: Crisp Sets: An Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts.

Fuzzy Sets Versus Crisp Sets:

Alpha -Cuts :Additional Properties of alpha -Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets.

Learning Outcomes:

At the end of this unit, the student will be able to

• The basic concepts of Sets and Fuzzy sets	L2
• Analyze the Fuzzy Sets Versus Crisp Sets	L3

UNIT – II: Operations On Fuzzy Sets:

Types of Operations, Fuzzy Complements, Fuzzy Intersections: t-Norms.

Fuzzy Unions: t-Conorms ,Combinations of Operations, Aggregation Operations.

Learning Outcomes:

At the end of this unit, the student will be able to

• Do some operations on Fuzzy sets	L2
• Assess t-Norms Fuzzy Unions	L3

UNIT – III: Fuzzy Arithmetic & Fuzzy Relations :

Fuzzy Arithmetic :

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals, Arithmetic Operations on Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Relations:

Crisp versus Fuzzy Relations, Projections and Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on a Single Set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations, Fuzzy Ordering Relations.

Learning Outcomes:

At the end of this unit, the student will be able to

• Perform arithmetic operations on Fuzzy numbers and equations.	L2
• Analyze Fuzzy Relations, Projections and Cylindric Extensions etc.	L3

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UNIT – IV: Fuzzy Relation Equations & Possibility Theory:	
Fuzzy Relation Equations: General Discussion ,Problem Partitioning ,Solution Method. **Possibility Theory:** Fuzzy Measures, Evidence Theory, Possibility Theory, Fuzzy Sets and Possibilty Theory, Possibility Theory versus Probability Theory.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Solve Fuzzy relation equations.	L3
• Analyze Possibility Theory.	L4
UNIT – V: Fuzzy logic:	
Classical Logic: An Overview, Multi-valued Logics, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Inference from Conditional and Qualified Propositions, Inference from Quantified Propositions.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Understand the Fuzzy logic.	L1
• Analyze the Inferences from Conditional, Qualified, and Quantified Propositions.	L4
Text Books:	
1. Fuzzy Sets and Fuzzy Logic, Geoge J. Klir and Bo Yuan	
Reference Books:	
1. Fuzzy Mathematical Models in Engineering and Management Science, A. Kaufmann and M.M. Gupta	
2. Fuzzy Logic, Timothy J. Ross	
3. Fuzzy Set Theory, H.J. Zimmermann	
4. Introduction to Fuzzy Logic and Fuzzy Sets, J.J. Buckley and E. Eslami	
Course Outcomes:	
At the end of this Course the student will be able to	
• Understand the basic concepts of Fuzzy sets and logic.	**L1**
• Do some operations of Fuzzy sets.	**L2**
• Solve Fuzzy relation equations.	**L3**
• Analyze the Inferences from Conditional, Qualified, and Quantified Propositions.	**L4**
• analyze the real word problem through the technique of Fuzzy set theory and logic to have better insight of the real word problems.	**L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA
DEPARTMENT OF PHYSICS
III B.TECH – I SEMESTER-R20 (Open elective-Interdisciplinary) –OE-ID.1(THEORY)

FUNCTIONAL NANOMATERIALS FOR ENGINEERS
(Common to all branches)

L	T	P	C
3	0	0	3

Course Objectives:

- Be able to describe the terminology and basics of smart materials and smart systems
- Be able to understand the classification and applications of smart materials.
- Be able to understand the use of appropriate materials for energy applications.
- Be able to identify appropriate techniques for understanding the mechanisms of nanosensors
- Be able to explain the concepts of self-assembling monolayers and their applications

UNIT-I: INTRODUCTION TO FUNCTIONAL /SMART NANOMATERIALS — **9 Hrs**

Introduction:-Nanomaterials and their importance (in brief), Functional/ Smart Nanomaterials, – (Hydrogels, Carbon nanotubes) and their Functionalization techniques, Properties of Smart materials (Sensing materials, Actuation materials, Self-detection, Self-corrective, self-healing, Shock Absorbers)- Components of smart systems (Sensor :- Data Acquisition, Data Transmission; Command and control unit, Actuator:- Data Instructions, Action Devices)

Learning Outcomes:

At the end of this unit, the student will be able to

• **Understand** the basic properties and functionalization of smart nanomaterials	L1
• **Explain** the need of functional/smart nanomaterials for advanced tecghnology	L2
• **Identify** engineering applications of sensors	L3
• **Analyze** the sensing, control and detection mechanism in smart nanomaterials	L4
• **Illustrate** the components of smart systems	L2

UNIT-II: CLASSIFICATION AND APPLICATIONS — **9 Hrs**

Introduction, Classification of smart materials (piezoelectric, electrostrictive, Magnetostrictive, Thermoresponsive and Electrochromic), Shape Memory Alloys and their working principle, Applications of smart materials in Aircrafts, Medicine, Robotics,Smart fabrics, Sporting goods and smart glass, Merits and de-merits of smart materials.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Classify** smart materials based on electrical, magnetic and thermal characteristics	L1
• **Understand** the basic concepts and working principle of memory alloys	L2
• **Identifies** the Engineering applications of smart materials	L2
• **Apply** the concepts to Aircrafts, Medicine and Robotic fields	L3
• **Identify** the Merits and demerits of smart materials in engineering field	L2

Unit-III NANOSENSORS — **9 Hrs**

Introduction, Principle of nanosensors, Types of nanosensors (Physicalnanosensors – *Pressure, Force, Mass, Displacement*, Optical nanosensors – *Proximity, Ambient light*, Chemical nanosensors- *Chemical composition, Molecular concentration*).Applications of nanosensors (Medicine, Aerospace, Communication, Structural Engineering).

Learning Outcomes:

At the end of this unit, the student will be able to

• **Explain** the working principle and concept of nanosensors	L1
• **Classify** the nanosensors based on their working principle and application	L2
• **Summarize** various types of nanosensors	L2
• **Explain** the applications of nanosensors in various fields	L2
• **Apply** the concept of nanosensors in Medicine, Aerospace, Communication, Structural Engineering fields	L3

UNIT-IV: SELF-ASSEMBLING MONO LAYERS 9Hrs

Introduction, principles of self-assembly, monolayers, Characteristics of Self assembled monolayers (SAMs), Types of SAMs, Factors influencing Monolayer order, Methods of preparation of SAMs(Langmuir- Boldgett film :Mechanism, Experimental arrangement, Assembly, Advantages and disadvantages of LB films) patterning of SAMs (Locally attract, Locally remove, Modify tail group).Applications (Self-cleaning and moisture repellent).

Learning Outcomes:

At the end of this unit, the student will be able to

• **Explain** the concept of self-assembling	L1
• **Understand** the significance of molecular layers	L2
• **Explain** the concept of Langmuir- Boldgett film preparation	L2
• **Explain** the important factors influencing Monolayer order	L2
• **Classify** the materials based on patterning of SAMs	L2
• **Apply** the concept of Self-cleaning and moisture repellent	L3

UNIT-V: NANOMATERIALS FOR ENERGY APPLICATIONS 9Hrs

Introduction, **Solar Cells** (Silicon Solar Cells, Thin film Solar Cells, Organic Solar Cells, Polymer solar cells) Working Principle, Efficiency estimation and advantages. **HydrogenFuel Cells** – Working Principle, Configuration, Assembly of fuel cell, Water **splitting** – H_2 Production, Photocatalytic process.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Explain** the concept of solar cell	L1
• **Classify** the solar cells based on manufacturing material	L2
• **Explain** the construction and working principle of solar cell	L2
• **Interpret** the efficiency and advantages in various solar cells	L2
• **Explain** the construction and working principle of hydrogen cells	L2
• **Identify** applications of water splitting for H_2 production	L2
• **Explain** the photocatalytic process	L2

Text Books:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2012
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials,-Vol (1&2), Nova Publishers, 2014.

Course Outcomes:	
At the end of this Course the student will be able to	
• **Identify** the various functional/smart nanomaterials materials	L1
• **Classify** the smart nanomaterials based their applications and properties	L2
• **Apply** the various functional nanomaterials in various applications	L3
• **Classify** the solar cells based on manufacturing material	L4
• `**Interpret** the efficiency and advantages in various solar cells	L5

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA				
B.Tech – III-I-Sem	L	T	P	C
	3	0	0	3

Chemistry of Energy Materials (OE.1)
(common to all branches)

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquefaction method.
- Necessity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

UNIT-I: **Electrochemical Systems**	9 Hrs

a) Introduction to Energy- Materials, Chemistry, Engineering and Technology.
b) Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, Electrode mechanism, Batteries-Lead-acid and Lithium ion batteries.

Learning Outcomes:
At the end of this unit, the student will be able to:

- Solve the problems based on electrode potential (L3)
- Describe the Galvanic Cell (L2)
- Differentiate between Lead acid and Lithium ion batteries(L2)
- Illustrate the electrical double layer(L2)

UNIT-II:**Fuel Cells**	7 Hrs

Basic design of fuel cell, Fuel cell working principle, Fuel cell efficiency Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), and their applications

Learning Outcomes:
At the end of this unit, the student will be able to:

- Classify the fuel cell(L2)
- Describe the working Principle of Fuel cell(L2)
- Explain the efficiency of the fuel cell (L2)
- Discuss about the Basic design of fuel cells(L3)

UNIT-III: **Hydrogen Storage**	9 Hrs

Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF) zinc-(3-aminotriazolato)-oxalate; MOF-74 (Zn_2 -(2,5-dihydroxy-1,4-benzenedicarboxylate), Carbon structures (Carbon nano tubes, fullerenes), metal oxide porous structures, hydrogen storage by high pressure methods-liquefaction method

Learning Outcomes:

After completing the course, the student will be able to:

- Differentiate Chemical and Physical methods of hydrogen storage (L2)
- Discuss the metal organic frame work(L3)
- Illustrate the carbon and metal oxide porous structures (L2)
- Describe the liquification methods(L2)

UNIT-IV: **Solar Energy**	8 Hrs

Solar energy introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar Fuels – Hydrogen: Ammonia& Hydrazine, Solar cells (Si-Te& Cd-Te), advantages and disadvantages

Learning Outcomes:

After completing the course, the student will be able to:

- Apply the photo voltaic technology (L3)
- Demonstrate about solar energy and prospects(L2)
- Illustrate the Solar cells (L2).
- Discuss about concentrated solar power(L3)

UNIT-V: **Photochemical and Photo electrochemical Conversions**	7 Hrs

Photochemical cells and applications of photochemical reactions, photo electrochemical cell, advantages of photoelectro catalytic conversions.

Learning Outcomes:

- After completing the course, the student will be able to:
- Differentiate between Photo and Photo electrochemical Conversions(L2)
- Illustrate the photochemical cells(L2)
- Identify the applications of photochemical reactions(L3)
- Interpret advantages of photoelectron catalytic conversion(2)

Text Books:

1. Bahl and Bahl and Tuli, Essentials of Physical Chemistry, S. Chand Publications, New Delhi, 28th Edition, 2020.
2. US Department of Energy (EG&G technical services and corporation), Fuel Cell Hand Book 7th Edition, 2004.

Reference Books:

1. Ira N. Levine, Physical chemistry 6th Edition, McGraw Hills Education, New Delhi, 2009.
2. Silver and Atkins, Inorganic Chemistry, , 7th Edition, Oxford University Press, 2018
3. Michael Hirscher, Hand book of Hydrogen Storage: New materials for future energy, storage, Wiley-VCH Verlag GmbH & Co. KGaA, 2010

4. Klaus Jagar et.al.. Solar energy fundamental, technology and systems, UIT-Cambridge publishers, 2016

Course Outcomes:

At the end of this Course the student will be able to

- Understand to perform simultaneous material and energy balances(L1)
- Lists about various electrochemical and energy systems(L1)
- Classify solid, liquid and gaseous fuels(L3)
- Analyze the energy demand of world, nation and available resources to fulfill the demand(L3)
- Evaluate the conventional energy resources and their effective utilization(L3)
- To be able to understand and perform the various characterization techniques of fuels(L1)
- Explain knowledge of modern energy conversion technologies(L2)
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively(L1)

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACE55A- BASICS OF CIVIL ENGINEERING

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- To study the basic concept of Civil Engineering and instruction buildings.
- To understand the concept of planning of buildings and drawing of single stored building.
- To study the Basic principles of surveying and instruments used.
- To study about the various materials used for the construction of Buildings.
- To understand the construction of Structural Elements in buildings.

UNIT-I:

Introduction to Civil Engineering Building planning : Introduction to types of buildings as per NBC; Selection of site for buildings. Components of a residential building and their functions. Introduction to industrial buildings – office / factory / software development office / power house /electronic equipment service centre

UNIT-II:

Site plan, Orientation of a building, Open space requirements, Position of doorsand windows, Size of rooms; Preparation of a scaled sketch of the plan of asingle storeyed residential building in a given site plan. Introduction to the various building area terms - Computation of plinth area/ built up area, Floor area / carpet area - for a simple single storeyed building; Setting out of a building.

UNIT-III

Surveying - Principles and objectives of surveying; Horizontal measurements – instruments used – tape, types of tapes; Ranging(direct ranging only) Theodolite and Total station-Principles

UNIT-IV:

Building materials

Bricks, cement blocks - Properties and specifications.

Cement – OPC, properties, grades; other types of cement and its uses (inbrief).

Cement mortar – constituents, preparation.

Concrete – PCC and RCC – grades.

Steel - Use of steel in building construction, types and market forms.

UNIT-V:

Building construction – Foundations; Bearing capacity of soil (definitiononly); Functions of foundations, Types - shallow and deep (sketches only).

Brick masonry – header and stretcher bond, English bonds – Elevation and plan (one brick thick walls only).

Roofs – functions, types, roofing materials (brief discussion only).

Floors – functions, types; flooring materials (brief discussion only).

Decorative finishes – Plastering – Purpose, procedure.

Paints and Painting – Purpose, types, preparation of surfaces for painting (brief discussion only).

Text Books:

- Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
- Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
- Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house
- Dr. K. R. Arora, "Surveying Volume-1", Standard book house, New Delhi, 13th Edition, 2012. 2. S. K.
- Duggal, "SurveyingVolume-2", Tata McGraw-Hill Education Private Limited, India,New Delhi, 3rd Edition, 2009.

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Course Outcomes:

At the end of this Course the student will be able to

- To learn the types of buildings and components of building.
- To get the knowledge of planning of single stored buildings.
- To understand Basic concepts of surveying and Basic uses of instruments in surveying.
- To know the materials used for the construction of Buildings.
- To get the knowledge about the construction methods of Buildings.

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

BASICS OF NON-CONVENTIONAL ENERGY SOURCES

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Identify various sources of Energy and the need of Renewable Energy Systems
- Understand the concepts of Solar Radiation, Wind energy and its applications
- Distinguish between solar thermal and solar PV systems
- Interpret the concept of geo thermal energy and its applications
- Understand the use of biomass energy and the concept of Ocean energy and fuel cells.

UNIT – I: Solar Energy **10 Hrs**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy thermal storage.

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about solar thermal parameters
- To distinguish between flat plate and concentrated solar collectors
- To know about thermal storage requirements
- To know about measurement of solar radiation

UNIT – II: PV Energy Systems **10 Hrs**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems..

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of PV effect in crystalline silicon and their characteristics
- Understand other PV technologies
- To know about electrical characteristics of PV cells & modules
- To know about grid connected PV systems

UNIT – III: Wind Energy **10 Hrs**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand basics of wind energy conversion and system
- To distinguish between VAWT and HAWT systems
- To understand about design considerations
- To know about site selection considerations of WECS

UNIT – IV: Geothermal Energy **10 Hrs**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India..

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Geothermal energy and its mechanism of production and its Applications
- Analyze the concept of producing Geothermal energies
- To learn about disadvantages and advantages of Geo Thermal Energy Systems
- To know about various applications of GTES

UNIT – V: Miscellaneous Energy Technologies **10 Hrs**

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the operation of tidal energy
- Analyze the operation of wave energy
- Analyze the operation of bio mass energy
- Understand the principle, working and performance of fuel cell technology
- Apply these technologies to generate power for usage at remote centres

Text Books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

Reference Books:

1. S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd,2008.
2. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

Course Outcomes:

At the end of this Course the student will be able to

- To distinguish between various alternate sources of energy for different suitable application requirements
- To differentiate between solar thermal and PV system energy generation strategies
- To understand about wind energy system
- To get exposed to the basics of Geo Thermal Energy Systems
- To know about various diversified energy scenarios of ocean, biomass and fuel cells

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME55a-3D PRINTING

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize of additive manufacturing / rapid prototyping and its applications in various fields.
- Impart reverse engineering techniques.
- Explain different processes available in additive manufacturing.
- Bring awareness on mechanical properties of materials and geometric issues related to additive manufacturing applications.

UNIT – I: Introduction to 3D PRINTING Systems: **10 Hrs**

History and Development of 3D printing, Need of 3D Printing, Difference between 3D Printing and CNC, Classification of 3D Printing Processes: Based on Layering Techniques, Raw Materials and Energy Sources, 3D Printing Process Chain, Benefits and Applications of 3D Printing, Representation of 3D model in STL format, RP data formats: SLC, CLI, RPI, LEAF, IGES, CT, STEP, HP/GL.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the applications for additive manufacturing processes. **L3**
- Explain the process of additive manufacturing. **L2**
- Represent a 3D model in STL format and other RP data formats to store and retrieve the geometric data of the object. **L3**

UNIT – II: CAD & Reverse Engineering: **8 Hrs**

Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation, Part Orientation and support generation, Model Slicing, Tool path Generation, Software's for Additive Manufacturing Technology: MIMICS, MAGICS. Reverse Engineering (RE) –Meaning, Use, RE – The Generic Process, Phase of RE Scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply various digitalization techniques. **L3**
- Explain the concept of reverse engineering and scanning tools. **L2**

UNIT – III: Solid and Liquid Based AM Systems: **8 Hrs**

Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications.

Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications.

Stereo lithography Apparatus (SLA): Principle, Process, Materials, Advantages, Limitations and Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of solid and liquid based AM systems. **L2**
- Identify the materials for solid and liquid based AM systems. **L3**

UNIT – IV: Powder Based AM Systems: **8 Hrs**

Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of powder based AM systems. **L2**
- Apply SLS, LENS and EBM 3D printing methods. **L3**

UNIT – V: Other Additive Manufacturing Systems: **8 Hrs**

Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain principles and limitation of 3D printing using BPM and SDM. **L2**
- Use BPM and SDM 3D printing methods. **L3**

Text Books:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e World Scientific Publishers, 2003.
3. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.
4. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate various additive manufacturing and rapid prototyping techniques applications. **L4**
- Describe different additive manufacturing processes. **L3**
- Apply methods in rapid prototyping. **L2**
- Use powder based AM system. **L3**
- Model 3D printing using SDM and BPM methods. **L6**

Online Learning Resources:

- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME55b-SMART MATERIALS

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Familiarize the smart materials and its role in developing intelligent systems.
- Introduce the students with HBLS and LBHS smart materials.
- Expose the students in smart systems development and uses.
- Understand the working principle of smart actuators and smart sensors.

UNIT – I: Introduction to Smart Materials: **10 Hrs**

Introduction to Smart Materials: What is Intelligence? Artificial intelligence Vs. embedded Intelligence, Definition of smart material, need for smart materials, classifications of smart systems, components of a smart systems, smart system applications, the role of Smart Materials in developing Intelligent Systems and Adaptive Structures.

Learning Outcomes:

At the end of this unit, the student will be able to
- Recall what intelligence is. **L1**
- Define smart materials. **L1**
- Describe the role of smart materials in development of intelligent systems and adaptive structures. **L2**
- Illustrate the applications of smart systems. **L2**

UNIT – II: High bandwidth - Low strain generating (HBLS) Smart Materials: **8 Hrs**

High bandwidth - Low strain generating (HBLS) Smart Materials:

Piezoelectric Materials – constitutive relationship, electromechanical coupling coefficients, piezoelectric constants, piezoceramic materials, variation of coupling coefficients in hard and soft piezoceramics, polycrystalline vs single crystal piezoelectric materials, polyvinyldene fluoride, piezoelectric composites.

Magnetostrictive Materials – constitutive relationship, magneto-mechanical coupling coefficients, Joule Effect, Villari Effect, Matteuci Effect, Wiedemann effect, Giant magnetostriction in Terfenol-D, Terfenol-D particulate composites, Galfenol and Metglas materials.

Learning Outcomes:

At the end of this unit, the student will be able to
- Describe the constitutive relationship of piezoelectric materials. **L2**
- Compare polycrystalline and single crystal piezeoelectric materials. **L2**
- Explain concepts of Joule effect, Villari effect, Matteuci effect, Wiedemann effect. **L2**
- Discus Galfenol and Metglas materials. **L6**

UNIT – III: Low bandwidth - High strain generating (LBHS) materials: **8 Hrs**

Low bandwidth - High strain generating (LBHS) materials: Shape Memory Alloys (SMA) – Introduction, Phenomenology, Influence of stress on characteristic temperatures, Modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators. Electro-active Polymers (EAP)- Introduction, Phenomenology, Influence of stress on characteristic temperatures.

Learning Outcomes:

At the end of this unit, the student will be able to
- List various types of LBHS smart materials. **L2**
- Identify the influence of stress on characteristic temperatures in SMA and EAP. **L3**
- Explain the concept of vibration control through shape memory alloys. **L2**
- Discus design considerations of shape memory alloy. **L6**

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UNIT – IV: Smart actuator: **8 Hrs**

Smart actuators:

Based on HBLS smart materials: Piezoelectric Actuators – Induced Strain actuation model, Unimorph and Bimorph Actuators, Actuators embedded in composite laminate, Impedance matching in actuator design, Feedback Control, Pulse Drive, Resonance Drive. Magnetostrictive Actuators – Magnetostrictive Mini Actuators, Thermal instabilities, Discretely distributed actuation, Manetostrictive Composites.

Based on LBHS Smart Materials - Shape Memory Alloy based actuators for Shape Control, Electro-active Polymers for Work-Volume Generation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall working principle of actuators. L1
- Explain impedance matching in actuator design, feedback control, pulse drive and resonance. L2
- Describe the working principle of Piezoelectric Actuators & Magnetostrictive Actuators. L2
- Discus the concepts of actuators based on HBLS and LBHS. L6

UNIT – V: Smart sensors: **8 Hrs**

Smart sensors:

Sensors based on HBLS Smart Materials - Piezoelectric Sensors, Magnetostrictive Sensors, Techniques of Self Sensing MEMS Sensors.

Sensors based on LBHS Smart Materials - EAP based sensors, SMA based encoders, Optical Fibre based Sensing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Select the type of sensor required for smart systems. L1
- Explain techniques of self sensing MEMS sensors. L2
- discus EPA based and SMA based sensors. L6
- Explain optical based sensing system. L2

Text Books:

1. M.V. Gandhi, B.D. Thompson" Smart Materials and Structures" Springer Science & Business Media, 31.
2. A.V. Srinivasan, Smart Structures; Analysis and Design, Cambridge University Press, Cambridge; New York, 2001
3. K.Uchino, Kluwer, Piezoelectric Actuators and ultrasonic Motors Academic Publishers, Boston, 1997.

Reference Books:

1. Brian Culshaw, Smart Structures and Materials, Artech House, Boston,2000.
2. Gauenzi, P., Smart Structures, Wiley, 2009.
3. Cady, W. G., Piezoelectricity, Dover Publication.
4. A.J. Moulson and J.M-Herbert, Electro ceramics: Materials, Properties/ / Wiley/ 2/e.

Course Outcomes:

At the end of this Course the student will be able to

- Describe the role of smart materials in development of intelligent systems and adaptive structures. L2
- Compare polycrystalline and single crystal piezoelectric materials. L2
- Identify the influence of stress on characteristic temperatures in SMA and EAP. L3
- Explain techniques of self sensing MEMS sensors. L2

Online Learning Resources:

- https://nptel.ac.in/courses/112104251
- http://wwwcourses.sens.buffalo.edu/mae538/LecNotes.html
- http://ssdl.iitd.ac.in/vssdl/smart.pdf
- https://www.stem.org.uk/resources/elibrary/resource/33044/smart-materials-1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC55a- FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Open Elective-I)

L – T – P – C
3 – 0 – 0 – 3

Course Objectives:

- To study the basic principle, construction and operation of semiconductor devices.
- To learn the real time applications of semiconductor devices.
- To introduce binary number systems, logic gates and digital logic circuits.
- To get an idea about the basic principles of communication systems and their applications.
- To learn the measurement of physical parameters using Sensors and Transducers.

