JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU
Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING

I Year B.Tech. ME-I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	English-I	3	1	0	3
2	THEORY	Mathematics-I	3	1	0	3
3	THEORY	Environmental Studies	3	1	0	3
4	THEORY	Engineering Drawing-I	1	1	3	3
5	THEORY	Engineering Chemistry	3	1	0	3
6	PRACTICA L	Communication Skills Lab	0	0	3	3
7	PRACTICAL	Chemistry Lab	0	0	3	2
8	PRACTICAL	Engineering Workshop/IT Workshop	0	0	3	2
9		NSS/NCC				
		Total	**13**	**5**	**12**	**21**

I Year B.Tech ME- II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Technical English-II	3	1	0	3
2	THEORY	Mathematics -II	3	1	0	3
3	THEORY	Computer programming	1	1	3	3
4	THEORY	Engineering Physics	3	1	0	3
5	THEORY	Engineering Drawing-II	3	1	0	3
6	THEORY	Engineering Mechanics	3	1	0	3
7	PRACTICAL	Computer programming Lab	0	0	3	2
8	PRACTICAL	Engineering Physics Lab	0	0	3	2
		Total	**16**	**6**	**9**	**22**

II Year B.Tech. ME- I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Thermodynamics	3	1	0	3
2	THEORY	Mathematical Methods	3	1	0	3
3	THEORY	Electrical and Electronics Engineering	3	1	0	3
4	THEORY	Mechanics of Solids	3	1	3	3
5	THEORY	Machine Drawing	1	1	3	3
6	THEORY	Material Science and Metallurgy	4	0	0	3
7	PRACTICAL	Electrical and Electronics Engineering Lab	0	0	3	2
8	PRACTICAL	Mechanics of Solids Lab & Material Science Lab	0	0	3	2
9		Human Values & Professional Ethics	2	0	0	0
		Total	**20**	**4**	**13**	**22**

II Year B.Tech. ME- II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Design of Machine Members-I	3	1	0	3
2	THEORY	Fluid Mechanics & Hydraulic Machinery	3	1	0	3
3	THEORY	Kinematics of Machinery	3	1	0	3
4	THEORY	Thermal Engineering-I	3	1	0	3
5	THEORY	Probability and Statistics	3	1	0	3
6	THEORY	Manufacturing Technology	3	1	0	3
7	PRACTICAL	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	2
8	PRACTICAL	Manufacturing Technology Lab	0	0	3	2
9		Computer Aided Drafting Lab	0	0	3	0
		Total	**18**	**6**	**9**	**22**

III Year B.Tech. ME- I Semester

S.No		**SUBJECT**	**L**	**T**	**P**	**CREDITS**
1	THEORY	Dynamics of Machinery	3	1	0	3
2	THEORY	Managerial Economics and Financial Analysis	3	1	0	3
3	THEORY	Machine Tools	3	1	0	3
4	THEORY	Design of Machine Members – II	3	1	0	3
5	THEORY	Thermal Engineering - II	3	1	0	3
6	THEORY	Automobile Engineering	3	1	0	3
7	PRACTICAL	Thermal Engineering Lab	0	0	3	2
8	PRACTICAL	Machine Tools Lab	0	0	3	2
9		Automotive Act & Practice	0	0	3	0
		Total	18	6	9	22

III Year B.Tech. ME- II Semester

S.No		**SUBJECT**	**L**	**T**	**P**	**CREDITS**
1	THEORY	Industrial Engineering & Management	3	1	0	3
2	THEORY	Engineering Metrology	3	1	0	3
3	THEORY	Refrigeration & Air Conditioning	3	1	0	3
4	THEORY	Operations Research	3	1	0	3
5	THEORY	Heat Transfer	3	1	0	3
6	THEORY	CAD/CAM	3	1	0	3
7	PRACTICAL	Heat Transfer Lab	0	0	3	2
8	PRACTICAL	CAD/CAM Lab	0	0	3	2
9		Advanced Communication Skills Lab	0	0	3	0
		Total	18	6	9	22

IV Year B.Tech. ME- I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Finite Element Methods	3	1	0	3
2	THEORY	Renewable Energy Sources	3	1	0	3
3	THEORY	Instrumentation & Control Systems	3	1	0	3
4	THEORY	Automation & Robotics	3	1	0	3
5	THEORY	Open Elective	3	1	0	3
6	THEORY	MOOC	3	1	0	3
7	PRACTICAL	Instrumentation & Metrology Lab	0	0	3	2
8	PRACTICAL	Computer Aided Engineering Lab	0	0	3	2
9		Project Part-A -Seminar	-	-	-	2
		Total	18	6	6	24

Open Elective
Entrepreneurship
Total Quality Management
Energy Ecology & Environment

IV Year : II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Production & Operations Management	3	1	0	3
2	THEORY	Power Plant Engineering	3	1	0	3
3	THEORY	E-I	3	1	0	3
4	THEORY	E-II	3	1	0	3
5		Comprehensive Viva -Voice	0	0	3	3
6		Project Part-B	0	0	15	10
		Total	12	4	18	25

Elective-I	Elective-II
Modern Manufacturing Methods	Tribology
Jet Propulsion and Rocket Engineering	Computational Fluid Dynamics
Mechanical vibrations	Energy Management

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Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

I Year B.Tech. ME-I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	English-I	3	1	0	3
2	THEORY	Mathematics-I	3	1	0	3
3	THEORY	Environmental Studies	3	1	0	3
4	THEORY	Engineering Drawing-I	1	1	3	3
5	THEORY	Engineering Chemistry	3	1	0	3
6	PRACTICA L	Communication Skills Lab	0	0	3	3
7	PRACTICAL	Chemistry Lab	0	0	3	2
8	PRACTICAL	Engineering Workshop/IT Workshop	0	0	3	2
9		NSS/NCC				
		Total	**13**	**5**	**12**	**21**

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	T	P	C
	3	0	3

ENGLISH-I

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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

UNIT –II

Chapter entitled *Inspiration* from "Using English"
Chapter entitled '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

Chapter entitled *Sustainable Development* from "Using English"
Chapter entitled '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

Chapter entitled *Relationships* from "Using English"
Chapter entitled ' T*he 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

Chapter entitled Science and Humanism from "Using English"
Chapter entitled '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 (for detailed study)** 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. **Current English grammar and usage-**S M Guptha, PHI, 2013.
6. **Modern English Grammar-**Krishna SWAMI .McMillan, 2009.
7. **Powerful Vocabulary Builder**- Anjana Agarwal New Age International Publishers, 2011.
8. **Writing with a Purpose, Tickoo and Sasi Kumar, OUP, 2011**
9. **Strengthen Your Writing, Orient Blackswan**

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	3	0	3

MATHEMATICS – I
(Common to All Branches)

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 and Integral calculus, ordinary and partial differential equations.
- 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 e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} 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 and envelopes..

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

UNIT – IV
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 – 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.
2. Engineering Mathematics, Volume - I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.

REFERENCES:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Engineering Mathematics, Volume - I, by G.S.S.Raju, CENGAGE publisher.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
4. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
5. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Outcomes:

- The students become familiar with the application of differential and integral calculus, ordinary and partial differential equations to engineering problems.

- The students attain the abilities to use mathematical knowledge to analyze and solve problems in engineering applications.

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	3	**0**	**3**

ENVIRONMENTAL STUDIES

OBJECTIVE: *To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.*

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : 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 : Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological sucession – 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)

BIODIVERSITY AND ITS CONSERVATION : 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 : 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

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wates – 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. – 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 – V

HUMAN POPULATION AND THE ENVIRONMENT : Population growth, variation among nations. Population explosion – Family Welfare Proggramme. – 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.

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 by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palaniswamy – Pearson education
(3) Environmental Studies by R.Rajagopalan, Oxford University Press.

REFERENCES :

(1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
(3) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(5) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

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	3	**0**	**3**

ENGINEERING DRAWING-I
(MECHANICAL)

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance Drawing Instruments and their Use – BIS Conventions in drawing and Lettering.

Curves used in practice:

a) Conic sections including the Rectangular Hyperbola
b) Cycloid, Epicycloid and Hypocycloid –normals and Tangents
c) Involute of a circle –Normals and Tangents
d) Helices –multi start on cylinder and cone

UNIT –II

Principles of orthographic projections – First and Third angle projections Projection of points. Projections of lines inclined to one plane.

UNIT –III

Projection of lines inclined to both reference planes – traces.

UNIT –IV

True length, true angles of projected lines –use of auxiliary planes –profile view, point view. Projection of regular planes inclined to both planes, true shapes.

UNIT –V

Projection of solids inclined to both planes.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

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, John&john.

Suggestions:

Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

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	3	0	3

Engineering Chemistry

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T	P	C
0	3	3

English Communication Skills (ELCS) 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- I

Phonetics – Introduction to Sounds of Speech – Vowels – Consonants – Phonetic Transcription & Orthographic Transcription

UNIT – II

Syllabification – Word Stress – Rules of word stress – Intonation – Falling tone and Rising tone

UNIT – III

Situational Dialogues – Role-play – Expressions in various situations – Self Introduction – Introducing others – Greetings – Apologies – Requests – Social and Professional etiquettes – Telephone Etiquettes

UNIT – IV

JAM – Describing object/person/place/situation – Giving directions

UNIT – V

Debates and Group Discussions

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 Skills 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.

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. **Speaking English Effectively**, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. **A Hand book for English Laboratories**, E.Suresh kumar, P.Sreehari, Foundation Books,2011
5. **English Pronunciation in Use. Intermediate & Advanced** ,Hancock, M. 2009. CUP
6. **Basics of Communication in English** ,Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
7. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
8. **English Pronouncing Dictionary**, Daniel Jones Current Edition with CD.Cambridge, 17th edition, 2011

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I- Year B.Tech. M.E. I-Sem **T P C**

3 0 3

Engineering Workshop Lab

1. TRADES FOR EXERCISES :

At least 2 exercises In each :

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

TEXT BOOK:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ Scitech Publishers.

Objective : The objective of this subject is to provide the basic concepts about different manufacturing processes and use of various workshop tools the exposer to the Power tools used in the inclusion

Codes / Tables : Nil

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

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Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

I Year B.Tech ME- II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Technical English-II	3	1	0	3
2	THEORY	Mathematics -II	3	1	0	3
3	THEORY	Computer programming	1	1	3	3
4	THEORY	Engineering Physics	3	1	0	3
5	THEORY	Engineering Drawing-II	3	1	0	3
6	THEORY	Engineering Mechanics	3	1	0	3
7	PRACTICAL	Computer programming Lab	0	0	3	2
8	PRACTICAL	Physics Lab	0	0	3	2
		Total	**16**	**6**	**9**	**22**

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I- Year B.Tech. M.E. II-Sem

	T	P	C
	3	0	3

TECHNICAL ENGLISH -II

PREAMBLE:

In the increasingly globalized world, technical communication and presentation skills are assuming great importance. Industries and employers constantly complain that young engineers have adequate technical knowledge, but no communication and presentation skills. Success is defined these days in terms of possessing these skills. The syllabus has been designed to develop communicative competencies of the students.

OBJECTIVES:

1. To develop awareness in students of the relevance and importance of technical communication and presentation skills.
2. To prepare the students for placements
3. To provide students with interactive practice sessions to make them internalize these skills

OUTCOME

Turning out the students with a clear concept of communication and presentation skills, getting them ready for placements and equipping them with readiness to implement them at work place.

UNIT 1:

Basics of Technical Communication – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

UNIT II

Informal and Formal Conversation - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

UNIT III

Written communication – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication

UNIT IV

Presentation Skills – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

UNIT V

Interview Skills – The Interview process –Characteristics of the job interview – Pre-interview preparation techniques – Projecting the positive image – Answering Strategies

Prescribed Books

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009

Reference Books

1. Communication Skills by Pushpalatha & Sanjay Kumar, Oxford Univsesity Press
2. Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/Cambridge University Press.2012.
3. **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.
4. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
5. **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
6.**English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.**

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	3	**0**	**3**

MATHEMATICS - II

(Common to All Branches)

Objectives:

- Our emphasis will be more on conceptual understanding and application of Fourier series, Fourier, Z and Laplace transforms and vector calculus.

UNIT – I

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 – II

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

UNIT – III

z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

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.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.

REFERENCES:

1. Engineering Mathematics, Volume - II, by G.S.S.Raju, CENGAGE 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:

- The student gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and vector calculus.

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DEPARTMENT OF MECHANICAL ENGINEERING

I-B.Tech. II- SEM	T	P	C
	4	0	3

Computer Programming
(Common to All Branches)

Course Objective

- To understand the core aspects of computer problem solving techniques
- To understand the programming language constructs
- To understand the programming paradigms
- To understand the compound data types
- To understand dynamic memory allocation concepts

Course Outcomes

- Able to design the flowchart and algorithm for real world problems
- Able to learn and understand new programming languages
- Able to construct modular and readable programs
- Able to write C programs for real world problems using simple and compound data types
- Adapt programming experience and language knowledge to other programming language contexts
- Employee good programming style, standards and practices during program development

Unit - I :

Introduction to Computers: Computer Systems, Computing Environment, Computer Languages, Creating and Running Programs, System Developments.