UNIT I

Introduction to Electronics Engineering: Overview, scope and objective of studying Electronics Engineering. Introduction to semiconductor devices: Bond structure of semiconductors, intrinsic and extrinsic semiconductors; Basic principle and operation of semiconductor devices – diode, bipolar junction transistor, field effect transistors; Introduction to VLSI.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the basic principle, construction and operation of semiconductor devices.(L2)
- Learn about the diode, bipolar junction transistor and field effect transistors.(L1)

UNIT II

Applications of semiconductor devices: Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

Learning Outcomes:

At the end of the unit, the student will be able to:

- To learn the real time applications of semiconductor devices.(L1)
- To understand the basic concepts of operational amplifier and their applications.(L2)

UNIT III

Introduction to digital systems: Binary number system, Boolean algebra, Logic gates, adders, one-bit memory, flip-flops (SR, JK), shift registers, Asynchronous counter.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the binary number systems, Boolean algebra and working of logic gates.(L2)
- Know the working and applications of digital logic circuits.(L1)

UNIT IV

Introduction to Communication Systems: Elements of a communication system – transmitter and receiver; Signal types in communication; FDM and TDM; Processing of signals for transmission – basic concepts of amplitude and frequency modulation; Examples of telecommunication systems – telephone, radio, television, mobile communication and satellite communication.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Identify the basic elements of a communication system.(L2)
- Understand various examples of telecommunication systems.(L2)

UNIT V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the basic working principle and applications of different sensors and transducers.(L2)
- Measure physical parameters using different types of sensors and transducers.(L3)

TEXT BOOKS

1. Millman J, Halkias C.C andJit S, "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition.
2. Mano M.M., "Digital Design", Prentice-Hall, 3rd Edition. 2002
3. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation",DhanpatRai& Co. 3rd edition Delhi, 2010.
4. Kennedy G. and Davis B., "Electronic Communication Systems", Tata McGraw-Hill, 4th 2008 Edition.

REFERENCE BOOKS

1. Tomasi W., "Advanced Electronic Communication Systems", Pearson/Prentice-Hall, 6th 2004 Edition.
2. Boylstead R.L. andNashelsky L., "Electronic Devices and Circuit Theory", Pearson, 10th 2009 Edition.

Course outcomes:

At the end of this course, the students will be able to

- Understand the basic principle, construction and operation of semiconductor devices.(L2)
- Learn the real time applications of semiconductor devices.(L1)
- Comprehend the binary number systems, logic gates and digital logic circuits.(L1)
- Understand the basic principles of communication systems and their applications.(L2)
- Measure the physical parameters using Sensors and Transducers.(L3)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC55b- TRANSDUCERS AND SENSORS

(Open Elective-I)

L – T – P – C
3 – 0 – 0 – 3

Course Objectives:

- To study about the characteristics of instrumentation system and transducers.
- To know the operation of different types of Temperature Transducers.
- To learn the operation of different types of Flow Transducers.
- To understand the working and operation of different types of Pressure Transducers.
- To gain the knowledge on working of Force and Sound Transducers.

UNIT I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Learn the characteristics of instrumentation system and transducers.(L1)
- Measure motion using different motion transducers.(L3)

UNIT II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the working principle of temperature transducers.(L2)
- Study about different types of bio sensors and smart sensors.(L1)

UNIT III

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the Bernoulli's principle and continuity.(L2)
- Learn how to measure flow using different types of flow meters.(L1)

UNIT IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Work with different types of manometers.(L3)
- Use different types of pressure transducersto measure pressure.(L3)

UNIT V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Learn how to measure force using force transducers.(L1)
- Understand the working and operation of sound transducers.(L2)

TEXT BOOKS

1. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", DhanpatRai& Co. 3[rd] edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, "Instrumentation Devices and Systems", TATA McGraw Hill publications. 2007.

REFERENCE BOOKS

1. Doebelin. E.O, "Measurement Systems Application and Design", McGraw Hill International, New York, 2004.
2. Nakra B.CandChaudharyK.K , "Instrumentation Measurement and Analysis", Second Edition, Tata McGraw-Hill Publication Ltd.2006.

Course outcomes:

At the end of this course, the students will be able to

- Understand the characteristics of instrumentation system and transducers.(L2)
- Know the operation of different types of Temperature Transducers.(L1)
- Compare the operation of different types of Flow Transducers.(L2)
- Correlate the working and operation of different types of Pressure Transducers.(L4)
- Gain the knowledge on working of Force and Sound Transducers.(L1)

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS55A- Fundamentals of Internet of Things

(Open Elective-I)

L	T	P	C
3	0	0	3

Course objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I : Fundamentals of IoT

Introduction – Characteristics-Physical Design – IoT Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.

Learning Outcome:

At the end of this unit, students will able to

- Describe the IoT devices physical design and able to design IoT devices in various levels of IoT L1
- Explain the technologies enabling related to industry. L2

UNIT II: IOT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP, NETOPEER.

Learning Outcome:

At the end of this unit, students will able to

- Describe the Software defined networks and Network function virtualization with respect to the IoT systems. L2
- Explain the NETCONF protocol with YANG modeling language. L2

UNIT III: IoT Design Methodology

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

Learning Outcome:

At the end of this unit, students will able to

- Describe the IoT devices complete design methodology with all specifications. L2
- Explain the system Integration and application development and deployment.L3 L3

UNIT IV: Sensors and Connectivity

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols

Learning Outcome:

At the end of this unit, students will able to

- Describe various sensors usage with respect to the IoT systems and differentiation between IP address and MAC address L3
- Explain the benefits of application layer protocols. L4

UNIT V: IOT Industry Applications

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Learning Outcome:

At the end of this unit, students will able to

- Describe the industry oriented IoT devices and its applications. L4

TEXT BOOKS:

2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

4. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
5. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
6. *Simon Monk, "Programming the Raspberry Pi: Getting Started with Python",* McGraw-Hill, *2013.*
7. CharalamposDoukas,"Building Internet of Things With the Arduino", Second Edition, 2012.
8. Dr.John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.

Course Outcomes:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models. L2
- Appraise the role of IoT protocols for efficient network communication. L3
- Illustrate different sensor technologies for sensing real world entities and identify the

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS55B-E-Marketing
(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
I. Understand the legal and ethical issues in e-marketing.

II. Analyze online marketing and supply chain management.

III. Provides extensive theoretical and practical knowledge of online marketing.

IV. Develop marketing skills required for a continuously growing international business environment.

UNIT – I: E-BUSINESS OVERVIEW :
Traditional commerce vs. e-commerce, e-commerce and e-business categories of e-commerce development and growth of e-commerce advantages and disadvantages of e-commerce international nature of e-commerce..

Learning Outcomes:
At the end of this unit, the student will be able to
To realize basics of E-Marketing. **L1**

To introduce different E-Business Models . **L2**

UNIT – II: E-BUSINESS INFRASTRUCTURE :

E Commerce architectural framework, the internet and www-internet protocols, internet, intranet and extranets, internet connection options, security issues in e commerce environment, encryption techniques payment systems types of payments legal, ethical and tax issues in e-commerce.

Learning Outcomes:
At the end of this unit, the student will be able to
To understand the E-Marketing Plan. **L2**

To know about Online Expression . **L3**

UNIT – III: ONLINE MARKETING AND SUPPLY CHAIN MANAGEMENT
Online marketing, business models of e marketing, online advertisement, advertisement methods and strategies online retailing e-auctions.Supply chain management-procurement process and the supply chain types of procurement, multi-tier supply chains and trends in supply chain management.

Learning Outcomes:
At the end of this unit, the student will be able to
To know about the Data Drive Strategy . **L6**

Gain knowledge on Consumer Behavior Online **L3**

UNIT – IV: ONLINE SERVICES :

Online financial services, online banking and brokerage, online insurance services, online real estate services, travel services online, hospitality services online, recruitment services online, publishing services online entertainment, e-learning.

Learning Outcomes:

At the end of this unit, the student will be able to

To know about Pricing Strategies L4

To know about Channel Management and Power. L6

UNIT – V: MOBILE COMMERCE :

Definition of mobile commerce, mobile commerce framework, growth of mobile commerce benefits and limitations of mobile commerce mobile network infrastructure, information distribution for mobile networks multimedia content, publishing, mobile payment models, mobile commerce applications.

Learning Outcomes:

At the end of this unit, the student will be able to

To know how Browsing Behavior Model L4

To know about Ten rules for CRM Success. L2

Text Books:

1. Gary P. Schneider, "Ecommerce-Strategy, Technology and Implementation", Cengage Learning, India Edition

2. Kenneth C. Laudon, Carol GuercioTraver, "E-commerce–Business", Technology, Pearson, Low Price Edition.

3. Bharat Bhasker, "Electronic Commerce Framework, Technologies and Applications", 3rdn Edition.Tata McGraw, Hill.

Reference Books:

1. Efraim Turban, Tae Lee, David King and H. Micheal Chung, "Electronic Commerce, Managerial Perspective", Pearson Education Asia.

2. CSV Murthy, "E-commerce-Concepts, Models and Strategies", HPH.

3. . J. Christopher Westland and Theodore H K Clark, "Global Electronic Commerce ,Theory and Case Studies", Oxford Universities Press.

Course Outcomes:

At the end of this Course the student will be able to

- Analyse the confluence of marketing, operations, and human resources in real-time delivery. L3
- Explain emerging trends in digital marketing and critically assess the use of digital marketing tools by applying relevant marketing theories and frameworks. L3
- Investigate and evaluate issues in adapting to globalised markets that are constantly changing and increasingly networked. L5
- Investigate and evaluate issues in adapting to globalised markets that are constantly changing and increasingly networked. L2
- Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets, as well as in identifying, assessing and selecting digital market opportunities. L3

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20ACS55C-Computer Architecture and Organization

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart basic concepts of computer architecture and organization.
- To explain key skills of constructing cost-effective computer systems.
- To familiarize the basic CPU organization.
- To help students in understanding various memory devices.

UNIT – I: STRUCTURE OF COMPUTERS:

Computer types, Functional units, Basic operational concepts, VonNeumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes.

COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.

Learning Outcomes:

At the end of this unit, the student will be able to

To realize basics of computer structure. **L1**

To know about the arithmetic operations. **L2**

UNIT – II: BASIC COMPUTER ORGANIZATION AND DESIGN:

Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC.

Learning Outcomes:

At the end of this unit, the student will be able to

To understand the organization of computer. **L2**

To know about design of the computer. **L3**

UNIT – III:REGISTER TRANSFER AND MICRO-OPERATIONS

REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit.

MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

Learning Outcomes:
At the end of this unit, the student will be able to

- To know about the registers and its operations. **L6**
- Gain knowledge on Micro operations. **L3**

UNIT – IV:MEMORY SYSTEM

MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.

Learning Outcomes:
At the end of this unit, the student will be able to

- To know about Semiconductor Memories **L4**
- To know about the Cache Memory **L6**

UNIT – V: INPUT OUTPUT

INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA.
MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.

Learning Outcomes:
At the end of this unit, the student will be able to

- To know about the Input/Output operations **L4**
- To know about the multiprocessors. **L2**

Text Books:

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.

Reference Books:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.

2.William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy

3.Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,

4.John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

Course Outcomes:

At the end of this Course the student will be able to

- Identify various components of computer and their interconnection. L3
- Identify basic components and design of the CPU: the ALU and control unit. L3
- Compare and select various Memory devices as per requirement. L5
- Compare various types of IO mapping techniques. L2
- Critique the performance issues of cache memory and virtual memory. L3

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME61-INTRODUCTION TO CAD/CAM

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.
- Explain the principles robotics, CIM, AR,VR and AI in CIM

UNIT – I: Introduction to CAD/CAM: **10 Hrs**

CAD/CAM: Introduction, hardware and software, I/O devices, benefits. graphics standards-Neutral file formats – IGES, STEP.

2D and 3D geometric transformations: Translation, scaling, rotation, mirroring, homogenous transformations, concatenation of transformations.

Learning Outcomes:

At the end of this unit, the student will be able to
- list various input and output devices L1
- apply geometric transformations in 2D and 3D L3
- apply window to viewport transformation L3

UNIT – II: Geometric Modelling **8 Hrs**

Parametric representation: Representation of curves, Hermite curves, Spline, Bezier and B-spline curves in two dimensions; Geometric modelling of surfaces: Surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, sweep surfaces, surface of revolution, blending of surfaces;

Geometric Modelling of Solids: Wireframe, surface modelling, solid entities, boolean operations, CSG approach and B-rep of solid modelling, geometric modelling of surfaces.

Learning Outcomes:

At the end of this unit, the student will be able to
- Apply the concepts of parametric representation to curves and surfaces. L3
- create surfaces such as Coons, Bezier and B-spline L6
- Differentiate wireframe, surface and solid modeling. L4
- Apply the solid modeling concepts. L3

UNIT – III: Computer Aided Manufacturing (CAM): **8 Hrs**

Computer Aided Manufacturing (CAM): Structure of numerical control (NC) machine tools, designation of axes, drives and actuation systems, feedback devices, computer numerical control (CNC) and direct numerical control (DNC), adaptive control system, CNC tooling, automatic tool changers and work holding devices, functions of CNC and DNC systems.

Learning Outcomes:

At the end of this unit, the student will be able to
- Identify the differences between NC, CNC and DNC. L3
- Use devices and activation systems. L3
- Apply adaptive control system. L3
- Apply different tooling and tool chargers, working holding devices. L3

UNIT – IV: Part Programming and APT Programming **8 Hrs**

Part Programming: Part programming instruction formats, information codes, preparatory functions, miscellaneous functions (G-codes, M-codes). Tool codes and tool length offset, interpolation, canned cycles, typical examples in turning, milling and drilling operation).

APT Programming: APT language structure, APT geometry, Definition of point, line, circle, plane.

APT Motion Commands: set-up commands, pint to point motion commands; continuous path motion commands part programming preparation for typical examples (turning, milling and drilling operation).

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the fundamentals of part programming in CNC. **L3**
- Use G codes, M codes in CNC part programs. **L3**
- Apply the concept of canned or fixed cycles for the hole making operations. **L4**
- Identify geometric features in APT language. **L2**
- Apply motion commands in APT to generate surfaces. **L3**

UNIT – V: Automation **8 Hrs**

Automation: Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages. Computer integrated manufacturing (CIM): Elements of CIM, Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI) and expert systems in CIM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize the fundamentals of robotics. **L2**
- Categorize the CIM environment and its elements. **L4**
- Explain the role VR, AR and AI in manufacturing engineering. **L3**

Text Books:

1. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Tien Chien Chang, Computer Aided Manufacturing, 3/e, Pearson, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the basics of geometric representation and transformations in CAD/CAM. **L3**
- Choose geometric modeling methods for building CAD models. **L1**
- Compare NC, CNC and DNC. **L2**
- Develop manual and computer aided part programming for turning and milling operations. **L3**
- Summarize the principles of robotics AR,VR and AI in CIM. **L2**

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_me44/preview
- https://www.youtube.com/watch?v=EgKc9L7cbKc
- https://www.youtube.com/watch?v=KXFpTb9cBpY
- https://web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1530947994.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_LECTURE_NOTES.pdf

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME62-AUTOMATION AND ROBOTICS

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems.
- Illustrate adaptive control systems and automated inspection methods.
- Define the fundamental concepts of industrial robotics.
- Apply basic mathematics to calculate the robot kinematic and dynamic mechanics
- Understand the robot programming methods and software packages.

UNIT – I: Introduction to automation **10 Hrs**

Introduction: Automation in production system, need, types, Principles and Strategies of automation, levels of automation, basic elements of an automated system, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Automated flow lines and transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define the automation in production system. **L1**
- Describing the concept of automated flow lines. **L2**
- Classify the types of hardware components of automation and control system. **L3**
- Compare various types of part transfer mechanisms. **L4**

UNIT – II: Assembly Line Balancing and Automated Manufacturing System **8 Hrs**

Assembly Line Balancing: Assembly process and systems assembly line, line balancing algorithms, ways of improving line balance, flexible assembly lines.

Material handling and Identification Technologies: Overview of automatic material handling systems, principles and design consideration, material transport systems, storage systems, overview of automatic identification methods.

Automated Manufacturing Systems: Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describing the concept of assembly line balancing. **L2**
- Identify the components of automated manufacturing system. **L1**
- Understand the concept of GT, FMS, cellular manufacturing and material handling system. **L1**
- Classify the types of automated manufacturing system. **L2**
- Design a simple material handling system for low cost manufacturing. **L6**

UNIT – III: Introduction to Robotics **8 Hrs**

Introduction: Brief history of robots, classification of robot, functional line diagram, degrees of freedom. Elements of robot - types and its functions, factors to be considered in the design of grippers.

Robot Actuators And Feedback Components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design a simple gripper for robot. **L6**
- Compare the types of actuators used in robot manipulator. **L4**

- List out the various types of robots and feedback components. **L1**
- Define the degree of freedom for robot. **L1**

UNIT – IV: Kinematics and Dynamics of a Manipulator **8 Hrs**

Manipulator Kinematics: Homogenous transformations as applicable to translation, rotations- D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobian, Lagrange - Euler and Newton - Euler formulation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate D-H notations for simple robot manipulator. **L4**
- Identify the path and position of robot gripper within work volume. **L1**
- Use the Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipulator dynamic problems. **L6**
- Explain the concepts of manipulator kinematics and dynamics. **L3**

UNIT – V: Robot Programming and Applications : **8 Hrs**

Robot Programming: Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion, joint integrated motion, straight line motion; avoidance of obstacles.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading; Process - spot and continuous arc welding & spray painting; Assembly and Inspection.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the requirements and features of robot programming **L1**
- Demonstrate the various applications of robots in manufacturing. **L6**
- List the various methods of robot programming. **L1**
- Use various software packages to write the robot programming. **L4**

Text Books:

1. Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing- Pearson Education.5/e, 2009.
2. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey , Industrial Robotics — Mc Graw Hill, 1986.

Reference Books:

1. S. R. Deb & Sankha Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill Education.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
4. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

At the end of this Course the student will be able to

- Classify the types of hardware components of automation and control system. **L3**
- Design a simple material handling system for low cost manufacturing. **L6**
- Design a simple gripper for robot. **L6**
- Compare the types of actuators used in robot manipulator. **L4**
- Understand the requirements and features of robot programming. **L1**
- Demonstrate the various applications of robots in manufacturing. **L6**

Online Learning Resources:

- https://www.digimat.in/nptel/courses/video/112104288/L01.html
- https://www.edx.org/learn/robotics
- https://www.youtube.com/watch?v=xrwz9IxpMJg
- https://nptel.ac.in/courses/112101098
- https://onlinecourses.nptel.ac.in/noc20_de11/preview

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME63-HEAT TRANSFER

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator, and condenser.

UNIT – I: Conduction **10 Hrs**

Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat transfer- conduction - solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer - Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the phenomenon related to different modes of heat transfer L1
- Compare different types of conduction heat transfer L3
- Apply concept of thermal resistance and its importance in practical problems L2

UNIT – II: Convection **12 Hrs**

Convection: Basic concepts of convection–heat transfer coefficients - types of convection –forced convection and free convection.

Free Convection -development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation

Forced convection in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the convective heat transfer principles L3
- Use analogy between fluid friction and heat transfer to solve engineering problems. L3

UNIT – III: Radiation **10 Hrs**

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the principles of radiation heat transfer L3
- Calculate the radiation heat transfer between two bodies L2
- Design a radiation shield for given conditions L3
- Examine the effect of greenhouse gases on atmosphere L4

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UNIT – IV: Heat Exchangers **8 Hrs**

Heat Exchangers: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the working of different types of heat exchangers **L2**
- Calculate the heat transfer in heat exchangers **L2**
- Design a heat exchanger for a given application **L3**

UNIT – V: Boiling, Condensation and Mass transfer: **8 Hrs**

Boiling and Condensation: Different regimes of boiling- nucleate, transition and film boiling – condensation - filmwise and dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Learning Outcomes:

At the end of this unit, the student will be able to

- Interpret the basic modes of condensation heat transfer **L2**
- Identify different regimes of boiling in design of boilers **L3**
- Explain the basic mechanism of mass transfer **L2**
- Differentiate between mass transfer due to convection and diffusion **L4**

Text Books:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
3. S. C. Arora & S. Domkundwar , A Course in Heat and Mass Transfer, Dhanpat Rai & CO.(P) LTD-Delhi , 2007.

Reference Books:

1. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the concepts of different modes of heat transfer. **L3**
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes. **L3**
- Analyze free and forced convection phenomena in external and internal flows. **L4**
- Design of thermal shields using the concepts of black body and non-black body radiation. **L5**
- Apply the basics of mass transfer for applications in diffusion of gases. **L3**

Online Learning Resources:

- https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heat-transfer-fall-2015/
- https://www.udemy.com/topic/heat-transfer/
- https://www.youtube.com/watch?v=TWTQx3W-2k8
- https://onlinecourses.nptel.ac.in/noc20_ch21/preview
- https://ekeeda.com/degree-courses/mechanical-engineering/heat-transfer
- https://www.coursera.org/lecture/thermodynamics-intro/02-04-heat-transfer-gyDfJ
- https://www.youtube.com/watch?v=cjJ2LV5lkB8

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

MANAGEMENT SCIENCE

(Common to all Branches)

L	T	P	C
3	0	0	3

Course Objectives:

- Understand the role of entrepreneurship in economic development.
- Identify the general characteristics of entrepreneurs.

UNIT – 1

INTRODUCTION TO MANAGEMENT

Concepts of Management - Nature, importance and Functions of Management - Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Leadership Styles, Social responsibilities of Management.

DESIGNING ORGANIZATIONAL STRUCTURES

Basic concepts related to Organisation - Departmentation and Decentralization, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, team structure) their merits, demerits and suitability.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the concept of management and organization.	L1
• Apply the concepts & principles of management in real life industry.	L2

UNIT – II

OPERATIONS MANAGEMENT:

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study. Statistical Quality Control: *c* chart, *p* chart, (simple Problems) Deming's contribution to quality.

MATERIALS MANAGEMENT: EOQ, Purchase Procedure and Stores Management.
Inventory — functions. Types, inventory classification techniques.

Marketing: Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the core concepts of Management Science and Operations Management.	L1
• Evaluate Materials departments & Determine EOQ.	L2

UNIT – III

HUMAN RESOURCES MANAGEMENT (HRM):

Concepts of HRM, Personnel Management and Industrial Relations (PMIR), Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation, Merit Rating and methods.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the concepts of HRM in Recruitment, Selection, Training & Development.	L1

• Apply Managerial and operative Functions.	L2

UNIT – IV

STRATEGIC MANAGEMENT:

Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

PROJECT MANAGEMENT (PERT/CPM):

Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand Mission, Objectives, Goals & strategies for an enterprise.	L1
• Evaluate PERT and CPM Techniques.	L2

UNIT – V

CONTEMPORARY MANAGEMENT PRACTICES:

Basic concepts of MIS, Materials Requirement Planning (MRP), Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma concept, Supply Chain Management, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

Learning Outcomes:

At the end of this unit, the student will be able to

• Analyze CRM, MRP, TQM.	L1
• Understand modern management techniques.	L2

Text Books:

1. **Management Science**,Aryasri: TMH, 2004.
2. **Management** ,Stoner, Freeman, Gilbert, 6th Ed, Pearson Education,New Delhi, 2004.

Reference Books:

1. **Marketing Mangement** , Kotler Philip & Keller Kevin Lane: 12/e, PHI,2005.
2. **Essentials of Management** ,Koontz & Weihrich:, 6/e, TMH, 2005.
3. **Management—Principles and Guidelines,** Thomas N.Duening & John M.Biztantra, 2003.
4. **Production and Operations Management**, Kanishka Bedi, , Oxford University Press, 2004.

Course Outcomes:

At the end of this Course the student will be able to

• Equipping engineers for a lifelong career addressing the critical technical and managerial needs of private and public organizations.	L1
• Exploring and developing analytic abilities, making better decisions, developing and executing strategies while also leading people who innovate.	L2
• Cultivating the technical skills as well as the behavioral challenges of running organizations and complex systems.	L3
• Emphasizing quantitative analytic skills and an entrepreneurial spirit	L4
• Have an introductory understanding of global entrepreneurship concepts.	L5

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

BUSINESS ENVIRONMENT
(Common to all Branches)

L	T	P	C
3	0	0	3

Course Objectives:

- To make the student understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.

UNIT – 1: BUSINESS ENVIRONMENT

Meaning – Various environments affecting business – Social Economic; Political and Legal; Culture; Competitive Demographic; Technological and International environments.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the concept of Business environment.	L1
• Explain various types of business environment.	L2

UNIT – II: FISCAL & MONETARY POLICY

FISCAL POLICY - Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - **MONETARY POLICY** - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the concept of public revenue and public Expenditure	L1
• Explain the functions of RBI and its role.	L2

UNIT – III: TRADE POLICY

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - **BALANCE OF PAYMENTS** – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the role of Indian international trade.	L1
• Analyze causes for Disequilibrium and correction measure.	L2

UNIT – IV: WORLD TRADE ORGANIZATION

WORLD TRADE ORGANIZATION - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the Dispute Settlement Mechanism.	L1
• Compare and contrast the Dumping and Anti-dumping Measures.	L2

UNIT – V: MARKETS

MONEY MARKETS AND CAPITAL MARKETS - Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply the knowledge in future investments.	**L1**
• Understand the role of SEBI in investor protection.	**L2**

Text Books:

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hallof India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition.HPH2016.