Introduction to the C Language: Introduction, C programs, Identifiers, Types, Variables, Constants, Input and Output, Programming Examples.

Introduction to Computer Problem Solving: Introduction , The Problem-Solving Aspect, Top-down Design, Bottom - up Approach, Flowcharts, Implementation of Algorithms, Program Verification, The Efficiency of Algorithms, The Analysis of Algorithms.

Unit – II:

Structure of C program: Expressions, Precedence and Associatively, Evaluating Expressions, Type Conversion, Statements, Sample Programs.

Selections and Making Decisions: Logical Data and Operators, Two way Selection, Multiway Selection.

Repetition: Concept of Loop, Pretest and Posttest Loops, Initialization and Updation, Event and Counter Controller Loop, Loops in C, Looping Applications.

Fundamental Algorithms: Exchanging the values between two variables, Counting, Summation of a set numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci

Sequence, Reversing the digits of a integer, Basic conversions, Character to Number Conversion

Unit – III :

Factoring Methods: Finding Square root of a Number, The Smallest Deviser of an Integer, The GCD of two Integers, Generating Prime Numbers, Computing Prime Factor of an Integer, Computing the prime factors of an Integer, Generation of Pseudo Random Number, Raising the number to Large Power, Computing the n^{th} Fibonacci.

Functions: Introduction, User Defined Functions, Inter Function Communication, Standard Functions, Scope, Programming Examples.

Array Techniques: Array Order Reversal, Array Counting, Finding the Maximum Number Set, Removal Duplicates from an Ordered Array, Partitioning an Array, Finding k^{th} smallest Element, Longest Monotone Subsequence.

Arrays: Introduction, Two Dimensional Arrays, Multi Dimensional Arrays, Inter Function Communication, Array Applications, Exchange Sort, Binary Search, Linear Search.

Unit – IV :

Strings: String Concepts, C Strings, Sting Input/Output Functions, Arrays of Strings, String Manipulation Functions, String/Data Conversion.

Enumerated, Structure, and Union Types: The Type Definition, Enumerated Types, Structure, Unions, Programming Applications.

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators, Mask.

Unit – V :

Pointers: Introduction, Pointers for Inter Function Communication, Pointers to Pointers, Compatibility, Lvalue and Rvalue.

Pointer Applications: Array and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications.

Binary Input/output: Text Versus Binary Streams, Standard Library Functions for Files, Converting File Type.

Text Books :

1. How to Solve it by Computer by R.G. Dromey, Pearson
2. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan & Richard F. Gilberg, Third Edition, Cengage Learning

Reference Books :

1. Programming in C: A Practical Approach, Ajay Mittal, Pearson.
2. The C programming Language, B. W. Kernighan and Dennis M. Ritchi, Pearson Education.
3. Problem Solving and Programming Designs in C, J. R. Hanly and E.B. Koffman.,
4. Programming with C Rema Theraja, Oxford
5. Problem Solving with C, M.T.Somashekara, PHI
6. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
7. Programming with C, R.S.Bickar, Universities Press.

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Engineering Physics

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	3	**0**	**3**

Engineering Drawing-II
(Mechanical)

Unit –I

Sections of solids: Sections and Sectional views of Regular solids –Prism, Cylinder, Pyramid, Cone – True shapes.
Development of Regular solids, sphere and transition piece.

Unit –II

Isometric projection: Isometric views of lines, plane figures, Compound solids, Spherical parts.

Unit –III

Conversion of Pictorial views to orthographic views –Conventions.

Unit –IV

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

Unit –V

Perspective projections –Planes and simple solids. Vanishing point Method only.

TEXT BOOKS:

3. Engineering Drawing, N.D. Bhat, Charotar Publishers
4. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

5. Engineering Drawing, Johle, Tata McGraw-Hill Publishers.
6. Engineering Drawing, Shah and Rana,2/e, Pearson Education
7. Engineering Drawing and Graphics, Venugopal/New age Publishers
8. Engineering Graphics, John&john.

Suggestions:

Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem

T	P	C
3	0	3

ENGINEERING MECHANICS

OBJECTIVE: *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. 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
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.

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

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DEPARTMENT OF MECHANICAL ENGINEERING

I-B.Tech. II SEM	T	P	C
	0	3	3

Computer Programming Lab
(Common to All Branches)

Week-1

1) Write an algorithm and draw a flowchart to make the following exchange between the variables a-> b -> c->d - > a
2) Write an algorithm and draw a flowchart to generate the first n terms of the sequence.
   A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
3) Write a algorithm and draw a flowchart to carry out the arithmetic operations addition, subtraction, multiplication, and division between two variables
4) Write a algorithm and draw a flowchart for printing prime numbers between 1 and n.

Week-2

1) Write a C program to construct a multiplication table for a given number.
2) Write a program to reverse the digit of a given integer.
1) Write a C program to calculate the factorial of a given number

Week-3 Write a program to calculate tax, given the following conditions:

a) If income is less than 1,50,000 then no tax.
b) If taxable income is in the range 1,50,001 – 300,000 then charge 10% tax

c) If taxable income is in the range 3,00,001 – 500,000 then charge 20% tax
d) If taxable income is above 5,00,001 then charge 30% tax

Week-4

1) Write a program to print the calendar for a month given the first Week- day of the month.
Input the first day of the month (Sun=0,Mon=1,Tue=2,Wed=3,.....) :: 3
Total number of days in the month : 31

Expected output

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
-	-	-	*1*	*2*	*3*	*4*
5	*6*	*7*	*8*	*9*	*10*	*11*
12	*13*	*14*	*15*	*16*	*17*	*18*
19	*20*	*21*	*22*	*23*	*24*	*25*
25	*26*	*27*	*28*	*29*	*30*	*31*

Week-5

1) Write a program to print the Pascal triangle for a given number
2) Write a program to calculate the following expression for given x value

$$f(x) = a_0 + \sum_{n=1}^{\infty}\left(a_n \cos\frac{n\pi x}{L} + b_n \sin\frac{n\pi x}{L}\right)$$

Week-6

1) Write C code to define a function cash_dispense, which takes an amount as its input, and returns the number of 1000, 500, 100, 50, 20, 10, 5, 2, 1 rupee denomination that make up the given amount.
2) Write C code to reverse the contents of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]
3) Write a program that will search and find out the position where the given key element exist in a user chosen array and print it as output.

Week-7

1) Write C code to compute the frequency table of survey responses given by 20 users. The survey responses range from 1 to 5 and are stored in an array. For example, 10 responses are stored in the array [1,1,5,2,3,3,5,5,2,2]. The frequency table will be as shown below:
   a. 1 = 2
   b. 2 = 3
   c. 3 = 2
   d. 4 = 0
   e. 5 = 3
2) Write a program to define a function to sort an array of integers in ascending order by using exchange sort.

Week-8

1) Write a C program to check whether a given string is a palindrome or not, without using any built-in functions
2) Write a function that accepts a string and delete the first character.
3) Write a function that accepts a string and delete all the leading spaces.

Week-9

Write a program to accept a string from user and display number of vowels, consonants, digits and special characters present in each of the words of the given string.

Week-10

1) Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as

union variable

2) Declare a structure *time* that has three fields *hr, min, secs.* Create two variables, *start_time* and *end_time.* Input there values from the user. Then while *start_time* is not equal to *end_time* display GOOD DAY on screen.

Week-11

1) Write a program to read in an array of names and to sort them in alphabetical order. Use sort function that receives pointers to the functions strcmp, and swap, sort in turn should call these functions via the pointers.
2) Write a program to read and display values of an integer array. Allocate space dynamically for the array using the *malloc()*.
3) Write a program to calculate area of a triangle using function that has the input parameters as pointers as sides of the triangle.

Week-12

1) Two text files are given with the names text1 and text2. These files have several lines of text. Write a program to merge (first line of text1 followed by first line of text2 and so on until both the files reach the end of the file) the lines of text1 and text2 and write the merged text to a new file text3.
2) Write a program to split a given text file into n parts. Name each part as the name of the original file followed by .part<**n**> where n is the sequence number of the part file.

Reference Books:

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan & Richard F. Gilberg, Third Edition, Cengage Learning
2. C Programming A Problem-Solving Approach, Behrouz A. Forouzan & E.V. Prasad, F. Gilberg, Third Edition, Cengage Learning
3. Programming with C Rema Theraja, Oxford
4. “C Test Your Skills”, Kamthane, Pearson Education
5. Programming in C: A Practical Approach, Ajay Mittal, Pearson
6. Problem solving with C, M.T.Somasekhara, PHI
7. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
8. Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	T	P	C
	3	0	3

Engineering Physics Lab

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Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME- I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Thermodynamics	3	1	0	3
2	THEORY	Mathematical Methods	3	1	0	3
3	THEORY	Electrical and Electronics Engineering	3	1	0	3
4	THEORY	Mechanics of Solids	3	1	3	3
5	THEORY	Machine Drawing	1	1	3	3
6	THEORY	Material Science and Metallurgy	4	0	0	3
7	PRACTICAL	Electrical and Electronics Engineering Lab	0	0	3	2
8	PRACTICAL	Mechanics of Solids Lab & Material Science Lab	0	0	3	2
9		Human Values & Professional Ethics	2	0	0	0
		Total	**20**	**4**	**13**	**22**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURUM

II Year B.Tech. M.E. I-Sem	T	P	C
	3	0	3

THERMODYNAMICS

UNIT- I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, 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.

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

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

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

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.

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

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II Year B.Tech. M.E. I-Sem

	T	P	C
	3	0	3

MATHEMATICAL METHODS
(CIVIL, MECH &CHEM)

Objectives:

- This course aims at providing the student with the concepts of Matrices, Numerical Techniques and Curve fitting.

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.

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 and Integration – 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 Method-Runge-Kutta Methods – Predictor-Corrector Method – Milne's Method. Numerical solutions of Laplace equation using finite difference approximation.

TEXT BOOKS:

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

REFERENCES:

3. Engineering Mathematics, Volume - II, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
4. Engineering Mathematics, Volume - II, by G.S.S.Raju, CENGAGE publisher.
5. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
4. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
5. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Outcomes:

The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

II YEAR I SEM B. Tech MECHANICAL

T	P	C
3+1	0	3

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING

PART – A

ELECTRICAL ENGINEERING

Objective:
Electrical Engineering contains basic Circuits, DC generators & motors, Transformers, Induction motors and their performance aspects will be studied.

UNIT – I Introduction to DC & AC Circuits
Ohm's Law, Basic Circuit Components, Kirchhoff's Laws, Types of Sources, Resistive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The J Operator and Phasor Algebra, Analysis of Ac Circuits With Single Basic Network Element, Single Phase Series.

UNIT-II DC Machines
D.C Generators: Principle of Operation of Dc Machines, Types of D.C Generators, E.M.F Equation in D.C Generator, O.C.C. of a D.C. Shunt Generator
D.C Motors: Principle of Operation of Dc Motors, Types of D.C Motors, Torque Equation, Losses and Efficiency Calculation in D.C Motor- Swinburne's Test

UNIT-III AC Machines
Transformers: Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.
Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).
Alternators: Principle of Operation-Constructional Details-EMF Equation-Voltage Regulation by Synchronous Impedance Method.
OUTCOME:
After going through this course the student gets a thorough knowledge on basics of Electrical Circuits, DC Machines, Transformers, Induction motors & Alternators with which he/she can able to apply the above conceptual things to real-world problems and applications.

PART – B

ELECTRONICS ENGINEERING

Course Objectives:

- To provide an understanding and analyzing basic Electronic Circuits.
- To familiarize the students with fundamental concepts of electronic devices such as diodes their types, transistors, FETs and so on.
- To incorporate the simple problem solving skills in circuits comprising the diodes, transistors and other semiconductors devices as circuit elements.
- To familiarize the students with fundamental concepts of Digital Electronics such as number systems, basic gates, Boolean algebra and so on.

Course Outcomes:

Upon completion of the course, students will be able to:

- Analyze any basic electronic circuits
- Acquire complete knowledge regarding working principles of basic semiconductor devices such as diodes, transistors, FETs and so on.
- Solve simple problems consisting semiconductor devices such as diodes, transistors, FETs as circuit elements.
- Understands the fundamental concepts associated with Digital Electronics such as number systems, basic gates, Boolean algebra and so on.

UNIT I

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. Silicon Controlled Rectifier-Two Transistor Analogy of an SCR, Characteristics, Applications of SCR, DIAC, TRIAC.

UNIT II

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 III

Digital Electronics: Number Systems-Decimal System, Binary System, Octal System, Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates- NAND, NOR

Gates. Boolean algebra and De Morgan's Theorems, Combinational Circuits-Adders and Subtractors.

TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.
4. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.
5. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007.
4. Mahesh B.Patil, "Basic Electronic Devices and Circuits", PHI Publications, 2013.
5. Debashis De, "Basic Electronics", Pearson 2010.
6. Dr.K.Sharma, "Basic Electrical Engineering and Electronics", CBS Publications 4th Edition, 2013.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAUM

II Year B.Tech. M.E. I-Sem

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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 – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers for simple loading cases.

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.

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 S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
5. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
6. Strength of materials by Surendar Singh, CBS Pubilications.
7. Strength of Materials by Schaum's out line series – Mc.Graw hill International Editions.
8. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPURAMU

II Year B.Tech. M.E. I-Sem

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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, flanged &protected flanged joint.

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.

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.*

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MATERIAL SCIENCE AND METALLURGY

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.

REFERENCES :

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal

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

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MECHANICS OF SOLIDS LAB & MATERIAL SCIENCE LAB

PART-A: MECHANICS OF SOLIDS LAB

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

LIST OF EXERCISES :

2. Tension test.
3. Bending test on (Steel/Wood) Cantilever beam.
4. Bending test on simple support beam.
5. Torsion test.
6. Hardness test.
7. Shear test

LIST OF MAJOR EQUIPEMNT:

1. UTM for conducting tension test on rods
2. Steel beam for flexure test.
3. Wooden beam for flexure test.
4. Torsion testing machine
5. Brinnell's/Rock well's hardness testing machine.
6. Shear testing machine

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PART-B: 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 – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU
Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME- II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Design of Machine Members-I	3	1	0	3
2	THEORY	Fluid Mechanics & Hydraulic Machinery	3	1	0	3
3	THEORY	Kinematics of Machinery	3	1	0	3
4	THEORY	Thermal Engineering-I	3	1	0	3
5	THEORY	Probability and Statistics	3	1	0	3
6	THEORY	Manufacturing Technology	3	1	0	3
7	PRACTICAL	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	2

8	PRACTICAL	Manufacturing Technology Lab	0	0	3	2
9		Computer Aided Drafting Lab	0	0	3	0
		Total	**18**	**6**	**9**	**22**

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DESIGN OF MACHINE MEMBERS-I

Course Objective

The primary objective of this course is to demonstrate how engineering design uses 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, shafts and keys.

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

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 Outcomes & Suggested Student Activity:

After completion of this unit students are capable to apply design procedures using theories of failure for different elements. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of machine design. http://machinedesign.com/
http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6

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 Outcomes & 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. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of cyclic loading design.
http://machinedesign.com/
http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8

UNIT – III

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

DESIGN OF 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.

Learning Outcomes & Suggested Student Activities:

After completion of this unit students are able to design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints. Further students are able to design bolted joints with direct loading and eccentric loading. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of joints. http://machinedesign.com/
http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16

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 Outcomes & Suggested Student Activities:

After completion of this unit students are able to design cotter joint, knuckle joint and shafts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of shafts, http://machinedesign.com/
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20

UNIT-V

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Learning Outcomes & Suggested Student Activities:

After completion of this unit students are able to design various rigid and flexible shaft couplings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of couplings. http://machinedesign.com/
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21

Text Books:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
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. MechanicalEngineeringDesign,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.

Web Resources

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv077-page1.htm
http: // www .f a s t e n a l .c o m / c o n t e n t / f e d s / p d f / A r t i c l e % 2 0 - %20Bolted%20Joint%20Design.pdf
http://people.rit.edu/megite Lec%203%20Fatigue%20Failure% 20031004_ for_students.ppt
http://engineershandbook.com/Tables/materials.htm
www.nptel.iitm.ac.in/video

Suggestions:

1. students may visit near by automobile workshops and machine tool shops to know about different machine elements like shafts, keys, couplings and riveted and bolted joints.
2. In addition to the text books students may also go through the reference books authored by V.B. Bhandari, by Pandya and Shah for more number of numerical problems.

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FLUID MECHANICS AND HYDRAULIC MACHINERY

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

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 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 &.
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

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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 .

REFERENCES :

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Theory of Machines, Thomas Bevan, CBS.
3. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
4. Theory of machines, P.L. Ballaney, Khanna Publishers.
5. 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

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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

Fuel System: 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

Fuels and Combustion:

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.

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/

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3 0 3

PROBABILITY AND STATISTICS
(CIVIL, MECH & CHEM)

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 and two way classification (Latic square Design and RBD)

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.
2. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.

REFERENCES:

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
5. Probability and Statistics by R.A. Jhonson and Gupta C.B.

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.

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II Year B.Tech. M.E. II-Sem

	T	P	C
	3	0	3

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/ kalpak Jian, 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

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T	P	C
3	0	3

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

OBJECTIVE: *The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.*

SYLLABUS :

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Varification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

LIST OF EQUIPMENT :

1. Venturimeter Sutup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel and Francis turbines.
11. Centrifugal pumps.

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	0	3	2

MANUFACTURING TECHNOLOGY LAB

Minimum of 12 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.
3. Bending and other operations

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

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Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. ME- I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Dynamics of Machinery	3	1	0	3
2	THEORY	Managerial Economics and Financial Analysis	3	1	0	3
3	THEORY	Machine Tools	3	1	0	3
4	THEORY	Design of Machine Members – II	3	1	0	3
5	THEORY	Thermal Engineering - II	3	1	0	3
6	THEORY	Automobile Engineering	3	1	0	3
7	PRACTICAL	Thermal Engineering Lab	0	0	3	2
8	PRACTICAL	Machine Tools Lab	0	0	3	2
9		Automotive Act & Practice	0	0	3	0
		Total	18	6	9	22

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	3

DYNAMICS OF MACHINERY

UNIT I

FRICTION: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear.

Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

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.

UNIT II

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

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.

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.

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 inline and radial engines for primary and secondary balancing.

UNIT V

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

Text Books:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.

2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

Reference Books:

1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.
2. The theory of Machines, J.E. Shiegley, McGraw Hill .
3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester	L	T	P	C
	3	1	0	3

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Demand Analysis: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

UNIT V: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

The students are required to submit any one of the following- two assignments/ a mini project/submission of any two case studies in the subject.

Learning Outcome: After completion of this course, the student will able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Ahuja H.L Managerial economics. S.Chand, 3/e, 2013
3.

REFERENCES

1. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester	L	T	P	C
	3	1	0	3

MACHINE TOOLS

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, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

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 and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

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.

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 – comparison of grinding, lapping and honing. machining time calculations.

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 Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications

Text Books:

1. Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013
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, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st 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 Press Taylor and Francies .

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. - I Semester	L	T	P	C
	3	1	0	3

DESIGN OF MACHINE ELEMENTS– II

UNIT I

DESIGN OF CURVED BEAMS: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT II

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.

DESIGN OF POWER SCREWS: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – 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.

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.

Text Books:

1. MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2010.
2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.
*3. Machine design by SundarRajan ***

Reference Books:

1. MachineDesign,Schaum‟sseries,TMHPublishers, NewDelhi, 1st edition, 2011
2. Design ofMachine Elements, V.B.Bhandari , TMH Publishers,NewDelhi, 2nd edition, 2013.
3. MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi
4. DesignofMachineElements,M.F.Spotts,PHIPublishers, NewDelhi.

5. MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2012.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	3

THERMAL ENGINEERING – II

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.

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.

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.
CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

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.

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, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants
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.

Text Books:
1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd 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.*

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. - I Semester

L	T	P	C
3	1	0	3

AUTOMOBILE ENGINEERING

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.

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, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Température Indicator.

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.

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.

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.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors, 13th edition, 2013.
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.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	2

THERMAL ENGINEERING LAB

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. I-Sem	L	T	P	C
	0	0	3	2

MACHINE TOOLS LAB

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.

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Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. ME- II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Industrial Engineering & Management	3	1	0	3
2	THEORY	Engineering Metrology	3	1	0	3
3	THEORY	Refrigeration & Air Conditioning	3	1	0	3
4	THEORY	Operations Research	3	1	0	3

5	THEORY	Heat Transfer	3	1	0	3
6	THEORY	CAD/CAM	3	1	0	3
7	PRACTICAL	Heat Transfer Lab	0	0	3	2
8	PRACTICAL	CAD/CAM Lab	0	0	3	2
9		Advanced Communication Skills Lab	0	0	3	0
		Total	18	6	9	22

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. II Semester	L	T	P	C
	3	1	0	3

INDUSTRIAL ENGINEERING & MANAGEMENT

UNIT I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.
Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

UNIT II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Selection of Plant Location – Types of Production; Plant Layout: Definition, Objectives, Types of Plant Layout - Materials Handling: Functions- Objectives – Types, Selection Criteria of Material Handling Equipment.

UNIT III

Work Study – Definition, Objectives, Method Study – Steps Involved – Various Types of Process Charts – Micro motion and Memo motion Studies.
Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations - Applications.

UNIT IV

Material Management – Functions; Inventory – functions, types, associated costs, inventory classification techniques- ABC, VED Analysis; Inventory Models- Deterministic models- EOQ Models – With and Without Shortages Models; Inventory Models with Price Breaks -Probabilistic Models –Discrete Variable, Continuous Variable. Inventory Control Systems : P&Q Systems. Stores Management and Purchase Management, Duties of Purchase Manager.

UNIT V

Human Resource Management - Functions of HRM, Job Evaluation, Merit Rating, Wage Incentives, Different Types of Incentive Schemes, Introduction to Factory act and Industrial Dispute Acts.
Inspection & Quality Control: Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance .

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.

3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

Reference Books:

1. Industrial Engineering and production management, MartindTelsang S.Chand..
2. Work Study by ILO(International Labour Organization)
3. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005
4. Production and Operations management, PanneerSelvam, PHI,2004.
5. Statistical Quality Control by EL Grantt, McGrawhil
6. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	1	0	3

ENGINEERING METROLOGY

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..

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.

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.

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.

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.

Text Books:

(1) Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE
(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, Mc GrawHill, 2013.
(5) Instrumentation, measurement &analysis ,B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. - II Semester

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REFRIGERATION AND AIR CONDITIONING

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.

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.

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.

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.

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.

Text Books:
1. Refrigeration and Air Conditioning ,CP Arora,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 containingRéfrigérant and Psychrometric property Tables and charts are permitted in Exam*

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OPERATIONS RESEARCH

UNIT I

Introduction to OR – Classification of Models –Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions- Duality- primal - dual Relations.

UNIT II

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method- Degeneracy. Assignment Problem - Optimal Solution -Travelling Salesman problem.

UNIT III

Game Theory: Introduction – Two- person zero sum games – Minimax (Maximin) Criterion - Principle of dominance, Saddle Point, Pure Strategy –Games with Mixed Strategies – different methods: Arithmetic and algebraic methods- graphical method for 2 x n and n x 2 games.

Queuing Theory: Introduction –Terminology, Birth & Death Process, Balking, Reneging, Jockeying;
Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and In-finite queue length; Multichannel Model with Poisson Arrivals, Exponential Service Times with finite queue length.

UNIT IV

Replacement models: Introduction – Types of Replacement Problems, Replacement items that deteriorate with time – Time value of money - Replacement of items which completely fail suddenly -Individual Replacement policy and Group Replacement policy.

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

UNIT V

PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA & AON Diagrams, Types of Floats; CPM- Critical Path, Crashing, Optimal Project Duration. Introduction to Resource Levelling & Smoothening.

PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time, particular time.
Introduction to Simulation – Simple Problems.

Text Books:

1. Quantitative techniques for management by N. D. Vohra, Tata McGraw-Hill Education, 3rd edition 01-Jul-2006
2. Operations Research by S.D.Sharma
3. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.
4. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.

Reference Books:

1. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
2. Linear Programming, SusyPhillippose, PHI
3. Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.
4. Operations Research: Methods & Problems , Maurice Saseini, ArhurYaspan& Lawrence Friedman
5. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers
6. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, PreetamBasu, Geralld J. Lieberman, TMH, 9th edition, 2011.

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III Year B.Tech.M.E. II Semester

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HEAT TRANSFER

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 – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

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.

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.

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.

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.

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

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, Kondandaraman, 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.*

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. -II Semester

L	T	P	C
3	1	0	3

CAD / CAM

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.

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 representation, constructive solid geometry representation.

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.

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.

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.

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.Lalit Narayan , PHI, 2008.
6. Computer Aided Manufacturing, T.C. Chang, Pearson, 3rd edition, 2008
7. A text book of CAD/CAM, CSP Rao, Hitech Publ.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech.M.E. I Semester	L	T	P	C
	0	0	3	2

HEAT TRANSFER LAB

***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
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

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

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. - II Semester

L	T	P	C
0	0	3	2

CAD / CAM LAB

I. Introduction to CAD/CAM software packages.

II. 1. Development of part drawings in the form of orthographic & isometric.
2. 3D Modelling of various parts.
3. Assembly Modelling of various parts.

III. a). Development of process sheets for various components based on tooling Machines.
b). Development of manufacturing and tool management systems.
c). Study of various post processors used in NC Machines.
d). Development of NC code for free form and sculptured surfaces using CAM packages.
e). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package.
f). Computer Aided Quality Control and inspection.