Reference Books:

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases,Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Course Outcomes:

At the end of this Course the student will be able to

• Apply the knowledge of Money markets in future investment.	**L1**
• Analyze India's Trade Policy.	**L2**
• Evaluate fiscal and monitory policy.	**L3**
• Develop a personal synthesis and approach for identifying business opportunities.	**L4**
• `Understand various types of business environment.	**L5**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME66-COMPUTER AIDED DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- To validate a Finite Element model using a range of techniques.
- To communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.
- To discuss the accuracy of the Finite Element solutions.

List of Experiments

Finite Element Analysis using Simulation package for different structures. The discretization can be done with 1-D, 2-D & 3-D elements to perform the following analysis for post processing:

1. **Static Analysis**
   a. Stress analysis of 2D truss.
   b. Stress analysis of a plate with a circular hole and L-Bracket – 2D and 3D.
   c. Stress analysis of beams (cantilever, simply supported & fixed ends).
   d. Stress analysis of an axi-symmetric component.
   e. Torsion based Problem.
2. **Thermal Analysis**
   a. Conductive heat transfer analysis of a 2D and 3D components
   b. Conduction and Convective heat transfer analysis of a 2D component
   c. Heat transfer rate of a composite wall
   d. Coupled field analysis of a component
3. **Modal Analysis**
   a. Mode frequency analysis of a 2D component
   b. Mode frequency analysis of beams (cantilever, simply supported)

Note: Students should practice the above problems with combinations of ANSYS, Octave, Scilab, MATLAB/ Mathematica, MAPLE/COMSOLetc. based on the available software's of either licensed or freeware. Staff can make use of Freeware in solving the FEA Problems with different combination of simulation packages.

References:

1. Nitin S Gokhale and Sanjay Deshpande, Practical Finite Element Analysis, Finite to Infinite Publishers, 1/e, 2008.
2. Joe Stefanelli, Finite Element Analysis in Practice-Instructor Manual, Auto-desk, 2010.
3. J.M. Ferreira, MATLAB codes for Finite Element Method", Springer Publications, 2020.
4. Heinrich, Juan C., Pepper, Darrell W, The finite element method: basic concepts and applications with MATLAB, MAPLE, and COMSOL:, CRC Press, 3/e, 2017.

Course Outcomes:

At the end of this Course the student will be able to

- Ability to solve engineering problems using the commercial software's such as ANSYS, SIMUFACT, ABAQUS, SIMULIA, Mathematica, MAT LAB, GNU Octave, Scilab, MAPLE/ COMSOL. **L6**

Online Learning Resources/Virtual Labs:

- https://www.youtube.com/watch?v=1gamqpyZjTg
- https://www.youtube.com/watch?v=4c-sPXolD0w
- https://www.youtube.com/watch?v=XSYRnEfPMqA
- https://au.mathworks.com/discovery/finite-element-analysis.html
- https://w3.pppl.gov/m3d/reference/fsem_intro.pdf
- https://www.youtube.com/watch?v=WXKUCky9CtA&list=PL3YYYtsmbXgdRoY27y3ZEjF5qE7YYeX_I
- https://www.youtube.com/watch?v=n3FDQqrRJqA
- https://www.youtube.com/watch?v=oHYVzAih_VM

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME67-COMPUTER AIDED MANUFACTURING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- To get practical knowledge on manual part programming of CNC lathe machine by using G codes and M codes.
- To get practical knowledge on manual part programming of CNC milling and drilling machine by using G codes and M codes.
- To get the practical knowledge on APT language.
- To get practical application of Industrial Robots

List of Experiments

1. Manual part programming (using G and M codes) in CNC Lathe Machine:
   - **a.** Part programming for linear interpolation, circular interpolation, chamfering and grooving.
   - **b.** Part programming by using standard Canned cycles for facing, turning, taper turning and thread cutting, Chess Bishop profile
   - **c.** Multiple turning operations which cover all lathe operations covering maximum G codes and M codes
2. Manual part programming (using G and M codes) in CNC Milling Machine:
   - **a.** Part programming for linear interpolation, circular interpolation and contour motions.
   - **b.** Part programming involving Canned cycles for drilling, Peck drilling and boring and pocketing & Mirroring.
   - **c.** Part programming for Gear cutting profile.
3. APT (Automatically Programmed Tools) Language-Cutting tool path generation by using any CAM simulation package / Experiment for different machining operations.
   - **a.** APT Lathe Programming's – 2 Experiments
   - **b.** APT Milling Programming's - 2 Experiments
4. Robotics: By using 5 or 6 – Axis robot
   - **a.** Pick and Place with palletizing/ de-palletizing of components
   - **b.** Nut, Bolt and Washer Assembly with robot.

References:

1. P Radhakrishnan, Computer Numerical Control (CNC) Machines, New Central Book agency, 2013.
2. S.R.DEB, Robotics Technology and Flexible Automation, McGraw Hill Education, 2017.
3. CHAO- HWA CHANG and MICHEL. A. MELKANOFF, NC Machine Programming and software Design, Prentice Hall Publishers, 1989.

Course Outcomes:

At the end of this Course the student will be able to

- Use and understanding of Preparatory and Miscellaneous (G& M) codes to generate or edit a program which will operate a CNC Lathe/ Milling and Drilling. **L3**
- Apply mathematical methods to calculate World/ Joint/ Tool coordinates in robotics. **L6**
- Apply the programming concepts of Robots for simple applications in material handling and assembly **L6**

Online Learning Resources/Virtual Labs:

- https://www.youtube.com/watch?v=NCEHRvFQqMo
- https://www.youtube.com/watch?v=Gwy_Vh46fCM
- https://www.youtube.com/watch?v=0sxLwytzT2Y
- https://www.youtube.com/watch?v=rgZT3RtfUqA
- https://www.youtube.com/watch?v=osqX7iQEnul
- https://www.youtube.com/watch?v=-F0i1LDk2XI
- https://www.youtube.com/watch?v=i-PgeWbDgq4
- https://www.youtube.com/watch?v=sJm1Nyb-AkE
- https://www.youtube.com/watch?v=UxO0xqvvGcM
- https://www.youtube.com/watch?v=Ic-iKGSc7dk

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME68-HEAT TRANSFER LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives: The objectives of the course are to make the students learn about

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

List of Experiments

1. Determine the overall heat transfer coefficient across the width of composite wall.
2. Determine the thermal conductivity of a metal rod.
3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus.
4. Determine the thermal conductivity of insulating material through lagged pipe apparatus.
5. Determine the efficiency of a pin fin in natural and forced convection.
6. Determine the heat transfer coefficient for a vertical cylinder in natural convection.
7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9. Determine the effectiveness of a parallel and counter flow heat exchanger.
10. Study the pool boiling phenomenon and different regimes of pool boiling.
11. Experiment on pool boiling.
12. Determine the emissivity of the test plate surface.
13. Experiment on Stefan-Boltzmann apparatus.
14. Determine the heat transfer rate coefficient in fluidized bed apparatus.

Virtual Lab:

1. Determination of thermal conductivity of a metal rod
   https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/determination-of-thermal-conductivity-of-a-metal-rod
2. Natural Convection heat transfer
   https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/natural-convection
3. Heat Transfer by Radiation
   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1
4. Heat transfer by Conduction
   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=1
5. The Study of phase change
   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&cnt=1
6. Black Body Radiation: Determination of Stefan's Constant
   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=548&cnt=1

References:

1. Abdul Matheen, Heat Transfer Laboratory Manual, Laxmi Publications; 2/e, 2007.

Course Outcomes:

At the end of this Course the student will be able to

- Explain different modes of heat transfer **L2**
- Identify parameters for measurement for calculating heat transfer **L5**
- Determine effectiveness of heat exchanger **L4**
- Design new equipment related to heat transfer **L5**
- Apply principles of heat transfer in wide application in industries. **L6**

Online Learning Resources/Virtual Labs:

- https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab
- https://www.iare.ac.in/sites/default/files/lab1/IARE_HT_LAB_MANUAL.pdf
- https://mrcet.com/downloads/digital_notes/ME/III%20year/(R18A0388)Heat%20Transfer%20Lab.pdf
- https://mrcet.com/downloads/ME/Mech%20III-II.pdf

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME60-3D PRINTING PRACTICE

(Skill Oriented Course-IV)

L	T	P	C
1	0	2	2

Course Objectives:

Students undergoing this course would

- Understand different methods of 3D Printing.
- Gain knowledge about simulation of FDM process
- Estimate time and material required for manufacturing a 3D component

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Explain different types of 3d Printing techniques
- Identify parameters for powder binding and jetting process
- Determine effective use of ABS material for 3D Printing
- Apply principles of mathematics to evaluate the volume of material require.

Module 1:

Introduction to Prototyping, Working of 3D Printer, Types of 3D printing Machines:

Exp 1: Modelling of Engineering component and conversion of STL format.

Exp 2: Slicing of STL file and study of effect of process parameter like layer thickness, orientation, and infill on build time using software.

Exercise 1 : Component-1

Exercise 2 : Component-2

Module 2:

Exp 1 : 3D Printing of modelled component by varying layer thickness.

Exp 2 : 3D Printing of modelled component by varying orientation.

Exp 3: 3D Printing of modelled component by varying infill.

Module 3:

Study on effect of different materials like ABS, PLA, Resin etc, and dimensional accuracy.

Module 4:

Identifying the defects in 3D Printed components.

Module 5

Exp1: Modelling of component using 3D Scanner of real life object of unknown dimension in reverse engineering.

Exp 2: 3D Printing of above modelled component.

References:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.

Online Learning Resources/Virtual Labs:

- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

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L	T	P	C
3	0	0	0

Constitution of India

Course Objectives:

1. To enable the student to understand the importance of constitution.
2. To understand philosophy of fundamental rights and duties.
3. To understand the structure of executive, legislature and judiciary.
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the concept of Indian constitution.
2. Apply the knowledge on directive principle of state policy.
3. Analyze the History, features of Indian constitution.
4. Evaluate Preamble Fundamental Rights and Duties.

UNIT-II

Democratic forms of Constitution, Union Government and its Administration Structure of the Indian Union: Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the structure of Indian government.
2. Differentiate between the state and central government.
3. Explain the role of President and Prime Minister.
4. Know the Structure of supreme court and High court.

UNIT-III

Federalism, Political relations, Financial relations of State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the structure of state government.
2. Analyze the role Governor and Chief Minister.
3. Explain the role of state Secretariat.
4. Differentiate between structure and functions of state secrateriate.

UNIT-IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

Learning Outcomes:

At the end of this unit students will be able to:

1. Understand the local Administration.
2. Compare and contrast district administration role and importance.
3. Analyze the role of Myer and elected representatives of Municipalities.
4. Evaluate Zilla panchayat block level Organisation.

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate , State Election Commission, Supreme Court, High Court.

Learning Outcomes:

At the end of this unit students will be able to:

1. Know the role of Election Commission apply knowledge.
2. Contrast and compare the role of Chief Election commissioner and Commissiononerate.
3. Analyze role of state election commission.
4. Evaluate various commissions of viz SC/ST/OBC and women.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government & Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication.
6. J.C. Johari, Indian Government and Politics Hans.

Course Outcomes:

1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
3. Understand the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

6. Know the sources, features and principles of Indian Constitution.
7. Learn about Union Government, State government and its administration.
8. Get acquainted with Local administration and Pachayati Raj.
9. Be aware of basic concepts and developments of Human Rights.
10. Gain knowledge on roles and functioning of Election Commission.

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME71c-TOTAL QUALITY MANAGEMENT

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about
- Introduce the students, the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of customer satisfaction by the application of various quality concepts.
- Understand the importance of Quality standards in Production

UNIT – I: Introduction **10 Hrs**

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Types and Techniques for Quality costs, Basic concepts of Total Quality Management.

Learning Outcomes:

At the end of this unit, the student will be able to
- Define what is quality. **L2**
- Explain the principles of Quality Planning. **L2**
- Explain the techniques of quality costs. **L2**
- Interpret the concepts of Total Quality Management. **L4**
- Contrast the present quality issues with the past. **L2**

UNIT – II: Historical Review: **8 Hrs**

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain the importance of Quality council. **L2**
- Identify the barriers of TQM Implementation. **L3**
- Discuss the benefits of TQM. **L6**
- Summarize the essential characteristics of successful quality leader. **L2**
- Outline the contributions of TQM Gurus. **L2**

UNIT – III: TQM Principles: **8 Hrs**

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain the importance of customer satisfaction, Service Quality and Customer Retention. **L2**
- Apply the principles of motivation and Empowerment. **L3**
- Compare the perfection and continuous improvement. **L2**
- Measure the Process improvement using Juran Trilogy. **L5**
- Demonstrate the concepts of performance measures using a case study. **L2**

UNIT – IV: TQM Tools: **8 Hrs**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Infer the benefits of benchmarking. **L2**
- List the benefits of QFD Process. **L1**
- Identify various zones in House of Quality. **L3**
- Apply Six sigma towards quality improvement. **L3**
- List the seven tools of quality. **L1**

UNIT – V: Quality Systems: **8 Hrs**

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

IATF (International Automotive task force)16949:2016 quality systems. ISO 9001:2015 quality system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of ISO Standards. **L2**
- Discuss the need of ISO9000 and Other Quality systems. **L6**
- Build awareness on the services of ISO9000. **L6**
- Infer the process of documentation. **L2**
- Compare ISO 9000 and ISO 14000. **L2**

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Course Outcomes:

At the end of this Course the student will be able to

- Develop an understanding on quality Management philosophies and frameworks **L6**
- Adopt TQM methodologies for continuous improvement of quality **L5**
- Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement **L4**
- Apply benchmarking and business process reengineering to improve management processes. **L6**
- Determine the set of indications to evaluate performance excellence of an organization. **L3**

Online Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME72a-TOOL DESIGN

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Describe the basic concepts of Tool Design.
- Classify Fits and Tolerances used in Tool Design.
- Define the fundamental concepts of Designing of Jigs and Fixtures.
- Apply basic mathematics to design the press tool dies.
- Understand the nomenclature of the milling cutters.
- Explain the conceptual design of CNC machine tools.

UNIT – I: INTRODUCTION TO TOOL DESIGN **10 Hrs**

Introduction –Tool Engineering – Tool Classifications- Tool nomenclature- ASA and ORS systems– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Carbides, Ceramics, CBN and Diamond - Designing with relation to heat treatment.

Learning Outcomes:

At the end of this unit, the student will be able to

- Implement various steps in tool design process. **L6**
- List the various types of tools **L2**
- Understand the challenges and requirements for tool design **L2**
- Explain about various types tooling materials **L3**
- Apply process selection tool materials **L2**

UNIT – II: DESIGN OF CUTTING TOOLS **8 Hrs**

Mechanics of Metal cutting –orthogonal and Oblique cutting- Chip formation and shear angle - Cutting forces- Merchant circle diagram - Heat generation during machining- temperature measuring techniques - calorimeter method thermocouple method and work-tool thermocouple method-Cutting fluids- classification, methods of applications. Single-point cutting tools – Drilling and Milling cutters – Broaching Tools.

Learning Outcomes:

At the end of this unit, the student will be able to

- Differentiate between oblique and orthogonal cutting. **L2**
- Identify the various types of chip formations. **L3**
- Summarize the single point cutting tool nomenclature. **L2**
- understand the various hole making cutting tools **L2**
- Apply the design techniques for designing of a gear and thread milling cutters. **L6**

UNIT – III: DESIGN OF JIGS AND FIXTURES **8 Hrs**

Introduction –Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Types of Fixtures – Turning Fixtures – Milling Fixtures – Welding Fixtures – Broaching Fixtures.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various jigs and fixtures. **L1**
- Summarize the principles of location. **L5**
- Explain the general considerations in design of drill gigs. **L4**
- Prescribe methods of construction of jigs and fixtures. **L5**
- Discuss the types of fixtures. **L2**

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UNIT – IV: DESIGN OF PRESS TOOL DIES **8 Hrs**

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Centre of pressure - Strip layout – Bending dies – Drawing dies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the difference between blanking and piercing. **L2**
- Identify the problems in parting lines of dies. **L3**
- Apply the design guidelines the designing of bending dies. **L5**
- Apply the design principles for drawing dies **L5**
- Utilize sheet metal effectively for blanking operations. **L3**

UNIT – V: TOOL DESIGN FOR CNC MACHINE TOOL **8 Hrs**

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain tooling requirements for numerical control systems. **L2**
- Discuss various tool holding methods in CNC machine tool. **L6**
- Understand the brown and sharp machine concepts. **L2**
- Use the design guidelines in CNC machine tools. **L3**

Text Books:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2. E.G.Hoffman,"Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore, 2004.
3. P.C.Sharma, "A Text book of Production Engineering", S.Chand Publications, 1999.

Reference Books:

1. Amitabha Bhattacharyya, Gopal Chandra Sen, " Principles of Machine Tools" New Central Book Agency; 2/e, 2009.
2. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing, 2000
3. Venkataraman K., "Design of Jigs, Fixtures and Presstools", TMH, 2005.
4. Haslehurst M., "Manufacturing Technology", The ELBS, 1978.
5. G R Nagpal, Tool Engineering and Design, Khanna Publishers,2002..

Course Outcomes:

At the end of this Course the student will be able to

- Compare the Ferrous and non ferrous tool materials. **L4**
- Classify the types of chip formation during orthogonal cutting. **L2**
- Design Drill Jigs and Fixtures. **L6**
- Design a simple gripper for robot. **L6**
- Understand the concept of design of die and piercing operations . **L1**
- Understand about the tool holding methods, Automatic tool changers and tool positions in CNC Machine. **L1**

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/TOOL%20DESIGN_Lecture_Notes.pdf
- https://www.cet.edu.in/noticefiles/261_MMP%20Lecture%20Notes-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture-notes.php?url=production-engineering
- https://nptel.ac.in/courses/112/105/112105233/
- https://www.youtube.com/watch?v=7MkX-sW97rI
- https://nptel.ac.in/courses/112/105/112105126/#

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME72b-REFRIGERATION AND AIR CONDITIONING

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry.
- Introduce the students how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.
- Expose the students on various refrigeration methods like VCR, VAR and latest developments.
- Know the various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems

UNIT – I: Introduction to Refrigeration **10 Hrs**

Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER (Energy Efficiency Ratio) , Different Refrigeration Methods.

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the terminologies associated with refrigeration. L2
- Describe the first and second law applied to refrigerating machines. L2
- Demonstrate the Bell-Coleman cycle in air refrigeration. L2
- Identify the various refrigeration cycles. L2

UNIT – II: Vapour Compression Refrigeration (VCR) System **8 Hrs**

Vapour Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants. - Desirable Properties - Classification of Refrigerants Used - Nomenclature-Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of vapour compression refrigeration system. L5
- Draw the T-S and P-h charts for representation of cycle. L1
- Classify various refrigerants used in vapour compression refrigeration systems. L1
- Model the numerical problems on refrigeration cycles. L3

UNIT – III: Vapor Absorption Refrigeration (VAR) System **8 Hrs**

Vapor Absorption Refrigeration (VAR) System- Description and Working of NH_3 - Water System and Li Br -Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of vapour absorption refrigeration system. L5
- Identify the latest developments of Electrolux, thermo electric vortex tube methods. L3
- Illustrate the working of various components of steam jet refrigeration system. L2
- Estimate the motive steam required for steam jet refrigeration system. L6
- Describe the working principle of Themo- Electric refrigerator and bortex tube refrigerator. L2

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UNIT – IV: Introduction to Air Conditioning: **8 Hrs**

Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts. Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate the psychrometric properties & processes. **L2**
- Select the air conditioning systems for different realistic situations. **L6**
- Define the terms sensible heat load and latent heat load. **L1**
- Draw the psychrometric charts for various air conditioning environments. **L1**

UNIT – V: Air Conditioning Equipment **8 Hrs**

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Appraise the importance of humidifiers and dehumidifiers. **L5**
- Select the requirements of temperature and humidity for human comfort. **L6**
- Demonstrate the heat pump working and its components. **L2**
- List the various air conditioning equipments. **L1**

Text Books:

1. C P Arora, Refrigeration and Air Conditioning, , TMH, 15/e, 2013.
2. S. C Arora & Domkundwar, A Course in Refrigeration and Air conditioning, Dhanpat rai & Co, 2018.

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2/e, 2013.
2. Principles of Refrigeration - Dossat / Pearson Education, 4/e, 2007.
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2/e, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4/e, 2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam.

Course Outcomes:

At the end of this Course the student will be able to

- Appraise the importance of humidifiers and dehumidifiers. **L5**
- Select the requirements of temperature and humidity for human comfort. **L6**
- Demonstrate the heat pump working and its components. **L2**
- List the various air conditioning equipments. **L1**

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_RAC_Lecture_Notes.pdf
- https://www.studocu.com/en-us/document/saint-louis-university/fluid-dynamics-laboratory/refrigeration-lecture-notes-1/3020577
- http://home.iitk.ac.in/~samkhan/ME340A.htm
- https://nptel.ac.in/courses/112105129
- http://dte.karnataka.gov.in/Institutes/gptkampli/GenericDocHandler/68-fc177b7d-f5d1-4580-b577-b1118df994f4.pdf

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME72c-PRODUCTION AND OPERATIONS MANAGEMENT

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduction to the technical design and manufacturing operations and supply management to the sustainability of an enterprise.
- Need for forecasting and types of forecasting.
- Import the basic principles of project management and other business functions such as value engineering, purchasing, marketing, finance etc.
- Analyze the new demands of the globally competitive business environment that supply chain managers face today.
- Knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT – I: Introduction **10 Hrs**

Introduction: Operations Management – Definition, Objectives, Types of Production System, Difference between OM & PM, Historical Development of Operations Management, Current Issues in Operation Management, Product Design – Requirements of Good Product Design, Product Development – Approaches, Concepts in Product Development, Standardization, Simplification, Speed to Market, Introduction to Concurrent Engineering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of operations management, production systems. **L1**
- Analyze steps in design a new product. **L4**

UNIT – II: Forecasting: **8 Hrs**

Forecasting: Introduction, Statistical Forecasting Techniques, Moving Averages, Exponential Smoothing Technique, Errors in Forecasting and Evaluation of Forecasting Techniques.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of forecasting. **L1**
- Understand and analyze the various methods of forecasting. **L1**

UNIT – III: Value Engineering and Plant Layout: **8 Hrs**

Value Engineering and Plant Layout: Value Engineering – Objectives, Types of Values, Function and Cost, Product Life Cycle, Steps in Value Engineering, Methodology in Value Engineering, FAST Diagram and Matrix Method. Facility Location and Layout – Factor Considerations in Plant Location, Comparative Study of Rural and Urban Sites, Methods of Selection of Plant Layout, Objectives of Good layout, Principles, Types of Layout, Line Balancing

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of value engineering. **L1**
- Identify the factors for locating a Plant Layout. **L3**
- Understand types of plant layout and line balancing. **L1**

UNIT – IV: Aggregate Planning and MRP: **8 Hrs**

Aggregate Planning and MRP: Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning- Transportation and Graphical Models, Master scheduling, Material Requirement Planning(MRP)- Terminology, Types of Demands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, Manufacturing Resources Planning (MRP II), Just in Time (JIT) Philosophy, Kanban System, Calculation of Number of Kanbans, Pull Systems vs. Push Systems, Requirements for Implementation of JIT, JIT Production Process, Benefits of JIT.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of aggregate planning, material requirement planning and JIT. **L1**
- Implement the concepts of JIT. **L5**

UNIT – V: Scheduling: **8 Hrs**

Scheduling: Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loading Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flow Shop Scheduling, Job Shop Scheduling, Line of Balance.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand types and policies of scheduling. **L1**
- Analyze and implement single machine, parallel machine, flow shop, and job shop scheduling algorithms. **L6**

Text Books:

1. Buffa E.S. and Sarin R.K., Modern Production / Operations Management, 8/e, Wiley India Pvt. Ltd., New Delhi, 2009.
2. Joseph G. Monks, Operations Management-Theory and Problems, 3/e, McGraw Hill Education, 1987.