The following packages can be used in lab.
Auto Cad, CATIA, Pro-E, I-DEAS, Iron- CAD, Edge CAM, Master CAM, Robot Packages etc.

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MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. II-Sem	L	T	P	C
	0	0		0

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

1. Introduction:

In the past engineering education has focused only on imparting “hard” or technical skills. With the entry of multinational companies in India there is a revolutionary change in the employment opportunities and recruitment process as well. Globalization demands universities to produce engineers who are equipped with effective interpersonal skills to meet global demands.

In this scenario the **Advanced English Language Communication skills lab** introduced at the 3rd B. Tech. level plays a key role to learn the foreign language in a happy atmosphere and in a successful way. Breaking through the traditional method of teaching, this course motivates student’s learning attitude by providing an interactive learning environment.

This course is developed on the methodology of LSRW skills along with soft skills. This course focuses on the practical aspects of listening, speaking, reading and writing that enable the students to expose to various activities like group discussions, Oral Presentations, Mock interview sessions etc., Personality development, etiquettes and to provide corporate knowledge to help the students in facing interviews in a formal organizational set up.

2. Objectives:

This lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To expose the students to a variety of self instructional, learner-friendly modes of language learning.
- To enable the students to learn better pronunciation and accent through listening and reading exercises.
- To train students to use language appropriately for interviews, group discussion and public speaking.
- To initiate them to greater use of the computer in resume preparation, format-making etc.
- To help the students to cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer based competitive exams such as GRE, TOFEL, and GMAT etc.
- To enable the students to acquire good communication skills as well as soft skills to meet global demands.

3 **Syllabus:**

The following course content is prescribed for the Advanced Communication Skills Lab:

Unit I:

Reading &Listening Comprehension: Skimming –scanning- Extensive and Intensive reading. Reading for making inferences. Active VS passive listening. Listening and Note taking, - Listening for making inferences.

. **Unit II:**

Writing Skills: Formal and informal writing- Resume Writing-E-Correspondence.

. **Unit III:**

Technical Presentations (Oral) : Planning-Preparation-Presentation . Art of Persuasion- Audience analysis- Handling questions.

.

Unit IV:

Interview Skills: Types of Interviews - pre-interview planning- answering strategies. Analysis of One to one –interviews – group interviews - Mock interviews.

Unit V:

Soft Skills: Inter Personal Skills- Goal setting – Etiquettes and good manners – Team Working – Work Ethics--Time management – Problem Solving.

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Minimum Requirements

The English Language Lab shall have two parts:

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.
The Communication Skills Lab with movable chairs and audio-visual aids with a PA System, a TV, a digital stereo-audio and video system, a Camcorder, etc

System Requirement (Hardware Component):

Computer network with LAN with a minimum of 60 multimedia systems with the following specifications:

P-IV Processor
Speed-2.8 GHZ
RAM_512 MB minimum
Hard Disk-80 GB
Headphones

Prescribed Software:

9. **K-Van Advanced Communication Skills**
10. **Walden Infotech Advanced Communication Skills.**

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. **Technical Writing and Professional Communication, Huckin and Olsen** Tata Mc Graw-Hil 2009.

2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.

3. **Cambridge English for Job-Hunting** by Colm Downes, Cambridge University Press, 2008

4. **Resume's and Interviews** by M.Ashraf Rizvi, Tata Mc Graw-Hill, 2008

5.. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

6. **Managing Soft Skills** by K R Lakshminarayan and T.Muruguvel, Sci-Tech Publications, 2010

7. **The ACE of Soft Skills** by Gopal Ramesh and Mahadevan Ramesh, Pearson Education, 2010

8. **Soft Skills** by Dr. K. Alex, S.Chand

9. **Study Skills for Professional Students in Higher Education** by Dr. M. Adithan, S.Chand.

10. **Personality Development and Soft Skills by Barun** K. Mitra, Oxford Higher Education.

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Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING

IV Year B.Tech. ME- I Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Finite Element Methods	3	1	0	3

2	THEORY	Renewable Energy Sources	3	1	0	3
3	THEORY	Instrumentation & Control Systems	3	1	0	3
4	THEORY	Automation & Robotics	3	1	0	3
5	THEORY	Open Elective	3	1	0	3
6	THEORY	MOOC	3	1	0	3
7	PRACTICAL	Instrumentation & Metrology Lab	0	0	3	2
8	PRACTICAL	Computer Aided Engineering Lab	0	0	3	2
9		Project Part-A -Seminar	-	-	-	2
		Total	18	6	6	24

Open Elective
Entrepreneurship
Total Quality Management
Energy Ecology & Environment

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. -I Semester

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3	1	0	3

FINITE ELEMENT METHODS

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.

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.

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.

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.

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 function formulation.

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, New Delhi.
6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. I Semester

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RENEWABLE ENERGY SOURCES

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/cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

UNIT – III

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.

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.

UNIT – IV

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OTEC : Principles, utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT –V

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson 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, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

Renewable Energy Resources / Tiwari and Ghosal / Narosa
Non- conventional Energy Sources / G.D. Rai

REFERENCE BOOKS:

Renewable Energy Sources / Twidell & Weir
Solar Energy / Sukhame
Solar Power Engineering / B.S. Magal Frank Kreith & J.F. Kreith
Principles of Solar Energy / Frank Krieth & John F Kreider
Non-Conventional Energy / Ashok V Desai / Wiley Eastern
Non-Conventional Energy Systems / K Mittal / Wheeler
Renewable Energy Technologies / Ramesh & Kumar / Narosa

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

IV Year A.Tech. M.E. -I Semester

L	T	P	C
3	1	0	3

INSTRUMENTATION AND CONTROL SYSTEMS

UNIT-I

Definition - Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT-II

MEASUREMENT OF TEMPERATURE: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators.

MEASUREMENT OF PRESSURE: Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.

UNIT - III

MEASUREMENT OF SPEED: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

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.

UNIT -IV

MEASUREMENT OF LEVEL: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubbler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

MEASUREMENT OF HUMIDITY - Moisture content in the gases, sling Psychrometer, Absorption Psychrometer, Dew point meter.

UNIT - V

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic force meters, load cells, Torsion meters, Dynamometers.

ELEMENTS OF CONTROL SYSTEMS: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems

TEXT BOOKS:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhaneshl TMH
2. Mechanical Measurements *I* Beckwith, Marangoni, Linehard, Phi/ PE

REFERENCES:

1. Instrumentation, measurement & analysis by B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design by D.S Kumar.
3. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
4. Mechanical and Industrial Measurements / R.K. *Jain/*Khanna Publishers.
5. Instrumentation & mech. Measurements by AK. Tayal ,Galgotia Publications
6. Mechanical Measurements /Sawhani

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	3

AUTOMATION & ROBOTICS

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.

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.

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.

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.

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.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover/Pearson Edu.

2. Industrial Robotics - M.P. Groover, TMH.

Reference Books:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – AshitaveGhosal,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.
6. Introduction to Robotics – John J. Craig,PearsonEdu

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. –I Semester

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3	1	0	3

ENTREPRENEURSHIP
(Open Elective)

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.

Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.

UNIT II:
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.

UNIT IV:
New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.

Choosing location and layout, Issues related to Selection of layout.

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. Global aspects of Entrepreneurship.

Text Books:

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 5th Edition

2. Dollinger: Entrepreneurship,4/e, Pearson, 2004.

REFERENCES:

1. Vasant Desai: Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Robert J.Calvin: Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola: The Entrepreneurial Connection, TMH, 2001.
5. Bolton & Thompson: Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal :Indian Economy, Wishwa Prakashan 2005.
7. Dutt & Sundaram: Indian Economy. S. Chand, 2005.
8. Srivastava: Industrial Relations & Labour Laws, Vikas, 2005.
9. Aruna Kaulgud: Entrepreneurship Management by. Vikas publishing house, 2003.
10. Thomas W. Zimmerer & Norman M. Scarborough: Essential of Entrepreneurship and small business management, PHI, 4/e, 2005.
11. Mary Coulter: Entrepreneurship in Action, PHI, 2/e, 2005.
12. Kaplan: Patterns of Entrepreneurship, Willey, 2005.
13. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2005.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. –I Semester

L	T	P	C
3	1	0	3

TOTAL QUALITY MANAGEMENT

(Open Elective)

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. Quality Standards – Need for Standardization - Institutions – Bodies of Standardization, ISO 9000 series – ISO 14000 series – Other Contemporary Standards – ISO Certification Process-Third Party Audit

UNIT – II

Process Management- Quality Measurement Systems (QMS) – Developing and Implementing QMS –TQM Tools & Techniques- 7 QC Tools- 7 New QC Tools.

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 – III

Quality Circles – Organization – Focus Team Approach – Statistical Process Control –Process Chart – Ishikawa Diagram – Preparing and using Control Charts.

UNIT – IV

Quality Function Development (QFD) – Elements of QFD – Benchmarking-Types- Advantages & Limitations of Benchmarking – Taguchi Analysis – Loss function - Taguchi Design of Experiments, Robust Design, 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:

1Total Quality Management,DakhBesterfield, Pearson Edu.

2. Total Quality Management, K.ShridharBhat, Himalaya.

REFERENCE BOOKS:

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.
3. Quality management, Bedi

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. –I Semester	L	T	P	C
	3	1	0	3

ENERGY ECOLOGY & ENVIRONMENT
(Open Elective)

UNIT-I
Energy source for earth – sun – its radiation – its absorption and reflection. Various renewable and non-renewable resources.

UNIT-II
Boisphere – Energetics of the biosphere – Concepts of Ecology – Components of Ecosystems.

UNIT-III
Energy transactions in biosphere – photo synthesis and producers – Herbivones – Carnivones – decomposers – Energy transfers & food wells.

UNIT-IV
Dependence on abiotic systems – biogeochemical cycles. Elements of Environment – Interrelationships in environmental components.

UNIT-V
Concepts of pollution and affecting the natural balances in energy systems. Energy concepts for a sustainable world bio – systems.

REFERENCE BOOKS:
1. Renewable Energy, Environment and Development, Maheshwar Dayal, Konark Publishers Pvt. Ltd.,
2. Ecology and Environment, P.D. Sharma Rastogi Publications.
3. Energy for a sustainable world, J.Goldenberg, T.B. Johnson, Amulya K.Reddy & Robert Williams Willey Eastern Ltd.,
4. Concepts of Ecology, E.J.Kormondal , Prentice Hall India Ltd.,

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. I-Sem

L	T	P	C
0	0	3	2

INSTRUMENTATION & METROLOGY LAB

Section A

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Calibration of strain guage for temperature measurement
5. Calibration of thermocouple for temperature measurement
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed
8. Calibration of resistance temperature detector for temperature measurement
9. Study and calibration of a rotometer for flow measurement
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads
11. Study and calibration of Mcleod gauge for low pressure
12. Study of anemometer

Section B

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. I-Sem

L	T	P	C
0	0	3	2

COMPUTER AIDED ENGINEERING LAB (CAE LAB)

I. Introduction to Analysis Software Package

II. Structural analysis: (Any Six exercises)

1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)

1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any four exercises)

1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated fin within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem (in an infinitely long concentric cylinders).
7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

Software can be used: ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

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Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

IV Year : II Semester

S.No		SUBJECT	L	T	P	CREDITS
1	THEORY	Production & Operations Management	3	1	0	3
2	THEORY	Power Plant Engineering	3	1	0	3
3	THEORY	E-I	3	1	0	3
4	THEORY	E-II	3	1	0	3
5		Comprehensive Viva -Voice	0	0	3	3
6		Project Part-B	0	0	15	10
		Total	12	4	18	25

Elective-I	Elective-II
Modern Manufacturing Methods	Tribology
Jet Propulsion and Rocket Engineering	Computational Fluid Dynamics
Mechanical vibrations	Energy Management

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester	T	P	C
	4	0	4

PRODUCTION & OPERATIONS MANAGEMENT

UNIT – I

Functions of production planning & control operations & productivity, productivity measurement, Design of goods.
Forecasting – Importance of forecasting – Types of forecasting,– Forecasting techniques – qualitative methods and quantitive methods – accuracy of forecasting methods.

UNIT – II

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.
Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.

UNIT – III

Inventory management – EPQ model with and without shortages, Inventory models with constraints. Optional replenishment system, Tin-Bin System – P–Systems and Q-Systems Policy.

UNIT – IV

MRP, –lot sizing techniques in MRP, introduction to ERP, Assembly line balancing.

UNIT – V

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control.

TEXT BOOKS :

1. Modern Production / Operations Management / Baffa & Rakesh Sarin.
2. Operation Management by B. Mahadevan/Pearson Edu.
3. Operation and O.M by Adam & Ebert- PHI Pub.,

REFERENCES :

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.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester	L	T	P	C
	3	1	0	3

POWER PLANT ENGINEERING

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.

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

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.

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. .

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.

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.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. –II Semester

L	T	P	C
3	1	0	3

MODERN MANUFACTURING METHODS
(ELECTIVE –I)

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.

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.

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.

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 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.

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.

Text Books:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian,Pearson
3. *Modern Machining Process , Pandey P.C. and Shah H.S., TMH.*

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. II Semester	L	T	P	C
	3	1	0	3

JET PROPULSION AND ROCKET ENGINEERING
(ELECTIVE-I)

UNIT-I

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters of performances –cycle modifications for improvement of performance.

Jet propulsion: Historical sketch-reaction principle –essential features of propulsion devices-Thermal Engines, Classification of –Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications

UNIT-III

Turboprop and Turbojet-1: Thermo dynamic cycles, plant layout, essential components, principles of operation –performance evaluation

Turboprop and Turbojet-II: Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV

Ramjet: Thermo dynamic Cycle, plant lay-out, essential components –principle of operation-performance evaluation –comparison among atmospheric thermal jet engines- serqujet and pulse jet, elementary treatment.

Rocket Engines: Need for, applicat**ions –**Basic principles of operation and parameter s of performance –classification ,solid and liquid propellant rocket engines ,advantages, domains of application –propellants –comparison of propulsion systems.

UNIT-V

Rocket Technology-I: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets ,need for –Feed systems, injectors and expansion nozzles –Rocket heat transfer and ablative cooling.

Rocket Technology- II: Testing & instrumentation –Need for Cryogenics –Advanced propulsion Systems, elementary treatment of Electrical Nuclear and plasma Arc propulsion.

TEXT BOOKS:

1. Gas Turbines and propulsive systems-P.Khajuria& S.P.Dubey/Dhanpatrai pub.
2. Gas Dynamics & Space Propulsion M.C.Ramaswamy / Jaico Publishing House.

REFERENCE BOOKS:

1. Rocket propulsion –Sutton
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.

3. Gas Turbines-V.Ganesan /TMH.

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester

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3	1	0	3

MECHANICAL VIBRATIONS
(Elective-I)

UNIT I
Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.
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.

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.

UNIT III
Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

UNIT IV
Multi Degree Freedom Systems: Lagrangion method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

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.

Text Books:
1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.
2. 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.*

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MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester	L	T	P	C
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TRIBOLOGY
(Elective-II)

UNIT I

SURFACES AND FRICTION: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion – Measurement of Friction.

UNIT II

WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals – Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III

LUBRICANTS AND LUBRICATION TYPES: Types, properties, Requirements of Lubricants – Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

UNIT IV

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

UNIT V

SURFACE ENGINEERING AND MATERIALS FOR BEARINGS: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Text Books:

1. *I.M. Hutchings, Tribology, " Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.*

Reference Books:

1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.
2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.
3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.
5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand

JNTUACEA **R13**

2013-14

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	1	0	3

COMPUTATIONAL FLUID DYNAMICS
(ELECTIVE - II)

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.

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.

UNIT III
ERRORS AND STABILITY ANALYSIS: introduction, first order wave equation, stability of hyperbolic and 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.

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.

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.

Text Books:
1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.
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.

JNTUACEA R13
2013-14

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester	L	T	P	C
	3	1	0	3

ENERGY MANAGEMENT
(Elective – II)

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

ENERGY MANAGEMENT PROGRAMS:

Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV

ENERGY AUDITING:

A definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

BOOKS:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.
4. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
5. Craig B.Smith, "Energy Management Principles", Pergamon Press.
6. The role of Energy Manager, E.E.O., U.K.
7. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
8. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

UG SYLLABUS FOR R15 REGULATIONS

Programme outcomes (POs)

1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	**Design/Development Of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	**Environment and Sustain ability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.

12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1	Identify, Formulate and Analyze complex Mechanical Engineering problems
PSO 2	Ability to implement the learned principles of Mechanical Engineering to Understand, analyze, evaluate and create more advanced mechanical systems or processes.
PSO 3	Ability to apply Mechanical Engineering Skills and Managerial Skills to Become Entrepreneurs and build the Attitude to innovate.

VISION AND MISSION OF THE DEPARTMENT

VISION :

To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

MISSION:

M1: Providing students with sound mechanical engineering knowledge, practices, skills and training

M2: Enriching the quality of life of students through teaching, research, internships, outreach programs and symposiums.

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

I Year B.Tech. ME-I Semester

S.No	Subject Code	SUBJECT	L	P	CREDITS
1	15A55101	English	4	-	4
2	15A51101	Mathematics-I	4	-	4
3	15A01101	Environmental Studies	4	-	4
4	15A03101	Engineering Drawing-I	2	4	4
5	15A53101	Engineering Chemistry	4	-	4
6	15A55102	English Language Communication Skills Lab	-	4	2
7	15A53103	Engineering Chemistry Lab	-	4	2
8	15A35101	Engineering Workshop & IT Workshop	-	4	2
		Total	**18**	**16**	**26**

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	L	P	C
	4	0	4

ENGLISH (15A55101)

(Common to All Branches)

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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.

COURSE OBJECTIVES	
1	To enable the students to communicate in English for academic and social purpose
2	To enable the students to acquire structures and written expressions required for their profession.
3	To develop and practice critical and evaluative reading
4	To encourage investigating questions of the humanities through rhetorical study
5	To enhance the study skills of the students with emphasis on LSRW skills

UNIT – I

Chapter entitled *Humour* from "Using English"

Chapter entitled „*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

Chapter entitled *Inspiration* from "Using English"

Chapter entitled „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

Chapter entitled *Sustainable Development* from "Using English"
Chapter entitled „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

Chapter entitled *Relationships* from "Using English"

Chapter entitled „ T*he 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

Chapter entitled Science and Humanism from "Using English"
Chapter entitled „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

2.EXPECTED OUTCOME:

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

	COURSE OUTCOMES
CO1	Develop facility in responding to a variety of situations and contexts calling for purposeful shifts in voice, tone, level of formality, design, medium, and/or structure
CO2	Become effective in the use of different modes of written communication in a professional environment
CO3	Develop capacity to apply different reading methods to evaluate a mass of data on the net and to glean the necessary information
CO4	Learn and use key rhetorical concepts through analyzing and composing a variety of texts
CO5	Well trained in LSRW skills and develop communicative competence

Prescribed Books:

1. **Using English (for detailed study)** 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. **Current English grammar and usage-**S M Guptha, PHI, 2013.
6. **Modern English Grammar-**Krishna SWAMI .McMillan, 2009.
7. **Powerful Vocabulary Builder**- Anjana Agarwal New Age International Publishers, 2011.
8. **Writing with a Purpose, Tickoo and Sasi Kumar, OUP, 2011**
9. **Strengthen Your Writing, Orient Blackswan**

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				3						3				2	1
CO2								3					1		1
CO3				3						3		3	1	2	
CO4								3	3			3	1		1
CO5				3											

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	**L**	**P**	**C**
	4	**0**	**4**

MATHEMATICS – I (15A51101)

(Common to All Branches)

Objectives

	COURSE OBJECTIVES:
1	To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications
2	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.

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, linear equations with variable coefficients: Euler-Cauchy Equations, Legendre‟s linear equation. Applications of linear differential equations-Mechanical and Electrical oscillatory circuits and Deflection of Beams.

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 and envelopes..

UNIT – III

Curve tracing – Cartesian, polar and parametric curves. Length of curves, surface area of solid of revolution (single integrals)

UNIT – IV

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

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.

COURSE OUTCOMES:	
CO1	The students become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems.
CO2	The students attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications.

TEXT BOOKS:

1. Engineering Mathematics-I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher
2. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.

REFERENCES:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1													2	2	
CO2	2			3										2	1
CO3	2	3											2	2	
CO4		3												2	1
CO5			3										2	2	1

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	**L**	**P**	**C**
	4	**0**	**4**

ENVIRONMENTAL STUDIES (15A01101)

	COURSE OBJECTIVES
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : 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 : Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological sucession – 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)

BIODIVERSITY AND ITS CONSERVATION : 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 : 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

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wates – 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. – 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 – V

HUMAN POPULATION AND THE ENVIRONMENT : Population growth, variation among nations. Population explosion – Family Welfare Proggramme. – 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.

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..

	Course outcomes:
CO1	Critical thinking: Demonstrate critical thinking skills in relation to environmental affairs.
CO2	Communication: Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of contexts
CO3	Interdisciplinary synthesis: Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
CO4	Ecological literacy: Demonstrate an awareness, knowledge and appreciation of the intrinsic values of ecological processes and communities.
CO5	Sustainability: Demonstrate an integrative approach to environmental issues with a focus an sustainability.

TEXT BOOKS :

(1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Kaushik, New Age Pubilishers.
(3) Environmental Studies by Benny Joseph, TMH Pubilishers.

REFERENCES :

(1) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company
(2) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(3) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
(4) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(5) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														1
CO2			3		1		3								1
CO3	2							3				1	2	2	
CO4				3	1		3						2		
CO5		2										1		2	

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

	L	P	C
I- Year B.Tech. M.E. I-Sem	**2**	**4**	**4**

ENGINEERING DRAWING-I (15A03101)
(MECHANICAL)

Course Objectives: To impart knowledge on	
C2 02.1	To impart knowledge on Representing any matter/object with the help of picture.
C2 02.2	To impart knowledge on Working drawings
C2 02.3	To impart knowledge on Orthographic drawing of different machine parts.
C2 02.4	To impart knowledge on Developing assembly drawings.
C2 02.5	To impart knowledge on Developing assembly drawings

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance Drawing Instruments and their Use – BIS Conventions in drawing and Lettering.

Curves used in practice:

a) Conic sections including the Rectangular Hyperbola
b) Cycloid, Epicycloid and Hypocycloid –normals and Tangents
c) Involute of a circle –Normals and Tangents
d) Helices –multi start on cylinder and cone

UNIT –II

Principles of orthographic projections – First and Third angle projections Projection of points. Projections of lines inclined to one plane.

UNIT –III

Projection of lines inclined to both reference planes – traces.

UNIT –IV

True length, true angles of projected lines –use of auxiliary planes –profile view, point view. Projection of regular planes inclined to both planes, true shapes.

UNIT –V

Projection of solids inclined to both planes.

Course Outcomes: After the completion of the course,	
CO1	The student will be able to understand the principles of drawing,uses of drawing instruments and able to draw curves in conic section.
CO2	The student will be able to draw orthographic projections and projection of point and lines
CO3	They can able to draw the projection of lines inclined to both the planes.
CO4	They can able to determine the true length and angle of projected lines
CO5	They can able to draw the projection of solids inclined to both the planes

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

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, John&john.

Suggestions:
Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2			2	1	1			1		2	
CO2		3					2	1					3		3
CO3	2		3	2				1	1	2		1		2	3
CO4		3		2			2	1					3		3
CO5	2	3	3	2			2	1	1			1		2	

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	L	P	C
	4	0	4

ENGINEERING CHEMISTRY (15A53101)

(Common to C.E, ME)

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 depend 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 materials 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	
1	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.
2	The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
3	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.
4	The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example

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

iii).Corrosion: definition, Types of Corrosion: Dry Corrosion (Direct Chemical attack), Wet Corrosion, Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and catholic protection and electro and electroless plating. (10h)

UNIT.2
POLYMERS

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

Elastomers

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. Elastomers (rubbers)

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

iii).Liquid Crystals: Introduction, classification and applications

iii).Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications.(12h)

UNIT.3
FUEL TECHNOLOGY

i).Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.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, Advantages and Disadvantages 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. (12h)

UNIT.4

CHEMISTRY OF ENGINEERING MATERIALS

i).Ceramic: General properties, classification.

ii).Glass: Manufacture of glass, properties of glass, fracture of glasses, types of glasses.

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

iv).Refractories: Classification, properties and applications

v).Lubricants: Theory of lubrication, properties of lubricants and applications

vi). Rocket Propellants: Classification, Characteristics of good propellant. (9h)

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 powder, ionisation)

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 Electro dialysis (12h)

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	COURSE OUTCOMES
CO1	The students 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.
CO2	Understand industrially based polymers, various engineering materials.
CO3	Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. The Students select and apply suitable treatments domestically and industrially.
CO4	They can able to know the chemical properties of engineering materials like ceramics, cement, glass, refractories, rocket propellants, lubricants.

CO5	Understanding the water treatment to reduce the impurities, corrosion of boiler, Internal and external treatment of water.

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 Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi
2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				1		3									
CO2		2	3										1	2	3
CO3				1	2										
CO4		2				3	3						1	2	3
CO5			3												

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	**L**	**P**	**C**
	0	**4**	**2**

ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB (15A55102)

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.