Reference Books:

1. James L. Riggs, Jim Rigs, Production Systems: Planning, Analysis and Control, 4/e, Wave Land Press, 1992.
2. Chary S.N., Production and Operations Management, 5/e, McGraw Hill Education, 2017.
3. Richard B.Chase, Ravi Shankar, Robert Jacobs F., Operations and Supply Chain Management, 15/e, McGraw Hill Education, 2018
4. Pannerselvam R., Production and Operations Management, 3/e, PHI Learning Pvt. Ltd., New Delhi, 2012.
5. Steven Nahmias, Tava Lennon Olsen, Production and Operation Analysis: Strategy – Quality – Analytics – Applications, 7/e, Waveland Press Inc., 2015.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the operations and supply management to the sustainability of an enterprise. **L2**
- Identify the need for forecasting and understand different forecasting methods. **L3**
- Identify various production and plant layouts. **L3**
- Examine the quality control of the production. **L4**
- Apply Just in Time (JIT) basic principles and applications. **L2**
- Recommend the production schedule for productivity. **L4**
- Design, analyze and implement single machine, parallel machine, flow shop and job shop scheduling algorithms. **L6**

Online Learning Resources:

- https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf
- https://lecturenotes.in/subject/100/production-and-operation-management
- https://www.studocu.com/in/document/guru-gobind-singh-indraprastha-university/production-operations-management/full-unit-1-lecture-notes-6/3528988
- https://mrcet.com/downloads/digital_notes/ME/III%20year/POM%20NOTES.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_OM_NOTES.pdf
- https://nptel.ac.in/courses/112107238
- https://nptel.ac.in/courses/110107141

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME73a-MECHATRONICS AND MEMS

(Professional Elective-V)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development of mechatronic system and MEMS.

UNIT – I: Introduction **10 Hrs**

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Implement various steps in design process. L6
- Apply economical considerations at design stage. L2
- Develop creativity attitude in designing. L5
- Use Ashby charts for material selection. L3
- Apply process selection charts. L2

UNIT – II: Sensors: **8 Hrs**

Static and dynamic characteristics of sensors, Selection criteria for sensors. Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Assign dimensional tolerances and surface roughness values. L4
- Identify the necessity of redesigning of the components. L3
- Summarize the design rules for machining. L2
- Assign recommendations for machining of components. L4
- Assign dimensional tolerances and surface roughness values. L4

UNIT – III: Actuators: **8 Hrs**

Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Selection criteria for actuators. Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various casting processes. L1
- Assign tolerances for various casting processes. L5
- Simulate sand casting design. L4
- Prescribe pre and post treatment of welds. L5
- Discuss the effects of thermal stresses in weld joints and brazed joints. L2

UNIT – IV: Microprocessors, Microcontrollers and Programmable Logic Controllers: **8 Hrs**

Architecture of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

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Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the difference between open and closed die forging. **L2**
- Identify the problems in parting lines of dies. **L3**
- Apply the design guidelines the extruded sections. **L2**
- Apply the design principles for various sheet metal operations. **L2**
- Utilize sheet metal effectively for blanking operations. **L3**

UNIT – V: Micro Electro Mechanical Systems (MEMS): **8 Hrs**

History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, and Applications: Lab on chip.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain visco elastic and creep behavior in plastics. **L2**
- Discuss various plastic molding processes. **L6**
- Apply the design considerations for injection molding. **L2**
- Use the design guidelines in machining of plastics. **L3**

Text Books:

1. W. Bolton, Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, 3/e, Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010.
3. N. Mahalik, MEMS, McGraw Hill Educations, 2017.

Reference Books:

1. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2004.
2. James J Allen, Micro Electro Mechanical Systems Design, CRC Press, 2005.
3. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010.
4. Mohammed Gad, MEMS; Design and Fabrication, CRC Press, 2010.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the knowledge of MEMS. **L2**
- Classifying different fabrication techniques of MEMS. **L4**
- Illustrate the application of MEMS in industry. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/112/101/112101005/
- https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_LECTURE_NOTES.pdf
- https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecture-notes/
- https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on-design-for-manufacturing.html
- https://www.youtube.com/watch?v=ofmbhbVCUqI
- https://onlinecourses.nptel.ac.in/noc21_me66/preview

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME73b-DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

(Professional Elective-V)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize on Fluid Power Engineering and Power Transmission System.
- Introduce the students, the basic concepts of hydraulic and pneumatic systems.
- Expose the students with various hydraulic and pneumatic actuators.
- Familiarize on fluid power systems and its applications to real time.
- Know the problem, which occur in fluid power systems and take necessary troubleshooting/ maintenance activities.
- Get practiced in designing hydraulic and pneumatic systems.

UNIT – I: Introduction **10 Hrs**

Introduction to fluid power - Types, advantages and application of fluid power systems. Properties of hydraulic fluids – General types of fluids – Fluid power symbols as per ISO/ANSI. Basic Components of Hydraulic and Pneumatic Systems. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems for force and motion analysis in automation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of fluid power and its types. **L2**
- List the advantages and applications of fluid power systems. **L1**
- Explain the properties of hydraulic fluids. **L2**
- Draw the ISO/ANSI symbols of fluid power. **L1**
- Compare mechanical, electrical, hydraulic and pneumatic systems. **L2**

UNIT – II: Hydraulic Pumps, Actuators and Controlling elements **8 Hrs**

Types of hydraulic pumps - construction and working principle - design considerations, selection, specifications and characteristics of pumps. Types of actuators-construction and working principle - design considerations, selection, specifications and characteristics of actuators.

Control and Regulation Elements: Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for hydraulic circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic working principles of the hydraulic pumps and actuators. **L2**
- List the types of pumps and actuators. **L1**
- Explain the design considerations of pumps and actuators. **L2**
- Identify the importance of control and regulation elements in fluid power. **L3**
- Select the valves for hydraulic circuits. **L1**

UNIT – III: Design of Hydraulic Circuits: **8 Hrs**

Speed control circuits - Regenerative circuits- Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier–Intensifier circuit. - Reservoir design - Selection of components. Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Safety circuits - Industrial applications circuits - Hydraulic Press - Milling Machine - Planner - Fork Lift.

Learning Outcomes:

At the end of this unit, the student will be able to

- Develop the hydraulic circuits for practical applications. **L6**
- Create circuits for various machines. **L6**
- Discuss the importance of accumulators and intensifiers in hydraulic circuits. **L6**
- Select the size of the accumulators. **L1**

- Explain the working principles of safety circuits. **L2**

UNIT – IV: Pneumatic Systems: 8 Hrs

Pneumatic fundamentals - Properties of air – Compressors – Filter, Regulator, and Lubricator unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Control Elements - Logic Circuits - Position - Pressure Sensing - Switching – Electro Pneumatic. Robotic arms.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the fundamental concepts of pneumatic systems. **L2**
- List the properties of air for pneumatic system. **L1**
- Demonstrate on F-R-L UNIT. **L2**
- Identify various control elements in pneumatic system. **L3**
- Develop electro pneumatic and electro hydraulic circuits for robotic applications. **L6**

UNIT – V: Design of Pneumatic Circuits 8 Hrs

Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors -Uses - Selection criteria for Pneumatic components.

Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design a pneumatic circuit using classic, cascade and step counter methods. **L6**
- Select pneumatic components for installation and maintenance of power packs. **L1**
- Explain the architectures of PLC and Microprocessors. **L2**
- Develop logical circuits in PLC for automation. **L6**
- Determine the faults in fluid power systems. **L3**

Text Books:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Andrew Parr, Hydraulic & Pneumatics, 2/e, Jaico Publishing House Elsevier, 1999.
3. Majumdar S.R, "Oil Hydraulics", Tata McGraw Hill, 2000.
4. Majumdar S.R, "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2001.

Reference Books:

1. Harry L. Stevart D.B, "Practical Guide to Fluid Power", Taraoeala Sons and Port Ltd. Broadey, 1976.
2. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

Course Outcomes:

At the end of this Course the student will be able to

- Compare the differences between hydraulic and pneumatic systems. **L2**
- Identify the practical applications in automation. **L3**
- Build the circuits for a given applications. **L6**
- Develop hydraulic and pneumatic power packs. **L6**
- Discuss the importance of PLC and microprocessor in hydraulic and pneumatic systems. **L6**

Online Learning Resources:

- Chrome-extension://efaidnbmnnibpcaglefindmkaj/viewer.htms?pdfhrl https%3A%2%2Fwww.iare.ac.in%2Fsites%2Fdefault%2Ffiles%2FDHPS%2520LECTURER %2520NOTES%2520FINAL.pdf&chunk=true.
- chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2 Fwww.iare.ac.in%2Fsites%2Fdefault%2Ffiles%2FDHPS%2520PPT%2520%2520FINAL.pdf &chunk=true.
- https://nptel.ac.in/courses/112/105/112105047/

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME73c-GEOMETRIC DIMENSIONING AND TOLERANCES

(Professional Elective-V)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Teach the basics of the geometric dimensioning and tolerances.
- Familiar with the form and orientation tolerances.
- Introduce tolerances of profiles of lines and surfaces with or without datums.
- Expose the students to various surface roughness parameters and their measurements in two dimensions.

UNIT – I: Basic Concepts **12 Hrs**

General terms and definitions of geometrical features - General principle of sizes - System of limits and fits - Inspection of dimensional and geometrical deviations - Datums, datum systems, and selection of datums. Restraining degrees of freedom, DOF, Simulators. Rule #1(Boundary principle) and Rule #2.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the general terms and definitions of geometrical features. L2
- List the various boundary principle rules. L1
- Identify the types of datums and datum systems. L3

UNIT – II: Form and Orientation Tolerances **10 Hrs**

Principles of dimensioning - Introduction to geometric dimensioning and tolerance (GD&T); Form tolerances: types, specifications and interpretations - measurement and evaluation of straightness, flatness and roundness - Orientation tolerances: types, specifications and interpretations, and verification of orientation tolerances. Exercises on each group. RFS, MMC and LMC concepts.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe orientation tolerances. L2
- List types of form tolerances and its specifications. L1
- Explain the measurement and evaluation of straightness and flatness. L2
- Explain the measurement and evaluation of roundness. L2

UNIT – III: Location, Runout and Profile Tolerances **10 Hrs**

Tolerances of location: types, specifications and interpretations - verification techniques - Tolerances of profiles of lines and surfaces with or without datums - Tolerances of runout - Tolerancing of angles and cones. Exercises on each group. RFS, MMC and LMC concepts.

Learning Outcomes:

At the end of this unit, the student will be able to

- List the types of tolerances of locations. L3
- Explain the concept of tolerances of runout. L2
- Explain tolerancing of angles and cones. L2

UNIT – IV: Surface Roughness **8 Hrs**

Various parameters and their measurements in two dimensions - filtering and filtering techniques - areal parameters, symbology

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of surface parameters in two dimensions. L2
- Explain the filtering techniques. L2

UNIT – V: Inspection of GD&T call-outs **8 Hrs**

Vectorial dimensioning and tolerancing - Statistical tolerancing of mechanical assemblies - Dimensional chains - Measurement uncertainty - Computer-aided tolerancing and verification. Inspection techniques- conventional and CMM.

Learning Outcomes:

Head
Mechanical Engineering Department
JNTUA College of Engineering,
PULIVENDULA - 516 390.

At the end of this unit, the student will be able to

- Compare various statistical tolerancing of mechanical assemblies. **L3**
- Identify the various computer aided tolerancing techniques. **L3**

Text Books:

1. Drake, P. J., Dimensioning and Tolerance Handbook, McGraw-Hill, Inc., New York. 1999.
2. Meadows, J. D., Geometric Dimensioning and Tolerancing: Applications and Techniques for use in Design, Manufacturing and Inspection, Marcel Dekker, Inc., New York. 1995.
3. Gill, P. S., Geometric Dimensioning and Tolerancing, S. K. Kataria & Sons, New Delhi, 2/e, 2013.

Reference Books:

1. Alex Krulikowski, Fundamentals of geometric dimensioning and tolerancing, Cengage Learning, 3/e, 2012.
2. James D Meadows, —Measurement of Geometric Tolerances in Manufacturing, CRC Press, 1/e, 1998
3. Gupta, I. C., A Text book of Engineering Metrology, Dhanpat Rai Publications, New Delhi, 2018.
4. Galyer, J. F. W. and C. R. Shotbolt, Metrology for Engineers, Cassell Publishers, London, 5/e, 1990.
5. Henzold, G., Handbook of Geometrical Tolerancing: Design, Manufacturing and Inspection, John Wiley & Sons, Chichester, 2/e, 2006.
6. Muralikrishnan, B. and J. Raja, Computational Surface and Roundness Metrology, Springer USA, 1/e, 2010.

Course Outcomes:

At the end of this Course the student will be able to

- This course systematically introduces the essentials of the language of geometric dimensioning and tolerancing (GD&T) based on ASME standards, as well as the essentials of surface roughness measurements in both 2D and 3D including filtering techniques. **L6**
- This course also introduces the related concepts of Vectorial dimensioning and tolerancing, dimensional chains, measurement uncertainty, etc. **L6**
- The knowledge gained by the students by learning the above topics will help them to perform very well in their profession as metrologists as well as product designers. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/112/106/112106179/
- https://www.youtube.com/watch?v=X_VepJhq_vk
- https://www.youtube.com/watch?v=cjzSXPDBA_Q&t=1s
- https://www.youtube.com/watch?v=-tLq1wXio0U
- https://digitaldefynd.com/best-gdt-courses/

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Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME70-INDUSTRIAL AUTOMATION

(Skill Oriented Course-V)

L	T	P	C
1	0	2	2

Course Objectives:

- Introduce basic concepts and principles of Industrial Automation.
- Familiarize with fluid power systems circuits.
- Describe concepts of SCADA software
- Explain the principles of PLC and 8085 microprocessor.
- Expose the students on Mechatronics.

List of Experiments:

Module 1: Design and testing of fluid power circuits to control

Introduction to Fluid power systems, Symbolic representation of hydraulic and pneumatic components.

Tasks:-

1. Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button.
2. Pneumatic training kit with FRL unit, Double acting cylinder, manually actuated DCV.
3. Pneumatic trainer kit with FRL unit, Double acting cylinder, Pilot actuated DCV.
4. Pneumatic trainer kit with FRL unit Double acting cylinder, Double solenoid actuated DCV, DCV with sensor / magnetic reed.
5. Hydraulic power pack with pumps and pressure relief valve.

Module 2:

- Open source SCADA software such as Free SCADA, Open SCADA,
- Indigo SCADA Code Sys Open source for PLC programming and interfacing with real time PLC
- Delta PLC software – free ware and corresponding PLC programming software.
- 8085 Microprocessor Trainer with Power Supply
- Traffic Light Control System

Module 3: Mechatronics

- Experiment on P, PI and PID Controller.
- Simulation of Hydraulic Actuation System.
- Simulation of Pneumatic Actuation System.
- Simulation on Stepper Motor.
- Simulation on Logic gates, decoders and flip-flops.

References:

1. B. Gavali, S. A. Patil and A. R. Koli, "Technology-Based Learning system in Programmable Logic Controller Education," 2016 IEEE Eighth International Conference on Technology for Education (T4E), Mumbai, 2016, pp. 264-265.
2. Groover, Mikell , Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2014.
3. Lamb, Frank. Industrial Automation: Hands On (English Edition). NC, McGraw-Hill Education, 2013. ISBN 978-0071816458.

Note:- Trainer can use freeware simulation software's.

Course Outcomes (CO)

At the end of the course, student will be able to

1.	Summarizes the how fluid power system work	**L2**
2.	Discuss about SCADA software	**L6**
3.	Develop the skills related to predict the output for various programs.	**L6**
4.	Explain the concepts of mechatronics.	**L2**

Online Learning Resources/Virtual Labs:

- http://iotmumbai.bharatividyapeeth.edu/media/pdf/lab_manuals/Manual_EE5I_EIA_22526.pdf
- https://faculty.ksu.edu.sa/sites/default/files/lab-manual_v3.pdf
- https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1494&context=eesp

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA				
B.Tech. VI /VII-Sem (R20)				
NUMERICAL TECHNIQUES **(Open Elective -II)**				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives: This course aims at providing the student

- With the concepts and several methods of Numerical methods.
- To explore the solutions of ordinary differential equations, partial differential equations and integral equations.

UNIT – 1: Solution to System of Nonlinear Equations and Spline Functions:	**9 Hrs**

Method of Iteration- Newton-Raphson method. Linear splines - Quadratic splines – Cubic splines: Minimizing property of Cubic splines – Error in the Cubic Spline ad its derivatives – Surface fitting by cubic splines. – Cubic B-Splines: Representation of B- Splines – Least squares solution – Applications of B-Splines.

Learning Outcomes:

At the end of this unit, the student will be able to

• Solve the algebraic and transcendental equations.	L2
• Solve the system of nonlinear equations and spline functions.	L4

UNIT – II: Numerical Linear Algebra:

Triangular matrices – LU decomposition of a matrix – vector and matrix norms. – Solutions of linear systems –Direct methods: Gauss elimination – necessary for pivoting – Gauss-Jordan method – modification of the Gauss method to compute the inverse – number of arithmetic operations – LU decomposition method – computational procedure for LU decomposition method – LU decomposition from Gauss elimination – solution of tridiagonal systems – III conditioned linear systems – Method for III- conditioned systems. – Solution of linear systems –Iterative methods.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the concepts of numerical linear algebra.	**L1**
• Apply the concepts of numerical linear algebra.	**L3**

UNIT – III: Initial and Boundary value problems:

Predictor-Corrector methods: Adams-Moulton method – Milne's method. – Cubic Spline method – Simultaneous and higher order equations. – Boundary value problems: Finite difference method – Cubic Spline method – Galerkin's method.

Learning Outcomes:

At the end of this unit, the student will be able to

• Solve first order initial value problems.	L3
• Solve ssimultaneous and higher order equations and boundary value problems.	L4

UNIT – IV: Numerical solution of Laplace's equation and Poisson's equation:

Laplace's equation and Poisson's equation – Finite difference approximations to derivatives – solution of Laplace's equation and Poisson's equation: Jacobi's method – Gauss-Seidel method – Successive over

Meany

relaxation method – ADI method.

Learning Outcomes:

At the end of this unit, the student will be able to

• Solve Laplace's equation using finite difference technique.	L3
• Solve Poisson's equation through iterative methods.	L4

UNIT – V: One dimensional Heat equation & Wave equation:

Heat equation in one dimension: Finite difference approximations-Bender-Schmidt recurrence formula-Crank-Nicolson formula ; Iterative methods for the solution of equations - Gauss-Seidel iteration formula and One dimensional Wave equation.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply numerical methods for solving one dimensional heat equation.	L3
• Apply numerical methods for solving one dimensional wave equation.	L4

Text Books:

1. S. S. Sastry, Introductory Methods of Numerical Analysis(Fifth Edition 2012), PHI Learning Private Limited, New Delhi.

Reference Books:

1. M.K.Jain,S.R.K.Iyengar, R.K.Jain, Numerical Methods for Scientific and Engineering Computation (sixth edition),Nee Age International(P) Limited, Publishers, New Delhi.
2. K.E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.S.D. Conte and C. De Boor, Elementary Numerical Analysis 302226 An Algorithmic Approach, McGraw-Hill, 1981.
3. K. Eriksson, D. Estep, P. Hansbo and C. Johnson, Computational Differential Equations, Cambridge Univ. Press, Cambridge, 1996.
4. G.H. Golub and J.M. Ortega, Scientific Computing and Differential Equations: An Introduction to Numerical Methods, Academic Press, 1992.
5. J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, 2nd ed., Texts in Applied Mathematics, Vol. 12, Springer Verlag, New York, 1993.

Course Outcomes:

At the end of this Course the student will be able to

• Understand the need of numerical methods in solving engineering problems of various fields.	**L1**
• Learn various numerical techniques to solve initial and boundary value problems.	**L2**
• Apply various methods in solving Laplace's equation.	**L3**
• Emphasizes the numerical solutions of one dimensional heat and wave equations .	**L4**
• Analyze the problems in engineering and technology using various techniques of Numerical methods.`	**L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA
DEPARTMENT OF PHYSICS
III B.TECH – II SEMESTER-R20 (Open elective-Interdisciplinary) –OE-ID.1(THEORY

MATERIALS CHARACTERIZATION TECHNIQUES
(Common to all branches)

L	T	P	C
3	0	0	3

Course Objectives:

- The latest analysis techniques and material structure and property correlation
- The most advanced imaging instruments for investigating the modern materials at the highest topographic resolution
- The commonly used analytical tools for characterizing modern materials at highest sensitivity
- The latest advancement in spectroscopy for getting structural and elemental analysis of Materials

UNIT – 1: Structure analysis by Powder X-Ray Diffraction — **9 Hrs**

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams –factors affecting Diffraction Intensities - structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer equation, Small angle X-ray scattering (SAXS) (in brief).

Learning Outcomes:

At the end of this unit, the student will be able to

• **Understand** the diffraction phenomenon in crystals	L1
• **Identify** the factors affecting diffraction pattern intensities	L2
• **Explain** the polycrystalline nature of the material	L3
• **Analyze** the crystal structure and crystallite size by various methods	L4
• **Illustrate** the Small angle X-ray scattering (SAXS)	L2

UNIT – II: Microscopy technique -1 –Scanning Electron Microscopy (SEM) — **9 Hrs**

Introduction, Principle, Construction and working principle of Scanning Electron Microscope, Specimen preparation, Different types of modes used (Secondary Electron and Back scattered Electron), Energy Dispersive X-ray Analyzer (to provide elemental identification and quantitative compositional information), Advantages and limitations of SEM.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Explain** the basic concepts and working principle of Scanning Electron Microscope	L1
• **Classify** the different types of Scanning Electron Microscope modes used	L2
• **Identifies** the specimen preparation for Scanning Electron Microscope	L2
• **Analyze** the morphology of the sample by using Scanning Electron Microscope	L4
• **Understand** the advantages and limitations of Scanning Electron Microscope	L2

UNIT – III: Microscopy Technique -2 - Transmission Electron Microscopy (TEM) — **9Hrs**

Principle, Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy,Difference between SEM and TEM, Advantages and Limitations of Transmission Electron Microscopy.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Explain** the basic principle and working principle of Transmission Electron Microscope	L1
• **Classify** the different types of Transmission Electron Microscope modes used	L2
• **Identifies** the specimen preparation for Transmission Electron Microscope	L2
• **Analyze** the morphology and crystal structure of the sample by using Transmission Electron Microscope	L2
• **Understand** the advantages and limitations of Transmission Electron Microscope	L3

UNIT – IV: Spectroscopy techniques **9 Hrs**

Principle, Experimental arrangement, Analysis and Advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy – quantitative analysis of elements and organic compounds, energy band gap determination – wood and Tauc and KubelkaMunk functions (ii) Raman Spectroscopy – Molecular analysis using vibrational modes (iv) X-ray photoelectron spectroscopy (XPS) for surface materials characterization and chemical analysis.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Explain** the principle and experimental arrangement of spectrometers	L1
• **Understand** the analysis and advantages of the spectroscopic techniques	L2
• **Explain** the concept of UV-Visible spectroscopy	L2
• **Explain** the principle and experimental arrangement of Raman Spectroscopy	L2
• **Explain** the principle and experimental arrangement of X-ray photoelectron spectroscopy (XPS)	L2

UNIT – V: Electrical & Magnetic Characterization techniques

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method,Vibrating sample Magnetometer (VSM) and SQUID (Superconducting Quantum Interference Device)

Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Explain** the various types of electrical properties analysis techniques	L1
• **Explain** the effect of magnetic field on the electrical properties	L2
• **Analyze** the magnetization by using induction method	L2
• **Explain** the construction and working principle of VSM	L2
• **Explain** the construction and working principle of SQUID	L2

Text Books:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall , 2001 – Science.

Course Outcomes:	
At the end of this Course the student will be able to	
• **Identify** the various characterization techniques	L1
• **Classify** the characterization techniques based on their applications and properties	L2
• Ilustates the various characterization techniques for materials characterization.	L3
• **Apply** suitability in Engineering Applications	L4

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

B.Tech – IV-I-Sem	L	T	P	C
	3	0	0	3

Polymers and their applications (OE.2)
(common to all branches)

Course Objectives:

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

UNIT-I: **Polymers-Basics and Characterization** — 9 Hrs

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization mechanisms: condensation, addition.Molecularweight concepts: determination bynumber, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers, Characterization of polymers by XRD, DSC.

Learning Outcomes:

At the end of this unit, the student will be able to:

- Classify the polymers (L3)
- Explain polymerization mechanism (L2)
- Differentiate addition, condensation polymerizations(L2)
- Describe measurement of molecular weight of polymer(L2)

UNIT-II: **Synthetic Polymers** — 8 Hrs

Polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins.