COURSE OBJECTIVES	
1	To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2	To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3	To provide opportunities for practice in using English in day to day situations
4	To improve the fluency in spoken English and neutralize mother tongue influence
5	To train students to use language appropriately for debate, group discussion and public speaking

SYLLABUS:
UNIT- I

Phonetics – Introduction to Sounds of Speech – Vowels – Consonants – Phonetic Transcription & Orthographic Transcription

UNIT – II

Syllabification – Word Stress – Rules of word stress – Intonation – Falling tone and Rising tone

UNIT – III

Situational Dialogues – Role-play – Expressions in various situations – Self Introduction – Introducing others – Greetings – Apologies – Requests – Social and Professional etiquettes – Telephone Etiquettes

UNIT – IV

JAM – Describing object/person/place/situation – Giving directions

UNIT – V

Debates and Group Discussions

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. Walden Infotech English Language Communication Skills.
2. Clarity Pronunciation Power – Part I (Sky Pronunciation)
3. Clarity Pronunciation Power – part II
4. K-Van Advanced Communication Skills
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. *DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.*
7. Lingua TOEFL CBT Insider, by Dreamtech
8. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
9. Cambridge Advanced Learners" English Dictionary with CD.

	COURSE OUTCOMES
CO1	Better Understanding of nuances of language through audio- visual experience and be independent learners
CO2	The significance of paralinguistic features will be understood by the students and they will try to be intelligible.
CO3	Become good at Inter-personal skills
CO4	Achieve neutral accent and be free from mother tongue influence
CO5	Being an active participant in debates and group discussion, showing ability to express agreement, argument to summarize ideas to elicit the views of others and present own ideas;

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. **Speaking English Effectively**, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. **A Hand book for English Laboratories**, E.Suresh kumar, P.Sreehari, Foundation Books,2011
5. **English Pronunciation in Use. Intermediate & Advanced**, Hancock, M. 2009. CUP
6. **Basics of Communication in English**, Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
7. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
8. **English Pronouncing Dictionary**, Daniel Jones Current Edition with CD.Cambridge, 17th edition, 2011.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3						2
CO2									3	3		3			
CO3														1	
CO4									3	3			1		2
CO5															

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	L	P	C
	0	4	2

ENGINEERING CHEMISTRY LAB (15A53103)

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 feel good factor at the laboratory bench about the chemical principles that he/she learned in the classroom.

	COURSE OBJECTIVES
1	Will learn practical understanding of the redox reaction
2	Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention
3	Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
4	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 Copper by Iodometry
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 Chromite indicator (Mohrs method)

(Any 10 experiments from the above list)

	COURSE OUTCOMES
CO1	Would be confident in handling energy storage systems and would be able combat chemical corrosion
CO2	Would have acquired the practical skill to handle the analytical methods with confidence.
CO3	Would feel comfortable to think of design materials with the requisite properties
CO4	Would be in a position to technically address the water related problems.
CO5	Determine viscosity, pH, acidity, corrosion of water

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 by SS Dhara, S. Chand Publications, New Delhi

REFERENCES:

1. A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi
2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				3									2		
CO2	2					2								2	1
CO3				3	1									2	
CO4	2		3		1	2							2	2	1
CO5			3	3											

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem	L	P	C
	0	4	2

ENGINEERING WORKSHOP& IT WORKSHOP LAB (15A35101)

Part-A

ENGINEERING WORKSHOP

(Common to All Branches)

	COURSE OBJECTIVES
1	The objective of this subject is to provide the basic concepts about the engineering workshop trades like Carpentry, Fitting etc.
2	Gain knowledge of the use of various workshop tools and make models in the respective trades.
3	Exposure to power tools

1. TRADES FOR EXERCISES:

At least 2 exercise In each:

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

Course Outcomes	
CO1	Student will be aware of the safety aspects in using the tools
CO2	Student will be able to use the tools for the preparation of models in respective trades of engineering workshop.
CO3	Precautions in making the models will be known by the student.
CO4	Student will be aware of the usage of the power tools for various purposes.
CO5	Knowledge about the measuring instruments will be achieved.

TEXT BOOK:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ Scitech Publishers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2			3			2		3	
CO2			2												
CO3		3			3		1				2	2			
CO4				2			1				2		2	3	2
CO5	3		2						3			2			2

Codes / Tables : Nil

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

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem

IT Workshop
(Common to All Branches)

PART – B (IT Workshop)

COURSE OBJECTIVES	
1	To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
2	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
3	To learn about Networking of computers and use Internet facility for Browsing and Searching

Preparing your Computer

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

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

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.

COURSE OUTCOMES	
CO1	Disassemble and Assemble a Personal Computer and prepare the computer ready to use
CO2	Prepare the Documents using Word processors and Prepare spread sheets for calculations using excel
CO3	Prepare Slide presentations using the presentation tool
CO4	Interconnect two or more computers for information sharing
CO5	Access the Internet and Browse it to obtain the required information

References:

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2						3		2	3	
CO2	3														
CO3	3	2	3		2				2						2
CO4										2		2	2		
CO5				2		1			2	2					2

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

I Year B.Tech ME- II Semester

S.No		SUBJECT	L	P	CREDITS
1	15A55201	Technical Communication and Presentation Skills	4	-	4
2	15A51201	Mathematics –II	4	-	4
3	15A05201	Problem solving and Computer Programming	4	-	4
4	15A52201	Engineering Physics	4	-	4
5	15A03201	Engineering Drawing-II	2	4	4
6	15A01202	Engineering Mechanics	4	-	4
7	15A05202	Computer programming Lab	-	4	2
8	15A52202	Engineering Physics Lab	-	4	2
		Total	**22**	**12**	**28**

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	**L**	**P**	**C**
	4	**0**	**4**

TECHNICAL COMMUNICATION & PRESENTATION SKILLS (15A55201)

PREAMBLE:

In the increasingly globalized world, technical communication and presentation skills are assuming great importance. Industries and employers constantly complain that young engineers have adequate technical knowledge, but no communication and presentation skills. Success is defined these days in terms of possessing these skills. The syllabus has been designed to develop communicative competencies of the students.

	COURSE OBJECTIVES
1	To develop awareness in students of the relevance and importance of technical communication and presentation skills.
2	To prepare the students for placements
3	To sensitize the students to the appropriate use of non-verbal communication
4	To train students to use language appropriately for presentations and interviews
5	To enhance the documentation skills of the students with emphasis on formal and informal writing

UNIT 1:

Basics of Technical Communication – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

UNIT II

Informal and Formal Conversation - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

UNIT III

Written communication – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication

UNIT IV

Presentation Skills – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

UNIT V

Interview Skills – The Interview process –Characteristics of the job interview – Pre-interview preparation techniques – Projecting the positive image – Answering Strategies

OUTCOME

Turning out the students with a clear concept of communication and presentation skills, getting them ready for placements and equipping them with readiness to implement them at work place.

	COURSE OUTCOMES
CO1	Become effective technical communicators
CO2	Be job-ready and able to face interviews confidently
CO3	Sensitive use of non-verbal language suitable to different situations in professional Life
CO4	Learn and use keys words, phrases and sentence structures making a mark in interviews and presentation skills
CO5	Effective writing skills with the ability to use different styles for different situations

Prescribed Books

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009

Reference Books

1.Communication Skills by Pushpalatha & Sanjay Kumar, Oxford Univsesity Press

2.Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron"s/DELTA/Cambridge University Press.2012.

3. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.

4. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

5. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

6.English for Technical Communication for Engineering Students, Aysha Vishwamohan,

Tata Mc Graw-Hill 2009.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															2
CO2									3						2
CO3										3		3	1		2
CO4									3						2
CO5									3			3		1	

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	**L**	**P**	**C**
	4	**0**	**4**

MATHEMATICS – II (15A51201)
(Common to All Branches)

COURSE OBJECTIVES:	
1	To impart basic knowledge on Fourier series, Fourier transforms, Laplace Transforms, z-transforms and partial differential equations.
2	To develop skills in analyzing the problems, designing mathematical models, Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations for the problems in engineering.

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 transform – Application of Laplace transforms 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.

	COURSE OUTCOMES: After completion of the course a successful student is able to
CO1	Acquire basic knowledge in (a) Fourier series and Fourier transforms (b) Fourier integrals (c) Laplace transforms and their applications (d) z- transforms and their applications (e) Solving partial differential equations (f) Heat transfer and wave motion
CO2	Develop skills in Analyzing the (a) Properties of Fourier series for a given function (b) Partial differential equations through different evaluation methods (c) Difference equations through z – transforms (d) Engineering systems and processes involving wave forms and heat transfer
CO3	Develop skills in designing mathematical models for (a) Problems involving heat transfer and wave forms (b) Engineering concepts involving, Fourier transforms, Fourier integrals, (c) Laplace transforms, z-transforms and difference equations
CO4	Develop analytical skills in solving the problems involving (a) Fourier series and Fourier transforms (b) Laplace transforms (c) Z-transforms and difference equations (d)Heat transfer and wave motion
CO5	Use relevant transformation techniques for (a) Obtaining Fourier transforms for different types of functions (b) Laplace transforms (c) Z- transforms (d) Partial differential equations

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3											1		
CO2	3													1	
CO3		3											1	1	
CO4	3				3										
CO5		3	3		3	3							1		

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	L	P	C
	4	0	4

Problem solving and Computer Programming (15A05201)

(Common to All Branches)

COURSE OBJECTIVES	
1	To understand the various steps in Program development
2	To understand the basic concepts in C Programming Language
3	To learn how to write modular and readable C Programs
4	To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures.
5	To understand the notations used to analyze the Performance of algorithms.
6	To understand and analyze various searching and sorting algorithms

UNIT - I

Introduction: Programs and Programming, Programming Languages, Compiler, Interpreter, Loader and Linker, Program Execution, Classification of Programming, Structured Programming Concept, Algorithms, Flowcharts, System Developments.

Fundamentals Algorithms: Exchange the Values between two variables, Counting, Summation of set of numbers, Factorial Computation, Generation of the Fibonacci sequence, Reversing the digits of a integer.

Basics Of C: Introduction**,** Developing Programs in C, A Simple C program, Parts of C Program Revisited.

UNIT – II

Structure of C: Structure of a C Program, Concept of a Variable, Data Types in C, Program Statements, Declaration, Tokens, Operators and Expressions, Type conversion in C.

Input and Output: Introduction, Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Function.

Control Statements: Introduction, Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection, Iteration and Repetitive Execution. Nested Loops.

UNIT – III

Arrays And Strings: Introduction, One-Dimensional Array, Strings, Multidimensional Arrays, Arrays of Strings.

Function: Introduction, Concept of Functions, Using Functions, Call by Value Mechanism, Working with Functions, Passing Arrays to Functions, Scope and Extent, Inline Function, Recursion.

UNIT - IV

Factoring Methods: Finding Square root of a Number, The Smallest Deviser of an Interger, The GCD of Two Integers, Generating Prime Numbers.

Pointers – Introduction, Understanding Memory, Address Operator, Pointer, Void Pointer, Null Pointer, Use of pointer, Arrays and Pointers, Pointers and string, Pointers and string, Pointers to pointers, Array of pointers, Pointers to Function, Dynamic Memory Allocation,.

UNIT – V

User-Defined Data Types and Variables: Introduction, User-defined Data Types, Structures, Union, Enumeration Types.

Files in C: Introduction, Using Files in C, Working with text Files, Working with Binary Fields, Direct File Input and Output, Files of Records, Random Access to Files of Records.

COURSE OUTCOMES	
CO1	Able to design the flowchart and algorithm for real world problems
CO2	Able to learn and understand new programming languages
CO3	Able to construct modular and readable programs
CO4	Able to write C programs for real world problems using simple and compound data types
CO5	Adapt programming experience and language knowledge to other programming language contexts

TEXT BOOKS:

1. Programming in C, Pradip Dey, Manas Ghosh, Second Edition, OXFORD,
2. How to Slove it by Computer by R.G. Dromey, Pearson.

REFERENCES:

1. Programming in C and Data Structures, Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Pearson Education.

2. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
3. Programming In C, Remma Teraja, Second Edition OXFORD.
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
3. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
4. Education / PHI
5. C Programming & Data Structures,E.Balagurusamy,TMH.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			1		1		3			3			
CO2			3			2		1		1	2		2	1	
CO3			3	3				1							3
CO4		2					3		3	1	2		2		
CO5	1				1					1					

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I-B.Tech. II SEM	T	P	C
	0	3	3

Engineering Physics

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	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.
3	To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications.
4	To understand and employ the concepts of waves & oscillations and acoustics to engineering applications.
5	To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications. Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nano and smart materials, their properties and applications in modern emerging technologies are elicited.
6.	To enlighten the characterization of materials by different techniques, the periodic arrangement of atoms in crystals, Bragg's law and X-Ray diffraction technique.

UNIT 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

Physical Optics*:* Introduction to interference – Colours in thin films – Newton‟s Rings – Michelson interferometer - Fraunhoffer diffraction due to single slit, double slit – Diffraction grating.

Lasers*:* Introduction – Characteristics of laser – Spontaneous and stimulated emission of radiation –- Einstein‟s coefficients — Population inversion – Pumping mechanisms - Ruby laser – He-Ne laser – Applications of lasers.

Fiber optics: Introduction – working principle of optical fiber – Numerical aperture and acceptance angle – Types of optical fibers –Optical fiber communication system – Attenuation and losses in optical fibers – Applications of optical fibers.

UNIT 2: **WAVES & OSCILLATIONS AND ACOUSTICS**

Waves & Oscillations*:* Categories of waves: Mechanical, electromagnetic, matter and gravitational – Reflection and transmission of waves at a boundary – Free oscillations – Damped Oscillations – Forced oscillations – Resonance – Coupled oscillations.

Acoustics*:* Sound absorption – Absorption coefficient and its measurement – Reverberation time – Sabine‟s formula – Eyring‟s formula.

UNIT 3: **DIELECTRICS AND MAGNETIC MATERIALS**

Dielectrics*:* Introduction – Dielectric Polarization – Types of Polarization – Lorentz field – Clausius- Mosotti equation – Dielectric strength, loss, breakdown.

Magnetic materials*:* Introduction – Basic definitions – Origin of magnetic moment – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials – Hysteresis – Soft and hard magnetic materials – Applications of magnetic materials.

UNIT 4: **ADVANCED MATERIALS**

Superconductors*:* Introduction – Properties of superconductors – Meissner effect– Type I and Type II superconductors – ac and dc Josephson effects – BCS theory (qualitative treatment) – High T_c superconductors – Applications of superconductors.

Nanomaterials: Introduction – Significance of nanoscale – Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic – Carbon nanotubes & their properties – Applications of nanomaterials.

Smart Materials: Shape Memory Alloys: Definition – Two phases – One way and two way memory effect – Pseudo elasticity – Applications

of shape memory alloys.

UNIT 5: MATERIAL CHARACTERIZATION AND CRYSTALLOGRAPHY

Material Characterization: Electron microscopy: SEM, TEM, AFM – UV-Visible and IR Spectroscopy – Non-destructive testing: objectives – Methods: Pulse-echo method.

Crystallography*:* Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction – Bragg‟s law – Laue method.

	COURSE OUTCOMES
CO1	The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fiber optics.
CO2	The concepts of types of waves and oscillations ,acoustics are highlighted
CO3	The dielectric and magnetic response of materials are focussed.
CO4	The importance of superconducting materials, nano and smart materials along with their engineering applications are well elucidated.
CO5	Characterization of materials by advanced techniques, the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique are focused.

Prescribed Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S.Chand and Company

2. Engineering physics – S. Mani Naidu, Pearson Education

3.Instrumental methods of analysis - Willard and Meritt

Reference Books:

1. Introduction to modern optics – Grant R Fowles
2. A text book on Optics – Brijlal & Subramanyam
3. Laser Fundamentals – William T. Silfvast, Cambridge University Press
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Shape Memory Alloys-Modeling and Engg. Applications – C Lagoudas, Springer
7. Hand Book of Non-destructive evaluation, C.J.Hellier, McGraw-Hill
8. Engineering Physics – V. Rajendran, K.Thyagarajan Tata MacGraw Hill Publishers
9. Engineering Physics – M.R.Srinivasan, New Age Publications
10. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
11. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
12. Engineering Physics – M. Arumugam, Anuradha Publications

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2								2	1	1
CO2	3				2				3				2		
CO3	3		3	3	2								2	1	1
CO4		3	2		3								2	1	1
CO5	3	3	3	2											

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem **T P C**

2 4 4

ENGINEERING DRAWING-II (15A03201)

(MECHANICAL)

Course Objectives: To impart knowledge on	
C2 02.1	To impart knowledge on Representing any matter/object with the help of picture.
C2 02.2	To impart knowledge on Working drawings
C2 02.3	To impart knowledge on Orthographic drawing of different machine parts.
C2 02.4	To impart knowledge on Developing assembly drawings.
C2 02.5	To impart knowledge on Developing assembly drawings

Unit –I

Sections of solids: Sections and Sectional views of Regular solids –Prism, Cylinder, Pyramid, Cone – True shapes.

Development of Regular solids, sphere and transition piece.

Unit –II

Isometric projection: Isometric views of lines, plane figures, Compound solids, Spherical parts.

Unit –III

Conversion of Pictorial views to orthographic views –Conventions.

Unit –IV

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

Unit –V

Perspective projections –Planes and simple solids. Vanishing point Method only.

	Course Outcomes
CO1	The student will be able to draw the sectional views and the true shape of the sectional view of the regular solids like prism, cone, cylinder, pyramid and sphere and develop them.
CO2	The student will be able to draw the 3D pictorial projections/views of the planes, regular solids and compound solids.
CO3	Given with the 3D pictorial views, the student will be able to convert the figure to 2D orthographic view.

CO4	Student will be able to draw the intersecting curves between the solids between the solids like cylinder, cone and prism.
CO5	Student shall develop to draw the perspective projections of planes and regular solids with the help of the given data.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

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, John&john.

Suggestions:
Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					3	3							2		2
CO2	3				3	3	3						2	1	
CO3	3					3			3					1	2
CO4	3				3		3		3				2	1	
CO5					3		3		3						2

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	L	P	C
	4	0	4

ENGINEERING MECHANICS (15A01202)

(Common to Civil and Mechanical Engineering)

	COURSE OBJECTIVES
1	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

COURSE OUTCOMES :	
CO1	To acquire the basic knowledge of the analysis of general structures when external loads are applied.
CO2	To understand the forces and their systems, equilibrium of systems of forces, static analysis of simple plane trusses.
CO3	To know about friction and their types, area moment of inertia, mass moment of inertia
CO4	Ability to know about kinematics, kinetics and concepts of mechanical vibrations.
CO5	To understand the basic concepts in structural mechanics.

TEXT BOOKS:

(1) Engineering Mechanics by Bhavakatti, New age Pubilishers
(2) Engineering Mechanics by Dr.R.k.Bansal, Lakshmi Publications.
(3) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.

REFERENCES:

(1) Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
(2) Engineering Mechanics by Shames & Rao – Pearson Education.
(3) Engineering Mechanics by Fedrinand L.Singer – Harper Collings Publishers.
(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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		3		3					3	2		
CO2	3	3		3		3			3		2			2	2
CO3				3	3	3	3		3			3	2	2	
CO4	3	3		3							2				
CO5	3	3	3		3		3		3			3	2		2

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. II-Sem	**L**	**P**	**C**
	0	**4**	**2**

COMPUTER PROGRAMMING LAB
(15A05202)
(Common to All Branches)

	COURSE OBJECTIVES
1	To work with the compound data types
2	To explore dynamic memory allocation concepts
3	Able to design the flowchart and algorithm for real world problems
4	Able to write C programs for real world problems using simple and compound data types
5	Employee good programming style, standards and practices during program development

Week-1

1) Write a C program to make the following exchange between the variables a-> b -> c->d - > a
2) Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, and division between two variables
3) Write a C program for printing prime numbers between 1 and n.

Week-2

1) Write a C program to construct a multiplication table for a given number.
2) Write a program to reverse the digit of a given integer.
3) Write a C program to find the sum of individual digits of a positive integer.
4) Write a C program to calculate the factorial of a given number

Week-3

1) Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

2) Write a program to calculate tax, given the following conditions:
   a) If income is less than 1,50,000 then no tax.
   b) If taxable income is in the range 1,50,001 – 300,000 then charge 10% tax
   c) If taxable income is in the range 3,00,001 – 500,000 then charge 20% tax
   d) If taxable income is above 5,00,001 then charge 30% tax

Week-4

1) Write a program to print the calendar for a month given the first Week- day of the month.
   Input the first day of the month (Sun=0,Mon=1,Tue=2,Wed=3,.....) :: 3
   Total number of days in the month : 31
   Expected output

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
-	-	-	*1*	*2*	*3*	*4*
5	*6*	*7*	*8*	*9*	*10*	*11*
12	*13*	*14*	*15*	*16*	*17*	*18*
19	*20*	*21*	*22*	*23*	*24*	*25*

25	*26*	*27*	*28*	*29*	*30*	*31*

2) Write a C program to find the roots of a quadratic equation

Week-5
1) Write a program to print the Pascal triangle for a given number
2) Write a C program to find the GCD (greatest common divisor) of two given integers
3) Write a C program to construct a pyramid of numbers.
4) Write C code to define a function cash_dispense, which takes an amount as its input, and returns the number of 1000, 500, 100, 50, 20, 10, 5, 2, 1 rupee denomination that make up the given amount

Week-6
1) Write C code to reverse the contents of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]
2) Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices

   ii) Multiplication of Two Matrices
3) Write a program that will search and find out the position where the given key element exist in a user chosen array and print it as output.

Week-7
1) Write C code to compute the frequency table of survey responses given by 20 users. The survey responses range from 1 to 5 and are stored in an array. For example, 10 responses are stored in the array [1,1,5,2,3,3,5,5,2,2]. The frequency table will be as shown below:
   a. 1 = 2
   b. 2 = 3
   c. 3 = 2
   d. 4 = 0
   e. 5 = 3
2) Write a program to define a function to sort an array of integers in ascending order by using exchange sort.

Week-8
1) Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.
2) Write a C program to determine if the given string is a palindrome or not by using string functions.
3) Write a function that accepts a string and delete the first character.
4) Write a function that accepts a string and delete all the leading spaces.

Week-9
Write a program to accept a string from user and display number of vowels, consonants,

digits and special characters present in each of the words of the given string.

Week-10
1) Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as union variable
2) Declare a structure time that has three fields hr, min, secs. Create two variables,start_timeandend_time. Input there values from the user. Then while start_time is not equal to end_time display GOOD DAY on screen.

Week-11
1) Write a program to read in an array of names and to sort them in alphabetical order. Use sort function that receives pointers to the functions strcmp, and swap, sort in turn should call these functions via the pointers.
2) Write a program to read and display values of an integer array. Allocate space dynamically for the array using the *malloc()*.
3) Write a program to calculate area of a triangle using function that has the input parameters as pointers as sides of the triangle.

Week-12

1) Two text files are given with the names text1 and text2. These files have several lines of text. Write a program to merge (first line of text1 followed by first line of text2 and so on until both the files reach the end of the file) the lines of text1 and text2 and write the merged text to a new file text3.
2) Write a program to split a given text file into n parts. Name each part as the name of the original file followed by .part<**n>** where n is the sequence number of the part file.

COURSE OUTCOMES	
CO1	Translate algorithms in to programs
CO2	Code and debug programs in C program language using various constructs.
CO3	Formulate problems and implement algorithms in C.
CO4	Able to use different data types in a computer program

Reference Books:

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, Third Edition, Cengage Learning
2. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, Third Edition, Cengage Learning
3. Programming with C RemaTheraja, Oxford
4. “C Test Your Skills”, Kamthane, Pearson Education
5. Programming in C: A Practical Approach, Ajay Mittal, Pearson
6. Problem solving with C, M.T.Somasekhara, PHI
7. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
8. Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		3	2			3	2					
CO2			2				1			2		3		3	1
CO3	3			3		2		3							
CO4				3		2		3	3		3		1		
CO5		3	2		3		1			2					1

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I-B.Tech. II SEM	T	P	C
	0	4	2

ENGINEERING PHYSICS LABORATORY (15A52202)

COURSE OBJECTIVES	
1	The Objective of this course is to make the students gain practical knowledge to correlate with the theoretical studies.
2	To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.
3	To train engineering students on basis of measurements and the instruments
4	To equip the students with practical knowledge in electronic, optics, and heat experiments

Any EIGHT of the following experiments has to be performed during the SEMESTER

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method
2. Determination of dispersive power of prism
3. Determination of thickness of thin object by wedge method
4. Determination of radius of curvature of lens by Newton‟s rings
5. Laser : Diffraction due to single slit
6. Laser : Diffraction due to double slit
7. Laser: Determination of wavelength using diffraction grating
8. Determination of Numerical aperture of an optical fiber
9. Meldes experiment: Determination of the frequency of tuning fork
10. Sonometer: Verification of the three laws of stretched strings
11. Energy gap of a material using p-n junction diode
12. Electrical conductivity by four probe method
13. Hall effect: Determination of mobility of charge carriers in semiconductor
14. B-H curve
15. Magnetic field along the axis of a current carrying coil – Stewart and Gee‟s method
16. Determination of dielectric constant and Curie temperature of a ferroelectric material

COURSE OUTCOMES	
CO1	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.
CO2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CO4	The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application.
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1				3				1		2	
CO2		2			2							1	2		
CO3	1		3	1			3		2	3	1		2		3
CO4		2				1		3							
CO5			3						2				2	2	

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME- I Semester

S.No	Subject Code	SUBJECT	T	P	CREDITS
1	15A51301	Mathematical Methods	4	0	4
2	15A03301	Thermodynamics	4	0	4
3	15A03302	Material Science and Metallurgy	4	0	4
4	15A03303	Kinematics of Machinery	4	0	4
5	15A01307	Mechanics of Solids	4	0	4
6	15A24301	Electrical and Electronics Engineering	4	0	4
7	15A54302	Human Values & Professional Ethics (Audit)	2	0	0
8	15A24302	Electrical and Electronics Engineering Lab	0	4	2
9	15A13302	Mechanics of Solids Lab & Material Science Lab	0	4	2
		Total	**26**	**8**	**28**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

T	P	C
4	0	4

MATHEMATICAL METHODS (15A51301)

(CIVIL, MECH &CHEM)

	Course Objectives:
1	This course aims at providing the student with the concepts 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: 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 Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

Course Outcomes:	
CO1	The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.
CO2	They can able to find out the solutions for algebraic and transcendental equations.
CO3	Able to do the problems on Newton's, Lagrange's, Gauss ,Stirling's & Bessel's formula.
CO4	Students can able to solve the problems on curve fitting.
CO5	They are able to find solutions for ordinary differential equations.