Learning Outcomes:

At the end of this unit, the student will be able to:

- Differentiate Bulk, solution, Suspension and emulsion polymerization(L2)
- Describe fibers and elastomers (L2)
- Identify the thermosetting and thermo polymers(L3)

UNIT-III: Natural Polymers & Modified cellulosics — 8 Hrs

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Learning Outcomes:

After completing the course, the student will be able to:

- Describe the properties and applications of polymers(L2)
- Interpret the properties of cellulose, lignin, starch, rosin, latex (L2)
- Discuss the special plastics of PES, PAES, PEEK (L3)
- Explain modified cellulosics(L2)

UNIT-IV: Hydrogels of Polymer networks and Drug delivery	8 Hrs

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, **Applications** of hydrogels in drug delivery.Introduction to drug systems including regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

Learning Outcomes:

After completing the course, the student will be able to:

- Identify types of polymer networks(L3)
- Describe methods involve in hydrogel preparation(L2)
- Explain applications of hydrogels in drug delivery(L2)
- Demonstrate the advanced drug delivery systems and controlled release(L2)

UNIT-V: **Advanced Polymers for engineering applications**	7Hrs

Importance of advance polymers examples-polymers in sensors,conducting and synthetic metals, photonics, thermoplastics. Applications of Biodegradable polymers, Bio-PET, BIO-PEP, Polylactides

Learning Outcomes:

After completing the course, the student will be able to:

- Demonstrate conducting polymers (L3)
- Explain Biodegradable polymers (L2)
- Discuss applications of Biodegradable polymers, Bio-PET, BIO-PEP, Polylactides (L3)

Text Books:

1. Fred W.Billmayer, A Text book of Polymer science, 3rd Edition, Wiley India, 2007
2. K.J.Saunders, Organic polymer Chemistry, Chapman and Hall, 1973.

Reference Books:

1. B.Miller, Advanced Organic Chemistry, Prentice Hall, 2nd Edn, 2003
2. Ambikanandan Misra, Aliasgar Shahiwala, Applications of polymers in Drug delivery system, Elsevier Pub., 2020.
3. Gowarikar, Polymer Chemistry –New Age International Publications, 2019
4. Physical Chemistry , Samel Galsstone, Lan Caster Press, 1970.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the state of art synthesis of Polymeric materials(L1)
- Understand the hydro gels preparation, properties and applications in drug delivery system (L2).
- Explain biodegradable polymers(L2)
- Discuss applications of Biodegradable polymers (L3)

B.Tech III Year II Sem & IV Year I Sem

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACE65A- ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- This course is aimed at exposing the student to the concept of environmental impact assessment and methodologies used for the same.
- The student will also be imparted the knowledge about the various laws related to EIA and also methods of EIA audit.

UNIT-I:

INTRODUCTION:-

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

UNIT-II:

EIA METHODOLOGIES:-

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

UNIT-III

IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE:-

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT-IV:

ASSEMENT OF IMPACT ON VEGETATION AND WILDLIFE :

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

ENVIRONEMNTAL AUDIT :

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT-V:

ENVIRONEMENTAL ACTS (PROTECTION AND PREVENTION)

Post Audit activities, The Environmental protection Act, The water preventation Act, The Air (Prevention & Control of pollution Act.), Wild life Act.Case studies and preparation of Environmental Impact assessment statement for various Industries.

Text Books:

- Environmental Impact Assessment Methodologies, byY. Anjaneyulu, B.S. Publication, Sultan Bazar,Hyderabad.
- Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice HallPublishers

Reference Books:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katari& Sons Publication., NewDelhi.
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

Course Outcomes:

At the end of this Course the student will be able to

1. Understand the concept of Environmental impact
2. Understand the methodologies related to EIA
3. Appreciate various laws related to environmental protection
4. Prepare the environmental impact assessment statement and to evaluateit.

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

ENERGY CONSERVATION & MANAGEMENT

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand energy efficiency, scope, conservation and technologies.
- To design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation Techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient Technologies.

UNIT – I: **09 Hrs**

Basic Principles of Energy Audit and management Energy audit – Definitions – Concept– Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various types of Energy Audit **L1**
- To know about various types of Energy conservation schemes and Energy Manager functions **L2**

UNIT – II: **09 Hrs**

Lighting Modification of existing systems – Replacement of existing systems – Priorities: Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various Lighting systems and types of lamps. **L1**
- To evaluate illumination level Illumination of inclined surface to beam and Design of Energy efficient lighting systems. **L2**

UNIT – III: **09 Hrs**

Power Factor and energy instruments Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about various Methods of Power Factor improvement **L1**
- To know about various Energy Instruments **L3**

UNIT – IV: **09 Hrs**

Space Heating and Ventilation Ventilation – Air–Conditioning (HVAC) and Water Heating: Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about analysis of Heating and HVAC **L1**
- To know about Energy conservation methods **L2**

UNIT – V: **09 Hrs**

Economic Aspects and Analysis : Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).Computation of Economic Aspects Calculation of simple payback method – Net present worth method – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic concept of Analysis of Economics and different methods **L1**
- To know about Computation of Economic Aspects Calculation **L2**

Text Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy efficient electric motors by John.C.Andreas, Marcel Dekker Inc Ltd-2ndedition,1995.

Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1stedition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I K International Publishing House pvt.ltd, 2011.
5. http://www.energymanagertraining.com/download/Gazette_of_IndiaP art IISecI-37_25-08-2010.pdf

Course Outcomes:

At the end of this Course the student will be able to

- Explain energy efficiency, conservation and various technologies. **L1**
- Design energy efficient lighting systems. **L2**
- Calculate power factor of systems and propose suitable compensation techniques. **L3**
- Explain energy conservation in HVAC systems. **L4**
- Determination of the economic analysis **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME65a-PROGRAMMING OF ROBOTS AND CONTROL

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system.

UNIT – I: Fundamentals of Robots: **10 Hrs**

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots.

Learning Outcomes:

At the end of this unit, the student will be able to

- outline the advantages, disadvantages and applications of robot. L2
- compare the types of robot manipulators based on applications. L2

UNIT – II: Robot Actuators And Feedback Components: **8 Hrs**

Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare the types of actuators used in robot manipulator. L2
- List out the various types of robots and feedback components. L1

UNIT – III: Robot Programming: **8 Hrs**

Methods of programming - requirements and features of programming languages, software packages, problems with programming languages - VAL, RAIL, AML, C, C++.

Learning Outcomes:

At the end of this unit, the student will be able to

- List out the various methods of robot programming L1
- Explain the requirements and features of programming L2

UNIT – IV: Control of Manipulators **8 Hrs**

Open-loop and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic concepts of robot controlling systems. L2
- Outline PD and PID control schemes. L3
- Use the force control strategies to determine the forces in robot. L2
- Explain the force control and torque control techniques. L2

UNIT – V: Robot Vision: **8 Hrs**

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the components of robot vision system. L3
- Explain the concept of image enhancement, segmentation and transformation. L2

- List the various components of robot vision system. **L1**
- Illustrate the industrial applications of robot vision system. **L2**

Text Books:

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — McGraw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. S.R.DEB

Reference Books:

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2/e, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1/e, Wiley- Inter science, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers,1987.
5. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
6. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence. Mc Graw Hill, 1987.
7. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

At the end of this Course the student will be able to

- Explain fundamentals of Robots. **L2**
- Apply kinematics and differential motions and velocities. **L3**
- Demonstrate control of manipulators. **L2**
- Understand robot vision. **L2**
- Develop robot cell design and programming. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/112105249
- https://onlinecourses.nptel.ac.in/noc20_de11/preview
- https://nptel.ac.in/courses/112104308
- https://nptel.ac.in/courses/112104288
- https://nptel.ac.in/courses/112101099
- https://www.iare.ac.in/sites/default/files/lecture_notes/ROBOTICS_LECURE_NOTES.pdf

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME65b-NON-CONVENTIONAL SOURCES OF ENERGY

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize with concept of various forms of renewable energy.
- Understand division aspects and utilization of renewable energy sources for both domestics and industrial applications.
- Expose the students in an environmental and cost economics of using renewable energy sources compared to fossil fuels.

UNIT – I: Introduction **10 Hrs**

Introduction to energy resources: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic concepts of solar radiation and solar collectors **L2**
- develop sun path diagrams **L3**
- Explain environmental impact of solar power. **L2**
- Discuss the instruments for measuring solar radiation and sun shine. **L6**

UNIT – II: Solar Energy Collection & Storage **8 Hrs**

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications :

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating technique, solar distillation and drying, photovoltaic energy conversion.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify solar energy collectors. **L1**
- Describe orientation and thermal analysis of solar energy collectors. **L2**
- Explain photovoltaic energy conversion. **L2**
- Illustrate the various solar energy applications. **L2**

UNIT – III: Wind Energy & Bio-Mass **8 Hrs**

Wind Energy : Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare vertical axis and horizontal axis windmills. **L3**
- Illustrate the performance characteristics of vertical axis and horizontal axis windmills. **L2**
- Discus the principles of Bio-conversion. **L6**
- Explain combustion characterises of bio-gas. **L2**

UNIT – IV: Geothermal Energy & Ocean Energy **8 Hrs**

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. **Tidal and wave energy:** Potential and conversion techniques, mini-hydel power plants, and their economics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of geothermal and ocean energy. **L2**
- Discus OTEC and principles utilization. **L6**
- Explain mini-hydel power plants and their economics. **L2**

UNIT – V: Direct Energy Conversion **8 Hrs**

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the working principle of MHD engine. **L2**
- Explain constructional details of various thermo-electric generators. **L2**
- Identify the various economic, thermodynamic aspects of electron gas dynamic conversion system. **L3**

Text Books:

1. Tiwari and Ghosal, Renewable energy resources, Narosa Publishing House-2004.
2. G.D. Rai, Non-Conventional Energy Sources, Khanna Publications-1988.

Reference Books:

1. Twidell & Weir, Renewable Energy Sources, Routledge; 3/e, 2015.
2. Sukhatme S.P., Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
3. Sathyajith Mathew, Wind Energy Fundamentals, Resource Analysis and Economics, Springer Publications, 2006.
4. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press, 2010.
5. Wind Power, Revised Edition: Renewable Energy for Home, Farm, and Business, Paul Gipe, Chelsea Green Publishing, 2004.
6. S.S. Rao, B.B. Parulekar, Energy Technology (Non Conventional, Renewable and Conventional), Khanna publications, 1994.

Course Outcomes:

At the end of this Course the student will be able to

- Outline the various economic, thermodynamic aspects of electron gas dynamic conversion system. **L3**
- Explain the basic concepts of solar radiation and solar collectors **L2**
- Discus OTEC and principles utilization. **L6**
- Describe orientation and thermal analysis of solar energy collectors. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/103103206
- https://nptel.ac.in/courses/108108078
- https://onlinecourses.nptel.ac.in/noc21_ph33/preview
- https://nptel.ac.in/courses/121106014
- https://mrcet.com/downloads/digital_notes/EEE/31082020/IV-I%20SOLAR%20&%20WIND%20ELECTRICAL%20SYSTEMS%20DIGITAL%20NOTES%201.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC65a- INTRODUCTION TO MICROCONTROLLER AND APPLICATIONS

(Open Elective-II)

L–T – P - C
3 – 0 – 0 – 3

Course Objective:

- To understand the basic concepts and architecture of 8051.
- To learn various instructions and addressing modes used in 8051
- To be able to program 8051 Timers and implement serial communication for a given application.
- To learn interfacing of memory, I/O devices and the usage of Interrupts.
- To know the basic architecture and interfacing of ARM microcontroller.

UNIT I

Architecture of 8051: Introduction, Block diagram of 8051 Microcontroller, Functions of each block, Pin details of 8051, ALU,ROM, RAM, Memory Organization of 8051, Special function registers, Program Counter, PSW register, Stack, I/O Ports, Timer, Interrupt, Serial Port, Oscillator and Clock, Clock Cycle, Machine Cycle, Instruction cycle, Reset, Power on Reset.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the architecture of 8051 microcontroller.(L2)
- Learn the functions of each block of 8051 microcontroller.(L1)

UNIT II

Instruction Set of 8051: Instruction set of 8051, Classification of 8051 Instructions, Data transfer instructions, Arithmetic Instructions, Logical instructions, Branching instructions, Bit Manipulation Instructions

Assembler and Addressing Modes: Assembling and running an 8051 program, Structure of Assembly Language, Assembler directives, Different addressing modes of 8051. **I/O:** Bit addresses for I/O and RAM, I/O programming, I/O bit manipulation programming.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Know different instructions available in the Instruction set of 8051.(L1)
- Learn and use different types of addressing modes of 8051 microcontroller.(L1)

UNIT III

Timer: Programming 8051 Timers, Timer registers, Different modes of Timer, Programming timer in different modes, Counter programming, Different modes of Counter, Sample programs.

Serial Communication: Basics of Serial communication, UART, RS 232 Protocol, 8051 interface to RS 232, 8051 UART Programming, SPI and I^2C implementation on 8051.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Write programs to use the 8051 Timers for a given application.(L6)
- Use different types of serial communication devices based on the application.(L3)

UNIT IV

Interrupt: 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in 8051.**IC 8255:** IC 8255, Block Diagram, Modes of 8255, Interfacing with 8051.

Interfacing Techniques: Interfacing external memory to 8051, Sensor interfacing, ADC interfacing, DAC interfacing, Keyboard interfacing, Seven segment LED Display Interfacing, Stepper Motor interfacing.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Interface memory and I/O devices for specific applications.(L4)
- Learn and apply Interrupts based on the application and usage.(L3)

UNIT V

ARM Cortex-M Microcontrollers: A Memory-centric System Model. Basics of Chip Design. The Arm Cortex-M Processor Architecture. Interconnects. The Advanced Microcontroller Bus Architecture (AMBA). Interfacing with the External World. Peripherals. Memory System. FPGA SoC Architecture.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Learn about the ARM based processor and its architecture.(L3)
- Interface ARM controllers for practical applications.(L3)

TEXT BOOKS

1. Muhammed Ali Mazidi, Janice GillispieMazidi andRolin D McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, 2008.
2. Ajit pal, "Microcontrollers, Principles and Applications", – PHI Ltd., - 2011.

REFERENCE BOOKS

1. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", TATA McGraw Hill publications, 2007.
2. Krishna Kanth, "Microprocessors and Microcontrollers", PHI Publications, 2010
3. Fundamentals of Systém-on-Chip Design on Arm Cortex-M Microcontrollers Paperback – 2 Aug. 2021by Rene Beuchat , Andrea Guerrieri , SahandKashani.

Course outcomes:

At the end of this course, the students will be able to

- Understand the basic concepts and architecture of 8051.(L2)
- Know the usage of various instructions and addressing modes in 8051(L1)
- Program 8051 Timers and implement serial communication for a given application.(L6)
- Interface memory, I/O devices and use Interrupts.(L4).
- Learn the basic architecture and interfacing of ARM microcontroller(L3).

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC65b- PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Open Elective-II)

L–T – P - C
3 – 0 – 0 – 3

Course Objectives:

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete fourierseries and fourier transforms.
- To design & analyze IIR digital filters from analog filters.
- To know various structures used in implementation of FIR digital filters.
- To grasp the importance and applications of Multirate Digital signal processing.

UNIT I

Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, LTI system Properties. Solution of Linear constant coefficient difference equations, frequency domain representation of discrete time signals and systems. Review of Z-transforms.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Analyze and process signals in the discrete domain.(L4)
- Determine time domain representations and frequency domain analysis of discrete-time signals and systems (L3)

UNIT II

Discrete Fourier Series and Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the pproperties of discrete fourier series.(L2)
- Describe DFT using FFT algorithms.(L1)

UNIT III

Design of IIR Digital Filters and Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Design IIR digital filters from analog filters.(L6)
- Construct IIR digital filters with different realization techniques.(L6)

UNIT IV

Design of FIR Digital Filters and Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR digital filters using window techniques and frequency sampling technique, comparison of IIR & FIR filters, basic structures of FIR systems.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Design FIR digital filters using window techniques.(L6)
- Construct the basic structures of FIR systems.(L6)

UNIT V

DSP Applications: Introduction to programmable DSPs, Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Adaptive filters: Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Apply Interpolation and Decimation with help of sampling and filtering.(L3)
- Understand the principle and applications of Forward Linear Predictive filter.(L2)

Text Books:

1. John G. Proakis andDimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithmsand Applications", Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing",PHI.
3. B.Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", TATA McGraw Hill, 2002.

References:

1. Andreas Antoniou, "Digital Signal Processing", TATA McGraw Hill, 2006
2. MH Hayes, "Digital Signal Processing", Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling and Sandra L. Harris, "Fundamentals of Digital Signal Processing using Matlab", Thomson, 2007.

Course outcomes:

At the end of this course, the students will be able to

- Articulate the frequency domain analysis of discrete time signals.(L3)
- Understand the properties of discrete fourierseries and fourier transforms.(L2)
- Design& analyze IIR digital filters from analog filters.(L6)
- Design various structures used in implementation of FIR digital filters.(L6)
- Summarize the importance and applications of Multirate Digital signal processing.(L2)

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACS65A- MACHINE LEARNING APPLICATIONS

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.

UNIT-I: INTRODUCTION

Introduction: An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT-II: DECISION TREE LEARNING

Decision Tree Learning: - Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over fitting. Neural Network Learning: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT-III SAMPLE COMPLEXITY AND OVER FITTING

Sample Complexity and Over fitting: Errors in estimating means. Cross Validation and jackknifing VC dimension. Irrelevant features: Multiplicative rules for weight tuning. Support Vector Machines: functional and geometric margins.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT-IV: INSTANCE-BASED TECHNIQUES

Instance-based Techniques: Lazy vs. eager generalization. K nearest neighbor, case- based reasoning. Clustering and Unsupervised Learning: K-means clustering, Gaussian mixture density estimation, model selection

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**
- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT-V: Genetic Algorithms

Genetic Algorithms: Different search methods for induction - Explanation-based Learning: using prior knowledge to reduce sample complexity. Dimensionality reduction: feature selection, principal component analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Tom Michel, Machine Learning, McGraw Hill, 1997
2. Trevor Has tie, Robert Tibshirani & Jerome Friedman. The Elements of Statically Learning, Springer Verlag, 2001.

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001
   3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.

Course Outcomes:

At the end of this Course the student will be able to

- Student should be able to understand the basic concepts such as decision trees and neural networks.Ability to formulate machine learning techniques to respective problems. **L2**
- Apply machine learning algorithms to solve problems of moderate complexity. **L3**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACS65B- OBJECT ORIENTED PROGRAMMING

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- Study the syntax, semantics and features of Java Programming Language
- Study the Object Oriented Programming Concepts of Java Programming language
- Learn the method of creating Multi-threaded programs and handle exceptions
- Learn Java features to create GUI applications & perform event handling

UNIT-I: INTRODUCTION

Introduction to Java: The key attributes of object oriented programming, simple program, The Java keywords, Identifiers, Data types and operators, Program control statements, Arrays, Strings, String Handling

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics. **L2**
- Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. **L3**

UNIT-II: CLASSES

Classes: Classes, Objects, Methods, Parameters, Constructors, Garbage Collection, Access modifiers, Pass Objects and arguments, Method and Constructor Overloading, Understanding static, Nested and inner classes.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use of geometric transformations on graphics objects and their application in composite form. **L2**
- Extract scene with different clipping methods and its transformation to graphics display device. **L3**

UNIT-III INHERITANCE

Inheritance – Basics, Member Access, Usage of Super, Multi level hierarchy, Method overriding, Abstract class, Final keyword.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explore projections and visible surface detection techniques for display of 3D scene on 2D screen. **L3**
- Render projected objects to naturalize the scene in 2D view and use of illumination models for this **L4**

UNIT-IV: INTERFACES

Interfaces – Creating, Implementing, Using, Extending, and Nesting of interfaces.

Packages – Defining, Finding, Member Access, Importing

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of Multimedia basics, different graphics systems and applications of computer graphics. **L5**
- Discuss various multimedia datastructures. **L5**

UNIT-V: EXCEPTION HANDLING

Exception handling: Hierarchy, Fundamentals, Multiple catch clauses, subclass exceptions, Nesting try blocks, Throwing an exception, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of Multimedia Authoring systems **L4**
- Understand the how videos are placed **L5**

Text Books:

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java The Complete Reference" Herbert Schildt, 8th Edition, 2011, Oracle press, TataMcGraw-Hill
3. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.

Reference Books:

1. "Programming with Java" T.V.Suresh Kumar, B.Eswara Reddy, P.Raghavan Pearson Edition.
2. "Core Java", Nageswar Rao, Wiley Publishers.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. "A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.
5. "Head First Java", Kathy Sierra, Bert Bates, O'Reilly
6. "SCJP – Sun Certified Programmer for Java Study guide" – Kathy Sierra, Bert Bates, McGrawHill
7. "Java in Nutshell", David Flanagan, O'Reilly
8. "Core Java : Volume I – Fundamentals, Cay S. Horstmann, Gary Cornell, The Sun Micro Systems Press

Course Outcomes:

At the end of this Course the student will be able to

Introduction to computer graphics

- Gain knowledge of client-side scripting, validation of forms and AJAX programming **L3**
- Understand server-side scripting with PHP language **L4**
- Understand what XML is and how to parse and use XML Data with Java **L5**
- To introduce Server-side programming with Java Servlets and JSP **L6**

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACS65C- WEB DESIGN

(Open Elective-II)

L	T	P	C
3	0	0	3

Course Objectives:

- To Learn the basic concepts in HTML, CSS, JavaScript
- To Understand the responsive design and development
- To learn the web project management and maintenance process
- To Design a Website with HTML, JS, CSS / CMS - Word press

UNIT-I: WEB DESIGN - HTML MARKUP FOR STRUCTURE

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

Learning Outcomes:

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT-II: CSS AND JAVASCRIPT

CSS - Formatting text - Colours and Background - Padding, Borders and Margins – Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation – JavaScript - Using Java Script.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT-III RESPONSIVE WEB DESIGN

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or DesktopFirst - CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT-IV: WEB PROJECT MANAGEMENT

Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development, Communicaton, Documentation - QA and testing -Deployment - Support and operations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**
- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT-V: PROJECT CASE STUDY

Using HTML, CSS, JS or using Opensource CMS like Word press, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015
3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

Reference Books:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014
2. Jon Duckett, Jack Moore, "JavaScript & JQuery: Interactive Front-End Web Development", John Wiley and Sons, edition 2014
3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017 4. Word press - http://www.wpbeginner.com/category/wp-tutorials/

Course Outcomes:

At the end of this Course the student will be able to

- Recognize the method of using layered approach for design . **L2**
- Explain the functionality of each layer of a computer network. **L3**
- Apply the knowledge of layered approach for the design of computer network software. **L4**
- Analyze the performance of protocols of a computer network. **L4**
- Recommend the protocols for different applications. **L5**
- Propose new protocols for a computer networks. **L6**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA					
B.Tech. VII-Sem (R20)					
MATHEMATICAL MODELING (Open Elective -III)					
		L	T	P	C
		3	0	0	3

Course Objectives:

- To provide the basic knowledge to understand a Mathematical model.
- To formulate a Mathematical model related to a real world problems of engineering, biological science etc.

UNIT – 1: Mathematical Modeling & Mathematical modeling Through Ordinary differential equations of First Order :	**9 Hrs**

Mathematical Modeling : Need, Techniques, Classifications and Simple illustrations.

Mathematical modeling Through Ordinary differential equations of First Order :

Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order.

Learning Outcomes:

At the end of this unit, the student will be able to

• Learn various mathematical techniques in modeling a problem.	**L2**
• Learn modeling in dynamics through ordinary differential equations of first order.	**L3**

UNIT – II: Mathematical modeling Through System of Ordinary differential equations of First Order:

Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order.

Learning Outcomes:

At the end of this unit, the student will be able to

• Develop a modeling of Epidemics through system of ordinary differential equations of first order.	**L4**
• Analyze a modeling in dynamics through systems of ordinary differential equations of first order.	**L3**

UNIT – III: Mathematical modeling Through Ordinary differential equations of Second Order:

Mathematical modeling of Planetary motion ; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order.

Learning Outcomes:

At the end of this unit, the student will be able to

• Evaluate a mathematical modeling of Planetary motion.	**L5**
• Analyze a mathematical modeling of Circular motion and motion of satellites	**L3**

UNIT – IV: Mathematical modeling Through Difference equations :

Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in

Mcpary

Probability theory.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Analyze mathematical modeling through difference equations in population dynamics and genetics.	**L4**
• Analyze mathematical modeling through difference equations in probability theory.	**L4**
UNIT – V: Mathematical modeling Through Functional, Integral, Delay- Differential and Differential-Difference Equations :	
Mathematical modeling Through Functional equations; Mathematical modeling Through Integral equations; Mathematical modeling Through Delay- Differential and Differential-Difference Equations.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Analyze a mathematical modeling through functional equations and integral equations.	**L4**
• Analyze a mathematical modeling Through Delay- Differential and Differential-Difference Equations	**L4**
Text Books:	
1. J. N. Kapoor. Mathematical Modeling , NEW AGE INTERNATIONAL PUBLISHERS.	
Reference Books:	
1. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.	
Course Outcomes:	
At the end of this Course the student will be able to	
• Understand the basic concepts in mathematical modeling.	**L1**
• Have better insight of the real word problems through mathematical modeling .	**L2**
• Apply various concepts of mathematics in modeling.	**L3**
• Analyze the real word problems through the techniques of modeling.	**L4**
• Evaluate the real word problems through mathematical modeling.	**L5**

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Mosley

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA
DEPARTMENT OF PHYSICS
IV B.TECH – I SEMESTER-R20 (Open elective-Interdisciplinary) –OE-ID.1(THEORY

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS

(Common to all branches)

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand basics of sensors, actuators and their operating principles.
2. To educate the students on different types of microfabrication techniques for designing and developing sensors.
3. To explain working of various types of electrochemical sensors and actuators.
4. To provide an understanding on characteristic parameters to evaluate sensor performance.

UNIT – 1: Introduction to Sensors and Actuators — 9 Hrs

Content of the Unit – I

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Classify** different types of Sensors and their characteristics	L2
• **Explain** about different fabrication process of Sensors	L1
• **Illustrate** Dry and wet etching	L2

UNIT – II: Temperature and Mechanical Sensors — 9 Hrs

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors,strain gauges, Pressure sensors: semiconductor, piezoresistive, capacitive, Variable reluctance pressure (VRP) sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

• **Summarize** various types of Temperature sensors	L2
• **Explain** basic working principle of different types mechanical sensors	L1
• **Summarize** various types of Mechanical sensors	L2
• **Explain** the working principle of different types mechanical sensors	L1

UNIT – III: Optical, Acoustic and Chemical Sensors — 9 Hrs

Content of the Unit – III

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Explain** the working and principle of various optical sensors	L1
• **Explain** the working principle of different Acoustic sensors	L1
• **Explain** the working and principle of various chemical sensors	L1
UNIT – IV: Magnetic, Electromagnetic and Radiation Sensors	9 Hrs
Inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors, **Radiation Sensors**: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Explain** the working principle of different magnetic and electromagnetic sensors	L1
• **Explain** the working principle of different radiation sensors	L1
• **Identifies** the applications Electronic sensors in various fields	L1
• **Identify** the various optical, solid state system components	L1
UNIT – V: Actuators Types, Principle, Magnetic, Electromagnetic actuators	9 Hrs
Introduction, Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators. Motors as actuators (linear, rotational, stepping motors),Magneto-strictive actuators, Voice coil actuators (speakers and speaker-like actuators).	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• **Illustrates** the different types of Actuators	L2
• **Explains** the basic principle of working of Actuators	L1
• **Identifies** the applications of Actuators sensors	L1
Text Books:	
1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015	
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999	
Reference Books:	
1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003	
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999	
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.	
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.	
5. Principles of Industrial Instrumentation By D. Patranabhis	
Course Outcomes:	
At the end of this Course the student will be able to	
➢ to identify the needs of sensors and actuators	L1
➢ to understand working principles of various sensors and actuators	L2
➢ to identify different type of sensors and actuators used in real life applications	L1
➢ to explore common methods for converting a physical parameter into an electrical quantity	L3
➢ to summaries use of sensors and actuators for different applications	L2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA				
B.Tech – IV-I-Sem	L	T	P	C
	3	0	0	3

Chemistry of Nanomaterials and applications (OE.3)
(common to all branches)

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- Characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

UNIT-I: **Introduction to nanoscience**	7 Hrs

Introduction,importance of nanomaterials, nanoscience in nature, classification of nanostructured materials, properties and scope of nanoscience and applicationsof nanotechnology.

Learning Outcomes:
At the end of this unit, the student will be able to:

- Classify the nanostructure materials(L2)
- Describe scope of nano science and technology(L2)
- Explain different synthetic methods of nano materials(L2)
- Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material(L3)

UNIT-II: **Synthesis of nanomaterials**	8Hrs

Bottom-Up approach:- Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis.
Top-Down approach:- Arc discharge Plasma arc method, aerosol synthesis, ion sputtering, laser pyrolysis,laser ablation, chemical vapour deposition method, electrodeposition method, and high energy ball milling

Learning Outcomes:
At the end of this unit, the student will be able to:

- Describe the top down approach(L2)
- Explain aerosol synthesis and plasma arc technique(L2)
- Differentiate chemical vapour deposition method and electrodeposition method(L2)
- Discuss about high energy ball milling(L3)

UNIT-III: Characterization of nanomaterials	7 Hrs

Techniques for characterization:Dynamic light scattering for particle size determination, Diffraction technique, electron microscopy techniques, BET method for surface area analysis.

Learning Outcomes:
After completing the course, the student will be able to:

- Discuss different technique for characterization of nanomaterial(L3)

- Explain electron microscopy techniques for characterization of nanomaterial(L3)
- Describe BET method for surface area analysis (L2)
- Apply different spectroscopic techniques for characterization(L3)

UNIT-IV: Structural studies of nanomaterials	8 Hrs

Properties of nanomaterials: fullerenes, carbon nanotubes, core-shell nanoparticles. Nano-crystalline materials, magnetic nanoparticles and important properties in relation to nano-magnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals

Learning Outcomes:

After completing the course, the student will be able to:

- Explain synthesis and properties and applications of nanaomaterials(L2)
- Discuss about fullerenes and carbon nanotubes(L3)
- Differentiate nanomagnetic materials and thermoelectric materials(L2)
- Describe liquid crystals(L2)

UNIT-V: **Applications of Nanomaterials**	7Hrs

Engineering, medicine. aerospace applications of nanomaterials. Technologies based on nano materials.

Learning Outcomes:

After completing the course, the student will be able to:

- Illustrate applications of nanaomaterials(L2)
- Discuss the magnetic applications of nanomaterials(L3)
- List the applications of non-linear optical materials(L1)
- Describe the applications fullerenes, carbon nanotubes(L2)

Text Books:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012

Reference Books:

1. Ludovico Cademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Concepts of Nanochemistry; Wiley-VCH, 2011.
2. Guozhong Cao, Nanostructures & Nanomaterials; Synthesis, Properties & Applications:, Imperial College Press, 2007
3. C. N. R. Rao, Achim Muller, K.Cheetham, Nanomaterials Chemistry, , Wiley-VCH, 2007

Course Outcomes:

At the end of this Course the student will be able to

- Understand the state of art synthesis of nano materials(L1)
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry(L2)
- Analyze nanoscale structure in metals, polymers and ceramics(L3)
- Analyze structure-property relationship in coarser scale structures(L3)

- Understand structures of carbon nano tubes(L1)

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACE75A- DISASTER MANAGEMENT AND MITIGATION

(OPEN ELECTIVE-III)

L	T	P	C
3	0	0	3

Course Objectives:

- The objectives of this are to give the basic knowledge of Environmental Hazards and disasters. The syllabus includes the basics of Endogenous and Exogenous hazard's and gives a suitable picture on the different types ofhazardas.

. **UNIT-I:**

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

UNIT-II:

Classification of hazards & Disasters: Natural hazards and Disasters - Man Made hazards & Disasters - Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

UNIT-III

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

UNIT-IV:

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes, distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards /Disasters- Physical hazards/ Disasters-Soil Erosion Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation-Biological hazards/ disasters:- Population Explosion.

UNIT-V:

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage(preparedness)-HVRA Atlas
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

Text Books:

1. Disaster Management by Rajib Shah, Universities Press, India,2003
2. Disaster Mitigation: Experiences And Reflections by PardeepSahni
3. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning
4. National Disaster Management Authority-Guidelines

Reference Books:

1. Kates,B.I& White, G.F The Environment as Hazards, oxford, New York, 1978
2. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
3. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
4. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo,1994
5. Dr.Satender,Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003

Course Outcomes:

At the end of this Course the student will be able to

- Understand the nature, cause and effects of disasters
- Comprehend the importance of Disaster Management and the need of awareness
- Acquire knowledge on disaster preparedness, recovery remedial measures and personal precautions

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

IOT APPLICATIONS IN ELECTRICAL ENGINEERING

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- To learn about a few applications of Internet of Things
- To distinguish between motion less and motion detectors as IOT applications
- To know about Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- To understand about applications of IOT in smart grid
- To introduce the new concept of Internet of Energy for various applications

UNIT – I: SENSORS **10 Hrs**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about basic principles of sensors and their classification **L1**
- To learn about various motion less sensors **L2**

UNIT – II: Occupancy and Motion detectors **10 Hrs**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about Capacitive occupancy **L1**
- To understand about Motion detectors **L2**

UNIT – III: MEMS **10 Hrs**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand about the basic concept of MEMS **L1**
- To know about electrostatic actuation **L2**

UNIT – IV: IOT FOR SMART GRID **10 Hrs**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

Learning Outcomes:

At the end of this unit, the student will be able to

- To get exposure fundamental applications of IoT to Smart grid **L1**
- To learn about driving factors of IoT in Generation level **L2**

UNIT – V: IOE - Internet of Energy **10 Hrs**

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IOE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid.

Learning Outcomes:

At the end of this unit, the student will be able to

- To get exposed the new concept of internet of energy **L1**
- To learn about architecture of IOE **L2**

Text Books:

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD SundaramShriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

Course Outcomes:

At the end of this Course the student will be able to

- To get exposed to recent trends in few applications of IoT in Electrical Engineering **L1**
- To understand about usage of various types of motionless sensors **L2**
- To understand about usage of various types of motion detectors **L3**
- To get exposed to various applications of IoT in smart grid **L4**
- To get exposed to future working environment with Energy internet **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME75a-INTRODUCTION TO COMPOSITE MATERIALS

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

UNIT – I: Introduction to composites: **10 Hrs**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the fundamentals of composites. L2
- Classify the composites based on matrix and structure. L2
- Identify the practical applications of composites. L3
- Summarize the properties and advantages of reinforcement materials. L2

UNIT – II: Polymer matrix composites **8 Hrs**

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave - Injection moulding – sheet moulding compound – properties and applications of PMCs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of polymer matrix composites. L2
- Identify the polymer matrix composites. L3
- Explain various process used in making the polymer matrix composites. L2
- Discuss the auto clave based methods. L6

UNIT – III: Metal matrix composites: **8 Hrs**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline the various types of metal matrix composite. L2
- Explain liquid state processes and solid state processes in MMCs preparation. L2
- Demonstrate In-situ processes. L2
- Identify the properties and applications of MMCs. L2

UNIT – IV: Ceramic matrix composites: **8 Hrs**

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – In-situ chemical reaction techniques – solgel polymer pyrolsis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize the various types of ceramic matrix materials. L2
- Explain the sintering, hot pressing, infiltration and lanxide process. L3
- Contrast between cold and hot isostatic pressing. L2
- Examine the properties and applications of CCMs. L2

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UNIT – V: Advances & Applications of composites: **8 Hrs**

Advantages and Limitations of carbon matrix composites – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Bio degradability - introduction to bio composites, classification, processing and, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the advantages and disadvantages of carbon matrix. **L2**
- Identify composites for aerospace applications. **L3**
- Apply chemical vapour deposition of carbon on carbon fibre perform. **L3**
- Select the carbon - carbon composites. **L1**
- Classify various bio- degradable composites. **L3**

Text Books:

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

Reference Books:

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

Course Outcomes:

At the end of this Course the student will be able to

- Identify the practical applications of composites. **L3**
- Identify the polymer matrix composites. **L3**
- Classify of bio- degradable composites. **L2**
- Outline the various types of ceramic matrix materials. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/112104229
- https://nptel.ac.in/courses/112104168
- https://nptel.ac.in/courses/101104010
- https://nptel.ac.in/courses/105108124
- https://nptel.ac.in/courses/112104221

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AME75b-CUSTOMER RELATIONSHIP MANAGEMENT

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about

- Introduce basic concepts and principles of customer relationship management (CRM).
- Familiarize with appreciate the role and changing face of CRM as an IT enabled function.
- Describe concept of managing and sharing customer data.
- Explain the principles of CRM links in e-Business.
- Expose the students on Enterprise resource planning (ERP),supply chain management (SCM) and Supplier relationship management (SRM).

UNIT – I: CRM concepts **10 Hrs**

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of customer relationship management. **L2**
- Define customer relationship management (CRM). **L1**
- Illustrate the service level agreements (SLAs). **L2**

UNIT – II: CRM in Marketing : **8 Hrs**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling & Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling - Channel Optimization - Event-based marketing. - CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of one-to-one relationship marketing. **L2**
- Develop the skills related to predict the behaviour and retention of the customer. **L6**
- Discus about customer profitability and value modeling. **L6**
- Illustrate the various methods for CRM and customer service. **L2**

UNIT – III: Sales Force Automation **8 Hrs**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM). - Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of CRM links in e-Business. **L1**
- Discus E-commerce and customer relationship on the internet. **L6**
- Describe Enterprise resource planning (ERP), Supply chain management (SCM). **L2**
- Explain terms supplier relationship management and partner relationship management. **L2**

UNIT – IV: Analytical CRM **8 Hrs**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use - Data Warehousing and Data Mining concepts - Data analysis - Market Basket Analysis (MBA), Click stream Analysis, Personalization and Collaborative Filtering.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain how to manage and sharing the customer data. **L2**

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- List the various ethics and legalities of customer database use. **L1**
- Describe various data warehousing and data mining concepts **L3**
- Discus about market basket analysis (MBA). **L6**

UNIT – V: CRM Implementation **8 Hrs**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define success factors for implementing the customer relationship management. **L1**
- Define functionalities of CRM. **L1**
- Explain the functions of CRM development team. **L2**
- Compare Home grown and out-sourced approaches. **L2**

Text Books:

1. Alok Kumar Rai, Customer Relationship Management Concept & Cases, Prentice Hall Of India Private Limted, New Delhi. 2011.
2. S. Shanmugasundaram, Customer Relationship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.

Reference Books:

1. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.
2. Jagdish Seth, Et Al, Customer Relationship Management.
3. V. Kumar & Werner J., Customer Relationship Management, Willey India, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Summarizes the how CRM works in industries. **L2**
- Discuss about market basket analysis (MBA). **L6**
- Develop the skills related to predict the behaviour and retention of the customer. **L6**
- Explain the concepts of customer relationship management. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/110105145
- https://onlinecourses.swayam2.ac.in/imb19_mg10/preview
- https://www.classcentral.com/course/swayam-customer-relationship-management-13977
- https://www.edx.org/course/customer-relationship-management

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC75a- FUNDAMENTALSTO IMAGE PROCESSING

(Open Elective-III)

L–T – P - C
3 – 0 – 0 – 3

Course Objectives:

- To learn the fundamentals of Image Processing and learn the different types of image transforms.
- To study different types of filtering techniques for image enhancement.
- To understand various types of image segmentation and thresholding techniques.
- To gain knowledge on wavelets and multi resolution image processing techniques.
- To comprehend various types of image compression and colour image processing methods.

UNIT I

Digital Image Fundamentals: Fundamental steps of digital image processing, Components of Digital Image processing, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures. Applications of Digital Image Processing.

Image Transforms: Fourier Transform and its properties in one dimensional and Two dimensional, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Sine transform, Walsh transform, Hadamard transform, Slant transform, KL Transforms and its properties.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the fundamentals of digital image processing.(L2)
- Analyze the image transforms in one and two dimensions.(L4)

UNIT II

Image Enhancements and Filtering: Gray level transformations, Histogram processing, histogram equalization, Enhancement of Frequency domain, Homomorphic filtering, Filtering in the frequency domain. Image Restoration: A Model of the Image Degradation \ Restoration Process, Noise Models, Inverse filtering, Minimum Mean Square Error (Weiner) Filtering, Constrained least squares filtering.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Analyze the filters in spatial and frequency domains. (L4)
- Understand the image restoration model and various types of noises in image restoration.(L2)

UNIT III

Image Segmentation: Detection of Discontinuities: Point detection, Line detection, Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Learn the concept of image segmentation.(L1)
- Analyze various types of thresholding techniques.(L4)

UNIT IV

Wavelets and Multi-resolution image processing: Back ground, Image Pyramids, Sub band coding, The HaarTransform.Multi resolution Expansions: Series Expansions, Scaling Functions, Wavelet Functions, Wavelet Transform in One dimension: The wavelet series expansions, The Discrete wavelet transform, The Continuous Wavelet Transform, The Fast wavelet Transform, Wavelet transform in two dimensions, Wavelet Packets.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the wavelets in one dimension and two dimensions.(L2)
- Explain the multi-resolution expansions and fast wavelet transform.(L1)

UNIT V:

Image Compression: Redundancy, coding, inter-pixel and psycho-visual; Loss less compression – Huffmann coding, predictive coding; Lossy Image compression- predictive and transform coding; Image compression standards.

Color Image Processing: Color Fundamentals, Color models–RGB, CMY, HSI; Pseudo color Image Processing, Basics of Full color Image Processing.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand the need for image compression and its types.(L2)
- Learn the color image processing and various types of color models. (L1)

TEXT BOOKS:

1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Second Edition, Pearson Education, 2008.
2. Anil Kumar Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2nd edition 2004.

REFERENCES:

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, "Digital Image processing using MATLAB", Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan and T Veerakumar, "Digital Image processing", Tata McGraw Hill.
3. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.

Course outcomes:

At the end of this course, the students will be able to

- Understand the fundamentals of Image Processing and apply different types of image transforms. (L2)
- Correlate different types of filtering techniques for image enhancement. (L4)
- Understand various types of image segmentation and thresholding techniques.(L2)
- Gain knowledge on wavelets and multi resolution image processing techniques.(L1)
- Summarize different types of image compression and colour image processing methods.(L2)

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AEC75b- BASICS OF VLSI DESIGN

(Open Elective-III)

L-T-P-C
3-0-0-3

Course Objectives:

- To give exposure to different steps involved in the fabrication of ICs and electrical properties of MOS devices.
- To know the design rules in drawing the layout of any logic circuit.
- To design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
- To learn the concepts scaling and designing building blocks of data path of any system using gates.
- Understand the design and operation of basic programmable logic devices.

UNIT I

MOS Technology: Introduction to IC Technology. The IC Era, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, nMOS and CMOS Fabrication processes.

Basic Electrical Properties of MOS Circuits: I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Transconductance and Output Conductance, nMOS Inverter, Determination of Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, CMOS Inverter.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand different steps involved in the fabrication of ICs and electrical properties of MOSdevices.(L2).
- Analyze the operation of NMOS, CMOS and BiCMOS inverters.(L4)

UNIT II

MOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly CMOS rules, Layout Diagrams-A Brief Introduction, Symbolic Diagrams-Translation to Mask Form.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Know the VLSI design flow and stick diagrams.(L1)
- Understand the design rules in drawing the layout of any logic circuit.(L2)

UNIT III

Basic Circuit Concepts: Sheet Resistance. Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, standard unit of capacitance, area Capacitance calculations, the Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Understand different types of logics in gate level design.(L2)
- Learn and compare different performance parameters in gate level design.(L1)

UNIT IV

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.

Sub System Design and Layout: Switch logic, Gate logic, Examples of Structured Design, parity generator, multiplexers, grey to binary code converter.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Appreciate the importance, models and limitations of scaling.(L1)
- Explain the building blocks of data path of any system using gates.(L1)

UNIT V

Programmable Logic Devices: Read only memories, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Complex programmable logic devices, Field programmable gate arrays.

Learning Outcomes:

At the end of the unit, the student will be able to:

- Explain different programmable logic devices.(L1)
- Compare the performance parameters and applications of different programmable logic devices.(L2)

TEXTBOOKS:

1. Kamran Eshraghian. Douglas, A. Pucknell and SholehEshraghian, "Essentials of LSI Circuits and Systems", Prentice Hall of India Private Limited, 2005 Edition.
2. Neil H.E.WESTE, David HarrisandAyan Banerjee, "CMOS VLSI Design A Circuits and systems perspective", Pearson Education, 2006 Third Edition

REFERENCES:

1. Richa Jain and Amrita Rai, "Principles of VLSI and CMOS Integrated Circuits", S.Chandand Company Limited. First edition.2012.
2. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition.

Course Outcomes:

At the end of this course, the students will be able to

- Understand different steps involved in the fabrication of ICs and electrical properties of MOS devices. (L2)
- Know the design rules in drawing the layout of any logic circuit.(L1)
- Compare different types of logic gates using CMOS inverter and their transfer characteristics.(L2)
- Learn the concepts to design building blocks of data path of any system using gates.(L1)
- Gain knowledge about basic programmable logic devices and testing of CMOS circuits.(L1)

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACS75A- APPLICATIONAS OF AI

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives:

- Define Artificial Intelligence and establish the cultural background for study Understand various learning algorithms
- Explore the searching and optimization techniques for problem solving
- Provide basic knowledge on Natural Language Processing and Robotics

UNIT – I: Introduction

What is AI, Foundations of AI, History of AI, The State of Art. Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recognize the importance of Artificial Intelligence **L1**
- Identify how intelligent agent is related to its environment **L2**

UNIT – II: Solving Problems by searching:

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain how an agent can formulate an appropriate view of the problem it faces. **L2**
- Solve the problems by systematically generating new states **L2**

UNIT – III: Reinforcement Learning:

Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL 10 Page Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction..

Learning Outcomes:

At the end of this unit, the student will be able to

- Examine how an agent can learn from success and failure, reward and punishment. **L5**
- Develop programs that make queries to a database, extract information from texts, and retrieve relevant documents from a collection using Natural Language Processing. **L6**

UNIT-IV: Natural Language for Communication

Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

Learning Outcomes:

At the end of this unit, the student will be able to

- Develop programs that translate from one language to another, or recognize spoken words. **L6**
- Explain the techniques that provide robust object recognition in restricted context. **L2**

UNIT – V: Robotics:

Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the role of Robot in various applications.
- List the main philosophical issues in AI.

Text Books:

1. Stuart J.Russell, Peter Norvig, “Artificial Intelligence A Modern Approach”, 3rd Edition, Pearson Education, 2019.

Reference Books:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

Course Outcomes:

At the end of this Course the student will be able to

- Apply searching techniques for solving a problem **L3**
- Design Intelligent Agents **L6**
- Develop Natural Language Interface for Machines **L6**
- Design mini robots **L6**
- Summarize past, present and future of Artificial Intelligence **L5**

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA

20ACS75B- MOBILE APPLICATION DEVELOPMENT

(Open Elective-III)

L	T	P	C
3	0	0	3

Course Objectives:

- Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

UNIT – I:

Introduction Android Programming: What is Android, Activities, Linking Activities Using Intents, Fragments, Calling Built – in Applications using Intents, Displaying Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L2**
- demonstrate their skills of using Android software development tools **L2**

UNIT – II:

Android User Interface: Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Listening for UI Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to develop software with reasonable complexity on mobile platform **L3**
- demonstrate their ability to deploy software to mobile devices **L3**

UNIT – III:

Designing User Interface with Views: Basic Views, Picker Views, Using List Views to Display Long Lists.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to debug programs running on mobile devices **L4**
- demonstrate their ability to deploy software to mobile devices **L4**

UNIT-IV:

Displaying pictures and menus with views and Data Persistence: Views to Display pictures, menus with views, additional views, saving and loading user preferences, persisting data to files, creating and using databases.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their skills of using Android software development tools **L4**
- demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

UNIT – V:

Content Providers: Sharing data in android, using a content provider, creating your own content providers.

Messaging and Networking: SMS Messaging, Sending E-Mail, Networking

Location-Based Services: Displaying Maps, Getting Location Data.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to deploy software to mobile devices **L5**
- demonstrate their ability to debug programs running on mobile devices **L5**

Text Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India
2. Beginning Swift Programming, Wei-Meng Lee, December 2014, ISBN: 978-1-119-00931-3

Reference Books:

1. Enterprise J2ME: Developing Mobile Java Applications, Michael Juntao Yuan, Pearson Education, 2004.
2. Android Application Development for Java programming by James C. Sheusi, Cengage Learning
3. Android A Programmers Guide by Jerome DiMargio, TMH.

Course Outcomes:

At the end of this Course the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L3**
- demonstrate their skills of using Android software development tools **L4**
- demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

B. Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEH01-ADVANCED AUTOMOTIVE ELECTRONICS

(Honors Degree course – 1)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Explain the use of electronics in the automobile.
- Explain the importance of various types of sensors and actuators in automotive electronics.
- Demonstrate the various control elements in Engine Management system.
- Familiarize with Vehicle management systems
- Identify various electronic and the instrumentation systems used in automobile.

UNIT – I: Introduction to microcomputer: **10 Hrs**

Introduction to microcomputer: Microcomputer: Buses, memory, timing, CPU registers; Microprocessor architecture: Initialization, operation codes, program counter, branch and jump instructions, subroutine. Analog to digital converters and Digital to analog converters, sampling, polling and interrupts, digital filters, lookup table.

Learning Outcomes:

At the end of this unit, the student will be able to

- Draw the architecture of microprocessor. **L3**
- Explain the importance of subroutines, branch and jump instructions in Microprocessor. **L3**
- Compare Analog to Digital Converters and Digital to Analog Converters. **L4**
- Identify the various components of Microcomputer. **L1**

UNIT – II: Sensors and actuators: **8 Hrs**

Sensors and actuators: Speed sensors, Pressure sensors: Manifold Absolute Pressure sensor, knock sensor, Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays.

Learning Outcomes:

At the end of this unit, the student will be able to

- Recall the working principles of various types of sensors used in automotive electronics. **L1**
- Identify the practical applications of sensors and actuators. **L2**
- Apply the concept of sensors and actuators in real world applications. **L3**

UNIT – III: Electronic engine management system: **8 Hrs**

Electronic engine management system: Electronic engine control: Input, output and control strategies, electronic fuel control system, fuel control modes: open loop and closed loop control at various modes, EGR control, Electronic ignition systems – Spark advance correction schemes, fuel injection timing control

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare open loop and closed loop control systems. **L4**
- Identify the various elements in Engine Management System. **L2**
- Recall the concepts of electronic ignition system. **L1**

UNIT – IV: Electronic vehicle management system: **8 Hrs**

Electronic vehicle management system: Cruise control system, Antilock braking system, electronic suspension system, electronic steering control, traction control system, Transmission control, Safety: Airbags, collision avoiding system, low tire pressure warning system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the importance of cruise control system. **L2**
- Outline working of the safety systems. **L1**

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- Demonstrate the control of electronic steering and traction. **L2**

UNIT – V: Automotive instrumentation system : 8 Hrs

Automotive instrumentation system: Input and output signal conversion, multiplexing, fuel quantity measurement, coolant temperature and oil pressure measurement, display devices- LED, LCD, VFD and CRT, Onboard diagnostics(OBD), OBD-II, off board diagnostics.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the method of measurement of fuel quality. **L2**
- Compare onboard diagnostics and off board diagnostics. **L4**
- Discuss various types of display devices. **L2**

Text Books:

1. Understanding Automotive Electronics, William B Ribbens, Newne Butterworth-Heinermar 2003.
2. Crouse W H, Automobile Elctrical Equipment, McGraw Hill Book Co.Inc, Newyork 2005.

Reference Books:

1. Bechhold "Understanding Automotive Electronics", SAE, 1998.
2. Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.
3. Tom Denton,"Automobile Electrical and Electronic Systems" 3rd edition- Edward Arnold, London - 2004.
4. Eric Chowanietz - 'Automotive Electronics' - SAE International USA – 1995.

Course Outcomes:

At the end of this Course the student will be able to

- Obtain an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today's automotive industry. **L1**
- Interface automotive sensors and actuators with microcontrollers. **L2**
- Know, the various display devices that are used in automobiles. **L2**
- Identify the elements in the engine management and vehicle management system. **L2**
- Obtain an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today's automotive industry. **L1**

Online Learning Resources:

- https://nptel.ac.in/courses/107106088
- https://www.youtube.com/watch?v=BOP8qLQzhDc
- https://nptel.ac.in/courses/108104140
- https://intranet.cb.amrita.edu/sites/default/files/164-AutomotiveElectronics.pdf
- http://digimat.in/nptel/courses/video/108108147/L01.html
- https://jssstuniv.in/wp-content/uploads/2020/09/M.Tech-Automotive-Electronics-_Final.pdf

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEH02-APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS

(Honours Degree course – 2)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Teach the basics of the major theories, approaches and methodologies used in CFD.
- Familiar with the differential equations for flow phenomena and numerical methods for their solutions.
- Introduce explicit and implicit schemes in hyperbolic equations.
- Expose the students to solve the problems through finite volume method.
- Understand the concepts of linear fluid flow problems, steady state problems and transient problems.

UNIT – I: Introduction and Solution methods **10 Hrs**

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare FDM, FEM, FVM methods. **L1**
- List the various solution methods of elliptical equations. **L1**
- Identify the types of parabolic equations. **L3**

UNIT – II: Hyperbolic equations: **8 Hrs**

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe explicit and implicit schemes. **L2**
- List second order one-dimensional wave equations. **L1**
- Explain the Runge-Kutta method. **L2**
- Explain Von Neumann stability analyses. **L2**

UNIT – III: Formulations Of Incompressible Viscous Flows **8 Hrs**

Formulations Of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply numerical models to fluid flow and heat transfer calculations. **L3**
- Determine incompressible viscous flows by FDM, PCM and Vortex methods. **L3**
- Formulate potential equation and Euler equations. **L6**

UNIT – IV: Finite Volume Method: **8 Hrs**

Finite Volume Method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Formulate finite volume method for two and three dimensional fluid flow problems. **L3**

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- Solve the fluid flow problems using finite volume method . L6

UNIT – V: Standard Variational Methods: **8 Hrs**

Standard Variational Methods: Linear fluid flow problems, steady state problems, Transient problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Model equations for linear fluid flow, steady state and transient flow problems. L3
- Apply standard variational methods to solve fluid flow problems. L3

Text Books:

1. Computational fluid dynamics/ T. J. C'hung/ Cambridge University press,2002.
2. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.

Reference Books:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985.
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
4. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford
5. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press

Course Outcomes:

At the end of this Course the student will be able to

- Summarize the major theories, approaches and methodologies used in CFD. **L2**
- formulate finite volume method for two and three dimensional fluid flow problems. **L3**
- apply numerical models to fluid flow and heat transfer calculations. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/112107079
- https://www.youtube.com/watch?v=3QFT7pGx03I
- https://www.youtube.com/watch?v=t7jS7V_6TGQ
- https://nptel.ac.in/courses/112107080

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEH03-MECHANICS AND MANUFACTURING OF COMPOSITE MATERIALS

(Honours Degree course – 3)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Understand the properties of composite materials.
- Familiarize the manufacturing methods for composites.
- Teach the practical requirements associated with joining and manufacturing

UNIT – I: Introduction To Composite Materials : **10 Hrs**

Introduction To Composite Materials

Introduction To Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. **Applications:** Automobile, Aircrafts. missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

Fiber Reinforced Plastic Processing: Lay-up and curing, fabricating process, open and closed mould process, hand lay-up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define Composite Materials. **L1**
- List the applications of composite materials. **L1**
- Compare open and closed mould process. **L3**
- Demonstrate the processing methods of ceramic materials. **L3**

UNIT – II: Micro & Macro Mechanics of Materials **8 Hrs**

Micro Mechanical Analysis of a Lamina:

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems.

Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Stress-Strain relations for lamina of arbitrary orientation, Numerical problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve numerical problems on evaluation of the four elastic moduli by rule of mixture. **L4**
- Understand the hooke's law for different types of materials. **L2**
- Explain the two dimensional relationship of compliance and stiffness matrix. **L2**
- Discuss the stress strain relationship for lamina of arbitrary orientation. **L2**

UNIT – III: Biaxial Strength : **8 Hrs**

Biaxial Strength Theories

Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.

Macro Mechanical Analysis of Laminate

Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation), Special cases of laminates, Numerical problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss the maximum stress theory and maximum strain theory. **L2**
- Differentiate between CL, T, A, B and D matrices. **L4**
- List the special cases of macro mechanical analysis of laminates **L1**

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UNIT – IV: Metal Matrix Composite : **8 Hrs**

Metal Matrix Composites: Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application.

Fabrication Process For MMC's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

Study Properties Of MMC's: Physical Mechanical, Wear, machinability and Other Properties. Effect of size, shape and distribution of particulate on properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the importance of metal matrix composites. **L2**
- Give the applications of metal matrix composites. **L1**
- Recall the fabrication processes for MMC's. **L1**
- Demonstrate on the various properties of MMC's. **L2**

UNIT – V: Failure Theories : **8 Hrs**

Failure Theories: Micromechanics of Failure of Unidirectional Lamina, Anisotropic Strength and Failure Theories, Importance of Shear Strength, Choice of Failure Criteria, Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss the failure theories of unidirectional lamina. **L2**
- Explain the anisotropic strength of unidirectional lamina . **L2**
- Understand the choice of failure criteria with help of examples. **L2**

Text Books:

1. K.K. Chawla, Composite Materials, Springer-Verlag, New York. 1998.
2. B.T. Astrom, Manufacturing of Polymer Composites, Chapman & Hall, 1997.
3. Stuart M Lee, J. Ian Gray, Miltz, Reference Book for Composites Technology, CRC press, 1989.

Reference Books:

1. Frank L Matthews and R D Rawlings, Composite Materials: Engineering and Science, Taylor and Francis, 2006.
2. D. Hull and T.W. Clyne, Introduction to Composite Materials, Cambridge University Press, 1996.
3. M.R. Piggott, Load Bearing Fibre Composites, Pergamon press, Oxford, 1998.
4. F. Ashby and D.R.H. Jones, Engineering Materials, Pergamon press, 1999.
5. R.W. Davidge and A. Kelly, Mechanical behavior of ceramics, Cambridge university press, 1999.
6. Andrew C. Marshall, Composite Basics, Marshall Consulting. Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination, 1998.

Course Outcomes:

At the end of this Course the student will be able to

- Design and manufacture composite materials for various applications. **L5**
- Conduct mechanical testing of composite structures and analyse failure modes. **L4**
- Synthesize structures for environmental effects. **L5**
- Analyse economic aspects of using composites. **L4**

Online Learning Resources:

- https://nptel.ac.in/courses/112104221
- https://nptel.ac.in/courses/112104229
- https://nptel.ac.in/courses/112104161
- https://onlinecourses.nptel.ac.in/noc22_me40/preview.

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEH04-APPLICATIONS OF OPTIMIZATION TECHNIQUES

(Honours Degree course – 4)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Explain principles of optimization and its need.
- Familiarization with theory of optimization methods and algorithms developed for solving various types of optimization problems.
- Understand the mathematical foundations for Genetic Algorithm, Operators.
- Know fundamental theory and concepts of neural networks, neuro – modelling, several neural network paradigms and its applications.
- Identify the application of optimization to design of machine elements.

UNIT – I: Introduction : **10 Hrs**

Classical Optimization Techniques: Single variable optimization with and without Constraints, Multi – Variable Optimization without constraints, Multi – Variable Optimization with Constraints – Method of Lagrange Multipliers, Kuhn-Tucker Conditions.

Numerical Methods for Optimization: Interval Halving Method, Fibonacci Method, Quadratic Interpolation Method, Newton Method, Quasi Newton Method, Secant Method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different classical and numerical optimization algorithms. **L3**
- Understand optimization methods and algorithms developed for solving various types of optimization problems. **L3**

UNIT – II: Genetic Algorithm (GA): **8 Hrs**

Differences and Similarities between Conventional and Evolutionary Algorithms, Working Principle, Reproduction, Crossover, Mutation, Termination Criteria, Different Reproduction and Crossover Operators, GA for Constrained Optimization, Draw Backs of GA.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems. **L3**
- Understand various operations in Genetic Algorithms. **L2**

UNIT – III: Genetic Programming (GP): **8 Hrs**

Principles of Genetic Programming, Terminal Sets, Functional Sets, Differences between GA & GP, Random Population Generation, Solving Differential Equations using GP.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand principles of Genetic Programming. **L2**
- Apply Genetic Programming, a computational problem-solving technique based on evolutionary principles. **L4**

UNIT – IV: Neural networks : **8 Hrs**

Introduction to Neural networks: Knowledge base information processing, General View of Knowledge Based Algorithm, Neural Information Processing, Hybrid Intelligence and Artificial Neurons.

Characteristics of Artificial Neural Networks: Single Neural Networks, Multi – Layer Neural Networks, Training of ANN – Objective, Supervise Training, Unsupervised Training, Overview of training.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand principles of ANN and training of networks. **L2**

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- Learn training, verification and validation of neural network models. **L1**

UNIT – V: Applications of Optimization in Design and Manufacturing Systems: 8 Hrs

Some typical applications like Optimization of Path Synthesis of a Four – bar Mechanism, Minimization of Weight of a Cantilever Beam, Optimization of Springs and Gears, General Optimization model of a Machining Process, Optimization of Arc Welding Parameters and General Procedure in Optimizing Machining Operations Sequence.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different techniques to solve various optimization problems arising from engineering areas. **L2**
- Identify different approaches of optimizing (maximizing or minimizing) an engineering problem or a function. **L4**

Text Books:

1. Singiresu S. Rao, Engineering Optimization, 3/e, New Age Publishers, 2010
2. Bart Kosko, Neural Networks and Fuzzy System, 2/e, Prentice Hall of India, 2001
3. Goldberg D.E., Genetic algorithms in Search, Optimization, and Machine learning, 4/e, Pearson, 2009.
4. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, 2/e, PHI Learning Pvt. Ltd., 2012.

Reference Books:

1. Kalyanmoy Deb, Multi Objective Optimization using Evolutionary Algorithms, 1/e, John Wiley and Sons, 2001.
2. Jasbir S. Arora, Introduction to Optimum Design, 4/e, Academic Press, 2016.
3. Ravindran A., Engineering Optimization Methods and Applications, 2/e, John Wiley and Sons, 2006
4. Fox R.L., Optimization Methods for Engineering Design, 1/e, Addison Wesley Publication Co., 1971.

Course Outcomes:

At the end of this Course the student will be able to

- Know the principles of optimization and its need. **L2**
- Identify optimization methods and algorithms developed for solving various types of optimization problems. **L2**
- Understand and appreciate the basic concepts of Genetic Algorithms and results of applying various genetic operators. **L3**
- Solve the concepts of Neural Networks for training and validation of neural network models. **L6**
- Know the principles of optimization and its need. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/107106088
- https://www.youtube.com/watch?v=BOP8qLQzhDc
- https://nptel.ac.in/courses/108104140
- https://intranet.cb.amrita.edu/sites/default/files/164-AutomotiveElectronics.pdf
- http://digimat.in/nptel/courses/video/108108147/L01.html
- https://jssstuniv.in/wp-content/uploads/2020/09/M.Tech-Automotive-Electronics-_Final.pdf

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM07-MATERIAL SCIENCE FOR ENGINEERS

(Minor degree course in 3D Printing – 1)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
- To Explain the methods to change the properties of materials through heat treatment processes.
- To Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
- To Familiarize properties and applications of ceramics, polymers and composite materials.
- To Demonstrate the fundamental properties of nano-materials and their applications.

UNIT – I: Structure of Metals and Constitution of alloys **10 Hrs**

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of material science in engineering. L2
- Recall the definitions and terminology of crystallography. L1
- Distinguish metals and alloys. L4
- Make use of the principles of construction of binary phase diagrams. L3
- Identify various invariant reactions in binary phase diagrams. L3

UNIT – II: Heat Treatment of Steels **8 Hrs**

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe_3Calloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the importance of steel and iron - iron carbide phase diagram. L2
- Explain the influence of heat treatment in modification of properties of steels. L2
- Develop a heat treatment cycle based on properties required. L3
- Explain the principles of surface hardening methods. L2

UNIT – III: Steels and Cast Irons **8 Hrs**

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Micro structure, properties and applications of alloy steels-stainless steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify various types of steels, their properties and applications. L2
- Identify various types of cast irons, their properties and applications. L3

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- Compare steels and cast irons and their limitations in applications. **L3**

UNIT – IV: Non-ferrous Metals and Alloys: **8 Hrs**

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cu phase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the importance of non-ferrous metals and alloys in engineering applications. **L2**
- Demonstrate various properties and applications of non-ferrous alloys. **L4**
- Differentiate between hardening of ferrous and non-ferrous alloys. **L4**

UNIT – V: Ceramics, Polymers and Composites: **8 Hrs**

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterial's.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of ceramics and their applications. **L2**
- Summarize the properties of polymers and composites and their use. **L2**
- Interpret the properties of Nano materials and their applications. **L2**
- Identify the difference between the micro and Nano scale materials and their uses. **L3**

Text Books:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.

Reference Books:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997..
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Course Outcomes:

At the end of this Course the student will be able to

- Explain the principles of binary phases. **L2**
- Apply heat treatment to different applications. **L3**
- Select steels and cast irons for a given application. **L3**
- Utilize nonferrous metals and alloys in engineering. **L3**
- Choose composites for various applications. **L3**
- Assess the properties of Nano-scale materials and their applications. **L2**

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM08-COMPUTER AIDED MACHINE DRAWING

(Minor degree course in 3D Printing – 2)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.

UNIT – I: Isometric and Orthographic Projections **8 Hrs**

Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes Figures, Simple and Compound Solids-Conversion of isometric Projections/Views of Orthographic Views-Conventions.

Learning Outcomes:

At the end of this unit, the student will be able to

- list various types of projections **L2**
- apply the knowledge of engineering graphics for Isometric views construction **L5**
- apply the basic knowledge for construction of orthographic views. **L5**

UNIT – II: Perspective projections **8 Hrs**

Perspective projections –Planes and simple solids. Vanishing point Method only.

Learning Outcomes:

At the end of this unit, the student will be able to

- Draw the perspective projections **L4**

UNIT – III: Detachable Joints & Permanent Joint **10 Hrs**

Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Draw the various types of detachable joints **L4**
- Identify the various types of welding joints **L3**
- Draw the riveted joints **L3**

UNIT – IV: Keys and Couplings **10 Hrs**

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling: bushed pin-type flange coupling, universal joint, Oldhams' coupling.

Sectional views: Creating solid models of complex machine parts and create sectional views.

Learning Outcomes:

At the end of this unit, the student will be able to

- Draw the various types of keys **L4**
- Identify the various types of couplings **L4**
- Draw the sectional views of various complex machine parts. **L5**

UNIT – V: Assembly drawings **10 Hrs**

Piston, connecting rod, Eccentric, Screw jack, Plumber block, Pipe vice, Clamping device, Tail stock, Air Cock, Machine vice, Carburetor.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the basic knowledge to construct the screw jack and plumber block **L6**

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- Draw the assembly drawings of machine componets **L6**

Text Books:

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.
2. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.

Reference Books:

1. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
2. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Course Outcomes:

At the end of this Course the student will be able to

- Demonstrate the conventional representations of materials and machine components. **L6**
- Model riveted, welded and key joints using CAD system. **L5**
- Create solid models and sectional views of machine components. **L6**
- Generate solid models of machine parts and assemble them. **L5**
- Translate 3D assemblies into 2D drawings. **L6**

Online Learning Resources:

- https://www.youtube.com/watch?v=4U0kmyXT47o
- https://www.youtube.com/watch?v=EA3YOMfh99M
- https://www.bietdvg.edu/media/department/ME/data/learning-materials/CAMD_MANUAL18ME36A_FINAL.pdf
- https://www.youtube.com/watch?v=4vw1GpigfMk

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM09 – 3D PRINTING MATERIALS

(Minor degree course in 3D Printing – 3)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about
- Explain the need of 3D Printing Technology.
- Familiarize manufacturing of polymer components.
- Describe the manufacture of products through powder metallurgy.
- Impart knowledge on various material characterization techniques.

UNIT – I: Introduction **8 Hrs**

Need for AM, Historical Development, Fundamentals of AM, AM Process Chain, Advantages and Limitations of AM, Classification of AM Systems, Materials used in AM.

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain the importance and historical development of AM. **L2**
- Discus about the advantages and limitations of AM **L3**
- Distinguish various types of AM systems. **L4**

UNIT – II: Polymers basic concepts **8 Hrs**

Polymers Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD].

Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques.

Learning Outcomes:

At the end of this unit, the student will be able to
- Understand the polymers use in AM system. **L2**
- Explain the Molecular weight distribution (MWD). **L2**
- Develop a Polymer processing methods. **L3**
- Explain the process of moulding and casting of polymers. **L2**

UNIT – III: Powder Metallurgy **10 Hrs**

Powder Metallurgy Basic Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM, Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes.

Learning Outcomes:

At the end of this unit, the student will be able to
- Classify various types of powder metallurgical techniques. **L2**
- Identify various types of atomization methods of metal powder **L3**
- Compare other emerging processes for manufacturing of powder preforms **L3**

UNIT – IV: Powder Shaping and Sintering **10 Hrs**

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, isostatic pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.

Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components.

Learning Outcomes:

At the end of this unit, the student will be able to
- Explain the powder compaction and process variables. **L2**
- Summarize the density distribution during compaction. **L2**

- Explain the Theory of Sintering. **L2**
- discus about Physical & Mechanical Properties Evaluation. **L3**

UNIT – V: Introduction to Characterization **10 Hrs**

Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization. Microstructures of Powder by Different techniques characterization methods -BET surface area analyzer, Atomic force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), Small Angle X-ray Scattering (SAXS) and High Power X-ray.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the properties of powder particles **L2**
- Summarize the various types of powder characterization methods. **L2**
- Interpret the results of XRD, SAXS and TEM. **L2**
- Identify the surface texture using surface area analyzer. **L3**

Text Books:

1. Chee Kai Chua, Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" 5/e, World Scientific.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4/e, 2005.

Reference Books:

1. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
2. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
3. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
4. Ray F. Egerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, Springer, 2005.

Course Outcomes:

At the end of this Course the student will be able to

- Development mechanical components with powder metallurgy technique. **L6**
- Select materials for Additive Manufacturing. **L4**
- Explain the concept of material characterization. **L3**
- Understand the concepts of powder shaping and sintering. **L1**

Online Learning Resources:

- https://nptel.ac.in/courses/112104265
- https://nptel.ac.in/courses/112103306
- https://nptel.ac.in/courses/108108115
- https://onlinecourses.nptel.ac.in/noc20_mg70/preview
- https://nptel.ac.in/courses/116102052

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B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM10 – APPLICATIONS OF 3D PRINTING

(Minor degree course in 3D Printing – 4)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Explain the typical application areas of additive manufacturing.
- Familiarize with the applications of 3D printing in Design and Engineering area.
- Describe the concepts of manufacturing of bio-medical implants.
- Impart knowledge on Applications in Automotive, Civil and other fields.

UNIT – I: Typical application areas of Additive Manufacturing **8 Hrs**

Finishing Processes- Cutting Processes, Sand-Blasting and Polishing, Coating, Painting.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the applications for additive manufacturing processes finishing processes. L2
- Explain the process of painting using additive manufacturing. L3
- demonstrate the various cutting processes using AM L3

UNIT – II: Applications in Design and Engineering **10 Hrs**

Applications in Design: CAD Model Verification, Visualizing Objects, Proof of Concept, Marketing and Commercial Applications.

Applications in Engineering Analysis and Planning: Scaling, Form and Fit, Flow Analysis, Stress Analysis, Mock-Up Parts, Pre-Production Parts, Diagnostic and Surgical Operation Planning, Design and Fabrication of Custom Prosthesis and Implant.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the various applications of AM in Design area. L2
- Identify the various applications of AM in Engineering area. L2
- Understand the concept of design and fabrication of custom prosthesis and implants. L3
- Explain the applications of AM in Visualization of Objects. L3

UNIT – III: Applications in Manufacturing and Tooling **8 Hrs**

Classification of rapid tooling, Direct Soft Tooling, Indirect Soft Tooling, Direct Hard Tooling.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of rapid tooling. L3
- classify the rapid tooling L2
- Differentiate the direct tooling and indirect tooling. L3

UNIT – IV: Applications in Bio-medical and Aerospace **8 Hrs**

Operation Planning for Cancerous Brain Tumor Surgery, Planning Reconstructive Surgery with RP Technology, Craniofacial Reconstructive Surgery Planning, Biopsy Needle Housing, Knee Implants, Scaffolds for Tissue Engineering, Customized Tracheobronchial Stents, Inter-Vertebral Spacers, Cranium Implant, Design Verification of an Airline Electrical Generator, Engine Components for Fanjet Engine, Fabrication of Flight-Certified Production Castings.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand the processes of planning reconstructive surgery with RP technology. L2
- identify the applications of AM in aerospace aplications L2
- explain the concept of manufacturing of biopsy needle housing and knee implants. L3

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UNIT – V: Applications in Automotive, Civil and other fields **10 Hrs**

Prototyping Complex Gearbox Housing for Design Verification, Prototyping Advanced Driver Control System with Stereolithography, Creating Cast Metal Engine Block with RP Process, Using Stereolithography to Produce Production Tooling, Civil engineering- 3D printing in house construction, Development of Contour Crafting Process, Building Disaster Relief Shelters, Metal Frames For Solid Structures, other fields- Coin industry, Jewelry Industry, tableware industry.

Learning Outcomes:

At the end of this unit, the student will be able to

- Indentify the applications of RP in Automotive fields. **L2**
- Explain the concept of creating cast metal engine block with RP processes. **L2**
- Understand the use of Stereo lithography to Produce Production Tooling. **L3**
- Identify the applications of RP in CIVIL and jewelry industry. **L2**

Text Books:

1. Chee Kai Chua, Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" 5/e, World Scientific.
2. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.
4. RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Course Outcomes:

At the end of this Course the student will be able to

- Design CAD model and verification of CAD model. **L6**
- Select type of 3D printing technology for different applications. **L2**
- Identify the various applications of 3D printing in manufacturing and aerospace. **L3**
- Explain the various Applications of 3D printing in Automotive, Civil and other fields. **L2**
- List the various applications of 3D printing technology. **L1**

Online Learning Resources:

- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM13 – INTRODUCTION TO ROBOTICS

(Minor degree course in Robotics and Automation -1)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system.

UNIT – I: Fundamentals of Robots **10 Hrs**

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define the robot L2
- Classify the robots L1
- Design the workspace for a robot manipulator using homogeneous transformation matrix. L6
- Indentify the robot characteristics.

UNIT – II: Kinematics, Differential Motions and Velocities of Robot **8 Hrs**

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, the inverse kinematic of robots, degeneracy and dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

Learning Outcomes:

At the end of this unit, the student will be able to

- describe the concept of Forward and inverse kinematics of robots L3
- understand the concept of DH Representation of forward kinematics L2
- Explain the use of Jacobian matrix for position of the end effector.. L3

UNIT – III: Control of Manipulators **8 Hrs**

Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand the control of manipulators L1
- describe the characteristics of second-order liner systems. L3
- explain the PD and PID control scheme L3
- apply the various force control strategies in manipulator control. L5

UNIT – IV: Robot Vision **8 Hrs**

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

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Learning Outcomes:

At the end of this unit, the student will be able to

- list the various parts of Robot vision system **L1**
- explain the concept of image processing and segmentation. **L2**
- describe the various industrial applications of robot vision **L3**
- state the camera transformations and calibration techniques **L3**

UNIT – V: Robot Cell Design and Programming **8 Hrs**

Robot cell layouts – Robot centered cell, In – line robot cell, considerations in work cell design, work cell control, inter locks, error detection, work cell controller. Methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of robot cell design. **L2**
- List the methods of robot programming. **L1**
- Understand the robotic languages. **L2**
- Explain the concept of work cell control design. **L3**

Text Books:

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — Mc Graw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

Reference Books:

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers, 1987.
5. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
6. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence. Mc Graw Hill, 1987.
7. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

At the end of this Course the student will be able to

- Explain fundamentals of Robots. **L2**
- Apply kinematics and differential motions and velocities. **L3**
- Demonstrate control of manipulators. **L2**
- Understand robot vision. **L2**
- Develop robot cell design and programming. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/108105088
- https://nptel.ac.in/courses/108105063
- https://nptel.ac.in/courses/108105062
- https://nptel.ac.in/courses/112104288

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM14 – INDUSTRIAL AUTOMATION

(Minor degree course in Robotics and Automation -2)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Impart the basic knowledge of automation and process control systems.
- Familiarize the automated flow lines and assembly line balancing.
- Demonstrate the primary material handling systems.
- Focus process industries, discrete manufacturing industries.
- Explain various control system components, programmable logic controllers and personal computers.

UNIT – I: Introduction To Automation **10 Hrs**

Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation. Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high-speed automatic insertion devices.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define the automation in production system. **L1**
- Describing the concept of information processing in manufacturing. **L2**
- Classify the types of hardware components of automation and control system. **L2**
- Identify the elements of automated system. **L1**

UNIT – II: Automated Flow Lines and Assembly Line Balancing **8 Hrs**

Automated Flow Lines: Part transfer methods and mechanisms, types of flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

Assembly Line Balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describing the concept of assembly line balancing. **L2**
- Identify the components of automated manufacturing system. **L1**
- Understand the concept of flow line with/without buffer storage. **L1**
- Compare various types of part transfer mechanisms. **L2**
- Analyze the ways of improving line balancing. **L6**

UNIT – III: Material Handling and Identification Methods **8 Hrs**

Material Handling Systems and Design: Introduction to Material Handling, Material Transport equipment, analysis of material transport systems, storage systems – storage system performance and location strategies, Conventional storage methods and equipment, Automated storage systems, Engineering analysis of storage systems.

Automatic Identification Methods: Overview of Identification Methods, Barcode technology, Radio frequency identification, other AIDC technologies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design a simple material handling system for low cost manufacturing. L6
- explain the concept of automated storage systems L3
- understand the barcode technology in manufacturing industry L1
- describe the AIDC technology. L3

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UNIT – IV: Industrial Control Systems **8 Hrs**

Industrial Control Systems: Process industries Vs Discrete manufacturing industries, levels of automation in the two industries, variables and parameters in the two industries. Continuous Vs Discrete control – continuous control system, discrete control system.

Computer Process Control and Its Forms: Control requirements, capabilities of computer control and forms of computer process control.

Learning Outcomes:

At the end of this unit, the student will be able to

- differentiate between Process industries Vs Discrete manufacturing industries **L4**
- Identify the levels of automation in Process industries Vs Discrete manufacturing industries **L1**
- understand the capabilities of computer control. **L1**
- describe computer process control **L3**

UNIT – V: Control System Components, PLC and PC **10 Hrs**

Control System Components: Sensors, Actuators, analog to digital convertors, digital to analog convertors, input/out devices for discrete data.

Programmable Logic Controllers and Personal Computers: Discrete process control, Programmable logic controllers, Ladder logic diagrams, personal computers using soft logic.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the various control system components in automation **L1**
- explain the concept of discrete process control **L2**
- understand the PLC and ladder logic diagrams **L3**
- Classify the various types of sensors used in control systems **L1**

Text Books:

1. M.P. Groover, Automation, Production systems and Computer Integrated Manufacturing, 3/e, PHI Learning, 2013.
2. Geoffrey Boothroyd, Assembly Automation and Product design, Taylor and Francis Publishers, 2005.
3. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas, G.Odrey, Industrial Robotics, Mc Graw Hill, 1986.

Reference Books:

1. Krishna Kant, Computer based industrial control, Prentice Hall of India, 2000.
2. Tiess Chiu chang and A.W.Richard, An introduction to automated process planning systems, Tata McGraw Hill, 2000.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the knowledge of an automation and process control strategies. **L3**
- Illustrate the automated flow lines and assembly line balancing. **L2**
- Utilize the basic material handling systems. **L3**
- Classify the process industries, discrete manufacturing industries and distinguish Continuous, Discrete control systems. **L2**
- Use various control system components and outline the programmable logic controllers and personal computers. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/108105088
- https://nptel.ac.in/courses/108105063
- https://nptel.ac.in/courses/108105062
- https://nptel.ac.in/courses/112104288

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM15– HYDRAULIC AND PNEUMATIC CIRCUITS

Minor degree course in Robotics and Automation -3

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Familiarize on Fluid Power Engineering and Power Transmission System.
- Introduce the students, the basic concepts of hydraulic and pneumatic systems.
- Expose the students with various hydraulic and pneumatic actuators.
- Familiarize on fluid power systems and its applications to real time.
- Know the problem, which occur in fluid power systems and take necessary troubleshooting/ maintenance activities.
- Get practiced in designing hydraulic and pneumatic systems.
- Understand the design procedure available for Hydraulic and Pneumatic circuits.

UNIT – I: Introduction **8 Hrs**

Introduction to Fluid Power - Types, advantages and application of fluid power systems. Properties of hydraulic fluids – General types of fluids – Fluid power symbols as per ISO/ANSI. Basic Components of Hydraulic and Pneumatic Systems. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems for force and motion analysis in automation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of fluid power and its types. L2
- List the advantages and applications of fluid power systems. L1
- Explain the properties of hydraulic fluids. L2
- Draw the ISO/ANSI symbols of fluid power. L1
- Compare mechanical, electrical, hydraulic and pneumatic systems. L2

UNIT – II: Hydraulic Pumps, Actuators **8 Hrs**

Types of Hydraulic Pumps: Construction and working principle - design considerations, selection, specifications and characteristics of pumps. Types of actuators-construction and working principle - design considerations, selection, specifications and characteristics of actuators.

Control And Regulation Elements: Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for hydraulic circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic working principles of the hydraulic pumps and actuators. L2
- List the types of pumps and actuators. L1
- Explain the design considerations of pumps and actuators. L3
- Identify the importance of control and regulation elements in fluid power. L2
- Select the valves for hydraulic circuits. L1

UNIT – III: Design Of Hydraulic Circuits **8 Hrs**

Speed control circuits – Regenerative circuits – Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier–Intensifier circuit. - Reservoir design - Selection of components. Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Safety circuits - Industrial circuits - Press - Milling Machine - Planner - Fork Lift.

Learning Outcomes:

At the end of this unit, the student will be able to

- Develop the hydraulic circuits for practical applications. L6
- Create circuits for various machines. L6
- Discuss the importance of accumulators and intensifiers in hydraulic circuits. L6

- Select the size of the accumulators. L1
- Explain the working principles of safety circuits. L2

UNIT – IV: Pneumatic Systems **8 Hrs**

Pneumatic fundamentals - Properties of air – Compressors – Filter, Regulator, and Lubricator unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Control Elements - Logic Circuits - Position - Pressure Sensing - Switching – Electro Pneumatic - Electro Hydraulic Circuits - Robotic Circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the fundamental concepts of pneumatic systems. L2
- List the properties of air for pneumatic system. L1
- Demonstrate on F-R-L UNIT. L3
- Identify various control elements in pneumatic system. L1
- Develop electro pneumatic and electro hydraulic circuits for robotic applications. L6

UNIT – V: Design Of Pneumatic Circuits **8 Hrs**

Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors -Uses - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design a pneumatic circuit using classic, cascade and step counter methods. L6
- Select pneumatic components for installation and maintenance of power packs. L1
- Explain the architectures of PLC and Microprocessors. L2
- Develop logical circuits in PLC for automation. L6
- Determine the faults in fluid power systems. L3

Text Books:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Majumdar S.R, "Oil Hydraulics", Tata McGraw Hill, 2000.
3. Majumdar S.R, "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2001.

Reference Books:

1. Andrew Parr, Hydraulic & Pneumatics, 2/e, Jaico Publishing House Elsevier, 1999.
2. Harry L. Stevart D.B, "Practical Guide to Fluid Power", Taraoeala Sons and Port Ltd. Broadey, 1976.
3. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

Course Outcomes:

- At the end of this Course the student will be able to
- Compare the differences between hydraulic and pneumatic systems. L2
- Identify the practical applications in automation. L3
- Build the circuits for a given applications. L6
- Develop hydraulic and pneumatic power packs. L6
- Discuss the importance of PLC and microprocessor in hydraulic and pneumatic systems. L6

Online Learning Resources:

- Chrome-extension://efaidnbmnnibpcaglefindmkaj/viewer.htms?pdfhrl https%3A%2%2Fwww.iare.ac.in%2Fsites%2Fdefault%2Ffiles%2FDHPS%2520LECTURER%2520NOTES%2520FINAL.pdf&chunk=true.
- chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwww.iare.ac.in%2Fsites%2Fdefault%2Ffiles%2FDHPS%2520PPT%2520%2520FINAL.pdf&chunk=true
- https://nptel.ac.in/courses/112/105/112105047/

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM16 – Programming of Robot and its Control

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system.

UNIT – I: Fundamentals of Robots **8 Hrs**

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots.

Learning Outcomes:

At the end of this unit, the student will be able to

- Outline the advantages, disadvantages and applications of robot. **L2**
- Compare the types of robot manipulators based on applications. **L3**

UNIT – II: Robot Actuators And Feedback Components **8 Hrs**

Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare the types of actuators used in robot manipulator. **L3**
- List out the various types of robots and feedback components. **L1**

UNIT – III: Robot Programming **8 Hrs**

Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. VAL, RAIL, AML, C, C++.

Learning Outcomes:

At the end of this unit, the student will be able to

- List out the various methods of robot programming **L1**
- Explain the requirements and features of programming **L3**

UNIT – IV: Control of Manipulators **10 Hrs**

Open and close – loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the basic concepts of robot controlling systems. **L3**
- Outline PD and PID control schemes. **L3**
- Use the force control strategies to determine the forces in robot. **L2**
- Explain the force control and torque control techniques. **L3**

UNIT – V: Robot Vision **8 Hrs**

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the components of robot vision system. **L1**
- Explain the concept of image enhancement, segmentation and transformation. **L3**
- List the various components of robot vision system. **L1**

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- Illustrate the industrial applications of robot vision system. **L4**

Text Books:

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — McGraw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

Reference Books:

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2/e, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1/e, Wiley- Inter science, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers, 1987.
5. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
6. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence. Mc Graw Hill, 1987.
7. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

At the end of this Course the student will be able to

- Explain fundamentals of Robots. **L2**
- Apply kinematics and differential motions and velocities. **L3**
- Demonstrate control of manipulators. **L2**
- Understand robot vision. **L2**
- Develop robot cell design and programming. **L3**

Online Learning Resources:

- https://nptel.ac.in/courses/112105249
- https://onlinecourses.nptel.ac.in/noc20_de11/preview
- https://nptel.ac.in/courses/112104308
- https://nptel.ac.in/courses/112104288
- https://nptel.ac.in/courses/112101099
- https://www.iare.ac.in/sites/default/files/lecture_notes/ROBOTICS_LECURE_NOTES.pdf

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B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM19-PRODUCTION PLANNING AND CONTROL

(Minor degree course in Industrial Engineering -1)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT – I: Introduction : **10 Hrs**

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational Aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the basic functions of production control. **L2**
- list the types of production **L3**
- understand the product development and design **L2**
- discuss the break even analysis and economics of a new design **L6**

UNIT – II: Work Study **8 Hrs**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

Learning Outcomes:

At the end of this unit, the student will be able to

- describe the basic procedure of work study **L3**
- enumerate the critical analysis, development and implementation **L5**
- explain types of work measurement techniques. **L2**
- illustrate the work sampling and synthesis from standard data. **L2**

UNIT – III: Product Planning And Process Planning **8 Hrs**

Product planning-Extending the original product information-Value Analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi-product system.

Learning Outcomes:

At the end of this unit, the student will be able to

- elaborate the process capabilities in multi-product system. **L3**
- illustrate the problems in lack of product planning. **L2**
- discus the need for process planning **L6**
- explain the steps involved in process planning. **L2**

UNIT – IV: Production Scheduling **8 Hrs**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of master scheduling and scheduling rules, **L2**
- discus about the Gantt charts,. **L6**
- identify the elements of material requirement planning. **L2**

UNIT – V: Inventory Control And Recent Trends In Ppc **8 Hrs**

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis - Recorder Procedure-Introduction to computer integrated production planning systems-elements of Just In Time Systems-Fundamentals of MRP II and ERP.

Learning Outcomes:

At the end of this unit, the student will be able to

- describe the inventory control and purpose of holding stock **L3**
- explain details of ordering procedures. **L2**
- discuss about the ABC Analysis **L4**

Text Books:

1. James. B. Dilworth," Operations management – Design, Planning and Control for manufacturing and services" McGraw Hill International edition 1992.
2. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.

Reference Books:

1. Chary. S.N., "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
4. Kanishka Bedi, "Production and Operations management", 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, "Operations management – A value driven approach" Irwin McGraw hill.

Course Outcomes:

At the end of this Course the student will be able to

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control. **L4**
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP). **L3**

Online Learning Resources:

- https://www.youtube.com/watch?v=yYIVumq6sVM
- https://nptel.ac.in/courses/110107141
- https://nptel.ac.in/courses/112107143
- https://www.youtube.com/watch?v=Q7KpUY8spmM

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM20-MARKETING MANAGEMENT

(Minor degree course in Industrial Engineering -2)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Developing an understanding of ideas and nuances of modern marketing.
- Describe the process to formulate and manage the B2B marketing strategy including all key components.
- Explain the techniques to conduct market analysis practices including market segmentation and targeting.
- Compare and contrast different perspectives that characterize the study of consumer behavior.

UNIT – I: Introduction : 10 Hrs

Marketing – Definitions - Conceptual frame work – Marketing environment: Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the basics marketing **L2**
- describe the human relations management **L3**
- explain information system in marketing **L2**
- discuss the prospects and challenges in global environment **L6**

UNIT – II: Marketing Strategy 8 Hrs

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

Learning Outcomes:

At the end of this unit, the student will be able to

- classify key drivers of marketing strategies **L1**
- describe strategies for industrial marketing **L2**
- explain customer marketing and service marketing **L2**
- illustrate the analysis of industrial and customer markets **L2**

UNIT – III: Marketing Mix Decisions 8 Hrs

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define pricing objectives. **L3**
- Illustrate the techniques for advertising and sales promotions **L2**
- Discus the new product and development and management **L6**
- Explain about product life cycle **L2**

UNIT – IV: Buyer Behaviour 8 Hrs

Understanding industrial and individual buyer behaviour - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the buyer behaviour **L2**
- Discus buyer behaviour models **L6**

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- Explain customer relationship management L2

UNIT – V: Marketing Research & Trends In Marketing **8 Hrs**

Marketing Information System – Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing - Ethics in marketing –Online marketing trends.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the marketing information system L2
- Explain concepts and applications of marketing research L2
- Identify the ethics in marketing L3

Text Books:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14/e, 2012
2. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e,2011.
3. Kotler, Philip(2002) Marketing Management, Millennium Edition. Intl ed. US: Prentice Hall, 2002

Reference Books:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012
2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill, First edition,2010
3. Lamb, hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning — 2012.
4. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e,2011.
5. Micheal R.Czinkota & Masaaki Kotabe, Marketing Management, Cengage, 2000.

Course Outcomes:

At the end of this Course the student will be able to

- Knowledge of analytical skills in solving marketing related problem. L6
- Awareness of marketing management process L2
- identify the scope and significance of Marketing in Domain Industry L2
- Examine marketing concepts and phenomenon to current business events In the Industry. L4

Online Learning Resources:

- https://nptel.ac.in/courses/110104068
- https://www.youtube.com/watch?v=uTIfDBH80HU&list=PLPjSqITyvDeUgSjU9XcEdZmd5Epz1L-Yn
- https://www.youtube.com/watch?v=XD7Ie16qMT4&list=PLNsppmbLKJ8JSbzCxO8TYG8HDxxO5sSmV

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B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM21-CUSTOMER RELATIONSHIP MANAGEMENT

(Minor degree course in Industrial Engineering – 3)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Introduce basic concepts and principles of customer relationship management (CRM).
- Familiarize with appreciate the role and changing face of CRM as an IT enabled function.
- Describe concept of managing and sharing customer data.
- Explain the principles of CRM links in e-Business.
- Expose the students on Enterprise resource planning (ERP),supply chain management (SCM) and Supplier relationship management (SRM).

UNIT – I: CRM concepts **10 Hrs**

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concepts of customer relationship management. L2
- define customer relationship management (CRM). L1
- illustrate the service level agreements (SLAs). L2

UNIT – II: CRM in Marketing : **8 Hrs**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling & Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing. - CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of one-to-one relationship marketing. L2
- develop the skills related to predict the behaviour and retention of the customer. L6
- discus about customer profitability and value modeling. L6
- illustrate the various methods for CRM and customer service. L2

UNIT – III: Sales Force Automation **8 Hrs**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM).

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of CRM links in e-Business. L1
- discus E-commerce and customer relationship on the internet. L6
- describe Enterprise resource planning (ERP), Supply chain management (SCM). L2
- explain terms supplier relationship management and partner relationship management. L2

UNIT – IV: Analytical CRM **8 Hrs**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use - Data Warehousing and Data Mining concepts - Data analysis - Market Basket Analysis (MBA), Click stream Analysis, Personalization and Collaborative Filtering.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain how to manage and sharing the customer data. L2

- list the various ethics and legalities of customer database use. **L1**
- describe various data warehousing and data mining concepts **L3**
- discus about market basket analysis (MBA). **L6**

UNIT – V: CRM Implementation **8 Hrs**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement.

Learning Outcomes:

At the end of this unit, the student will be able to

- define success factors for implementing the customer relationship management. **L1**
- define functionalities of CRM. **L1**
- explain the functions of CRM development team. **L2**
- compare Home grown and out-sourced approaches. **L2**

Text Books:

3. Alok Kumar Rai, Customer Relationship Management Concept & Cases, Prentice Hall Of India Private Limted, New Delhi. 2011.
4. S. Shanmugasundaram, Customer RelaTionship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.

Reference Books:

4. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.
5. Jagdish Seth, Et Al, Customer Relationship Management.
6. V. Kumar & Werner J., Customer Relationship Management, Willey India, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Summarizes the how CRM works in industries. **L2**
- Discuss about market basket analysis (MBA). **L6**
- Develop the skills related to predict the behaviour and retention of the customer. **L6**
- Explain the concepts of customer relationship management. **L2**

Online Learning Resources:

- https://nptel.ac.in/courses/110105145
- https://onlinecourses.swayam2.ac.in/imb19_mg10/preview
- https://www.classcentral.com/course/swayam-customer-relationship-management-13977
- https://www.edx.org/course/customer-relationship-management

B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

20AMEM22-SIX SIGMA AND LEAN MANUFACTURING

(Minor degree course in Industrial Engineering -4)

L	T	P	C
3	1	0	4

Course Objectives: The objectives of the course are to make the students learn about

- Introduce the students, the basic concepts of six sigma and lean manufacturing.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of cellular manufacturing and 5S.
- Understand the importance of Quality standards in manufacturing.

UNIT – I: Introduction to Six-Sigma **10 Hrs**

Introduction to Six-Sigma-Probabilistic models-Six Sigma measures-Yield-DPMO-Quality level-Reliability function using Six-Sigma-MTTF using Six Sigma-Maintenance free operating period-Availability using Six-Sigma-Point availability-Achieved availability-Operational Availability-Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concepts of probabilistic models. **L2**
- Determine the reliability function using six-sigma. **L3**
- Explain about MTTF using six sigma concepts. **L2**
- Illustrate the examples of availability using sigma. **L2**

UNIT – II: The Elements of Six Sigma and their Determination **8 Hrs**

The Elements of Six Sigma and their Determination-The Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)-Six sigma approach-Six sigma and the 1.5 σ shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- List the quality measurement techniques. **L1**
- Discus the process capability index(Cp). **L6**
- Compare the Cpk Approach and Six Sigma. **L3**
- Explain about different statistical quality control methods. **L2**
- State the relationship of control charts and six sigma. **L2**

UNIT – III: Introduction To Lean Manufacturing: **8 Hrs**

Introduction To Lean Manufacturing: Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate the basic elements of lean manufacturing. **L2**
- List the various lean manufacturing tools. **L1**
- Describe the principles of lean manufacturing. **L2**
- Compare conventional manufacturing and lean manufacturing system. **L2**

UNIT – IV: Cellular Manufacturing, JIT, TPM : **8 Hrs**

Cellular Manufacturing, JIT, TPM :Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

Learning Outcomes:

At the end of this unit, the student will be able to

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- Explain the concept of cellular manufacturing. **L2**
- Indentify the types of layouts. **L1**
- Describe the concepts of JIT and TPM. **L2**
- Demonstrate the pillars of TPM. **L2**
- Create the cell layout. **L6**

UNIT – V: Set Up Time Reduction, TQM, 5S, VSM 10 **8 Hrs**

Set Up Time Reduction, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

Learning Outcomes:

At the end of this unit, the student will be able to

- Define set up time reduction. **L1**
- Illustrate the principles and implementation of 5S techniques. **L2**
- Discus procedure and principles of value stream mapping. **L6**
- List the various reduction approaches. **L1**

Text Books:

1. U Dinesh Kumar, Crocker, Chitra and Harithe Saranga, Reliability and Six Sigma, Springer Publishers.
2. Sung H. Park, Six Sigma for Quality and Productivity Promotion, Asian Productivity Organization
3. Sammy G. Shina, Six Sigma for Electronics Design and Manufacturing, McGraw-Hill.

Reference Books:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003.
2. Mikell P. Groover (2002) _Automation, Production Systems and CIM.
3. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.

Course Outcomes:

At the end of this Course the student will be able to

- Summarize various techniques that are related to the six-sigma and lean manufacturing. **L2**
- Outline the concepts of cellular manufacturing, JIT and TPM. **L2**
- Illustrate the principles and implementation of 5S techniques. **L2**
- Discus procedure and principles of value stream mapping. **L6**
- Determine the reliability function using six-sigma. **L3**

Online Learning Resources:

- https://www.youtube.com/watch?v=G_0bl6FHo_c
- https://www.youtube.com/watch?v=SMOQV2CyVQo&list=PL8F39D0611CB7BD3B
- https://www.youtube.com/watch?v=iEM0df_0-0o
- https://www.youtube.com/watch?v=2ePeXePNLrs
- https://www.youtube.com/watch?v=50yrQ5Ub1lc&list=PLLy_2iUCG87B2T7MqpfCr8Vl4A5nwLVm2
- https://www.youtube.com/watch?v=-2Cd38P6YO0
- https://www.youtube.com/watch?v=Xi12Lwmz5dE
- https://www.youtube.com/watch?v=9P9Gs8o9oHk
- https://nptel.ac.in/courses/110105123