TEXT BOOKS:

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

REFERENCES:

2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
3. 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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		3		2			2			1	3	2	3
CO2			3												
CO3	3								2						
CO4		3		3										2	
CO5			3			2							3		3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	T	P	C
	4	0	4

THERMODYNAMICS (15A03301)

	Course Objectives
1	To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

UNIT- I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, 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.

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

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

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

Note: Steam tables Mollier Diagrams Shall be supplied.

	Course Outcomes
CO1	Describe basic concepts of thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications.
CO2	Analyse how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balance equation to various applications.
CO3	Identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle
CO4	Judge the properties of pure substances and method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance, usage of steam tables and mollier diagrams
CO5	Understand and analyse of ideal gas& gas mixtures, Gas Power Cycles, concept of ideal cycles for different engines and their working principle.

TEXT BOOKS :

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2					2			2		2		2
CO2		2	2	1						2		3		2	
CO3	3	2						2		2	2	3	2	2	2
CO4				1				2		2	2		2	2	
CO5			2	1								3			

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	T	P	C
	4	0	4

MATERIAL SCIENCE AND METALLURGY (15A03302)

	COURSE OBJECTIVES Students can able to learn about
1	Structure of Metals and types of solids
2	They can understand the equilibrium diagrams, properties and structure of the mild steel an Iron.
3	Heat treatment of steel, properties and structure of ceramic ,composite materials

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.

	COURSE OUTCOMES
CO1	Students can able to Study structure of different material. Select materials for design and construction.
CO2	The importance of structure of materials.
CO3	They can able the study the properties of ferrous and non ferrous materials.
CO4	To study the heat alloys.
CO5	To study about the ceramic and composite materials.

TEXT BOOKS :

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

REFERENCES :

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3		2		2						2		3	
CO2	3			2		2	1			2	2				1
CO3	3	3			2		1								1
CO4			3		2		1		3	2	2			3	
CO5		3	3		2		1		3			2	3		

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MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	**T**	**P**	**C**
	4	**0**	**4**

KINEMATICS OF MACHINERY (15A03303)

	COURSE OBJECTIVES
1	Analysis of Mechanisms
2	Concept of straight line motion mechanisms and steering gear mechanisms
3	Principles involved in the displacement, velocity and acceleration at a point in a link of a mechanism
4	Concepts of toothed gearing and gear train.
5	Designing of cam profile and analysis of motion of followers.

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. Klein"s 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, Simple problems.

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.

	Course outcomes
CO1	An understanding of concepts of different of mechanism with lower pairs and higher pairs.
CO2	Gain the knowledge of different types of straight line mechanism and steering gear mechanisms.
CO3	Obtain an in depth knowledge of finding displacement ,velocity and acceleration of different Points on different mechanisms using different methods (relative velocity, Instantaneous methods).
CO4	Aquire the knowledge on different gear profiles and calculating the different parameters of gears.Gain the knowledge in designing of gear trains for the required purpose.
CO5	Design and analyse different cam profile for different types of followers.

TEXT BOOKS :

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

REFERENCES :

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Theory of Machines, Thomas Bevan, CBS.
3. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
4. Theory of machines, P.L. Ballaney, Khanna Publishers.
5. Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers
6. Theory of Machines, by R.S. Khurmi & J.K. Gupta S. Chand Pub.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2		1		1		2		1	2		
CO2	3	2	2		2		1	1	1	2	2	1	2	3	
CO3				2	2	1	1		1		2	1		3	
CO4	3	2	2	2	2		1		1	2	2		2	3	
CO5			2					1		2					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	**T**	**P**	**C**
	4	**0**	**4**

MECHANICS OF SOLIDS (15A01307)

	Course Objectives:
1	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 – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers for simple loading cases.

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.

	Course Outcomes:
CO1	Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
CO2	Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.
CO3	Determining the flexural stresses and shear stresses on different beams.
CO4	Deriving torsion equation for circular shafts and and finding deflection on beams.
CO5	Solving equations for stresses and strains , Applying Lame’s theory for cylinders.

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) Mechanics of Materials by Swaroop Adarash, New Age Publications

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 S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	2			3		3
CO2		3			3	2			3	2		3	3	2	3
CO3	3	3								2		3	3	2	3
CO4	3				3	2			3			3		2	
CO5		3				2									

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	T	P	C
	4	0	4

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING (15A24301)

PART – A

ELECTRICAL ENGINEERING

	Course Objectives: To make the students learn about:
1	The basics of AC & DC Circuits, DC generators & motors.
2	The construction and operation of Transformers, Induction motors and their performance aspects will be studied.

UNIT – I

Introduction to DC & AC Circuits

Ohm‟s Law, Basic Circuit Components, Kirchhoff‟s Laws, Types of Sources, Resistive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The J Operator and Phasor Algebra, Analysis of Ac Circuits With Single Basic Network Element, Single Phase Series.

UNIT-II

DC Machines D.C Generators:

Principle of Operation of Dc Machines, Types of D.C Generators, E.M.F Equation in D.C Generator, O.C.C. of a D.C. Shunt Generator D.C Motors: Principle of Operation of Dc Motors, Types of D.C Motors, Torque Equation, Losses and Efficiency Calculation in D.C Motor- Swinburne‟s Test

UNIT-III

AC Machines Transformers:

Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests. Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).

Alternators: Principle of Operation-Constructional Details-EMF Equation-Voltage Regulation by Synchronous Impedance Method.

Course Outcomes: After completing the course, the student should be able to :	
CO1	Analyze the basics of AC & DC Circuits and know the performance characteristics of DC generators & motors.
CO2	Study the D.C. Generators, D.C.Motors.
CO3	Gets a thorough knowledge on Transformers, Induction motors & Alternators with which he/she can able to apply the above conceptual things to real-world problems and applications.

TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5^{th} Edition-2007

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2			2		2				1		2	1
CO2				1			1		3	2					
CO3		3			3			2			1	1	3		
CO4				1			1							2	
CO5	2							2	3						1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	**T**	**P**	**C**
	4	**0**	**4**

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING (15A24301)

PART – B

ELECTRONICS ENGINEERING (15A24301)

(Common to Mech. Engg. & Chem. Engg.)

COURSE OBJECTIVES: The students will be able to	
1	Understand principle and terminology of electronics.
2	Analyze the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators.
3	Understand the concept of number systems.
4	Understand the concept & principles of logic devices.

PART-B

UNIT I

Semiconductor Devices-N-Type and P-Type Semiconductors, The p-n Junction Diode - Drift and Diffusion Currents, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-types of Rectifier, Rectifiers with Filters, Zener Diode- Characteristics, Zener Diode as Voltage Regulator. Silicon Controlled Rectifier, DIAC, TRIAC.

UNIT II

Bipolar Junction Transistor (BJT) – Types of Transistors, Theory andOperations of Transistors, Input-Output Characteristics of BJT Configurations,Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as anAmplifier and Switch, Junction Field Effect Transistor (JFET)- (construction, principle of Operation, symbol), Characteristics -Input/output, Transfer Characteristics, Configurations of JFET, JFET Applications- JFET as an Amplifier and Switch, Comparison of BJT and JFET, MOSFET- The Enhancement and Depletion MOSFET, Characteristics and Applications of MOSFET

UNIT III

Digital Electronics: Number Systems-Decimal System, Binary System, Octal System,Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates-NAND, NOR Gates. Boolean algebra and De Morgan‟s Theorems,

COURSE OUTCOMES At the end of this course the student will be able to	
CO1	Apply the concept of science and mathematics to explain the working of diodes and its applications, working of transistor and its characteristics and to analyze and design different transistor biasing circuits.
CO2	Analyze the applications of operational amplifiers.
CO3	Solve problems of various digital logic gates and circuits.
CO4	Correlate the fundamental concepts to various Real life applications of today.

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TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.
4. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.
5. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1			1		2				2			
CO2		2		3	2					1	3			2	1
CO3			1		2		3		1			1			
CO4					2						3				1
CO5						1				1		1	3		

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MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

T	P	C
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HUMAN VALUES AND PROFESSIONAL ETHICS (15A54302)

	Course Objectives:
1	To create an awareness on Engineering Ethics and Human Values.
2	To instill Moral and Social Values and Loyalty
3	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

	Course Outcomes:
CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible and their own ethical values and the social context of problems.
CO4	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
CO5	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. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
3. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
4. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
5. . "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication. Research – Analyzing Ethical Problems in research – Intellectual property Rights(IPR).
6. "Professional Ethics and Human Values" by Prof.D.R.Kiran-

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1		3	1	1					
CO2						1		3	1	1					
CO3						1		3	1	1					
CO4						1		3	1	1					
CO5						1		3	1	1					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

T	P	C
0	4	2

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING LAB (15A24302)

PART – A: ELECTRICAL ENGINEERING LAB

	Course Objectives
1	The DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
2	Various test conditions of single phase transformers.

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne‟s Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
2. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
3. Brake Test on 3-Phase Induction Motor (Determination of Performance Characteristics).
4. Regulation of Alternator by Synchronous Impedance Methods.
5. Speed Control of D.C.Shunt Motor by
   a). Armature Voltage Control b) Field Flux Control Method
6. Brake Test on D.C Shunt Motor

Course Outcomes: After completing the course, the student should be able to do the following	
CO1	Learn about DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
CO2	Various test conditions of single phase transformers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			3		1		3					1		
CO2			1						1		1				2
CO3			1	3			2		1			1	1	3	
CO4		2			2			3		2	1				
CO5														3	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

T	P	C
0	4	2

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING LAB (15A24302)

ELECTRONICS ENGINEERING LAB (Six Experiments)

	COURSE OBJECTIVES The students will be able to
1	Understand the characteristics of PN junction diode and zener diode.
2	Understand the characteristics of BJT in CE and CB configurations
3	Learn the frequency response of CE Amplifier
4	Exposed to linear and digital integrated circuits

1. P-N Junction Diode and Zener Diode Volt-Ampere Characteristics.

2. Half-Wave Rectifier- a) Without Filter b) With Capacitor Filter.

3. Full-Wave Rectifier- a) Without Filter b) With Capacitor Filter.

4. Bipolar Junction Transistor in CE Configuration-Input and Output Characteristics, Computation of β.

5. Junction field effect Transistor in Common Source Configuration Output and Transfer Characteristics.

6. Verification of Logic Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR

	COURSE OUTCOMES
CO1	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
CO2	Analyze the application of diode as rectifiers, clippers and clampers.
CO3	Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits.
CO4	Learn the basics of linear integrated circuits and understand characteristics of operational amplifier.
CO5	Learn about available digital ICs and verify truth tables of logic gates and flip flops.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					2				1				1		
CO2	3	1	1				1		1				1		
CO3				3		1		3		2	2			1	2
CO4		1				1						3			
CO5					2			3		2					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

T	P	C
0	4	2

MECHANICS OF SOLIDS LAB (15A13302) (A)

	Course Objectives:
1	The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures.

LIST OF EXERCISES :

2. Tension test.
3. Bending test on (Steel/Wood) Cantilever beam.
4. Bending test on simple support beam.
5. Torsion test.
6. Hardness test.
7. Shear test

	Course Outcomes:
CO1	Ability to perform different destructive testing.
CO2	Ability to characteristic materials.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	1		1		1		1		1
CO2	1	2	2	1	2	1		1		1		1		1	
CO3															
CO4															
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem	**T**	**P**	**C**
	0	**4**	**2**

MATERIAL SCIENCE LAB (15A13302) (B)

Course Objectives:	
1	To impart knowledge on metallographic techniques for studying the microstructures of alloys.

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 – C steels.

3. Study of the Micro Structures of Cast Irons.

4. Study of the Micro Structures of Non-Ferrous alloys.

5. Study of the Micro structures of Heat treated steels.

6. Hardeneability of steels by Jominy End Quench Test.

7. To find out the hardness of various treated and untreated steels.

Course Outcomes:	
Co1	Ability to relate properties of microstructure.
Co2	Understand various crystal structures.
Co3	To study the thermosetting of ferrous and non ferrous materials.
Co4	To test magnetic defects of material.
Co5	To test the strength of material.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		2	2			3			3			1
CO2		3		2			3			2	3			3	
CO3	3		3		2				3		3	3			
CO4		3				2	3			2					
CO5				2											

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME- II Semester

S.No	Subject Code	SUBJECT	T	P	CREDITS
1	15A51401	Probability and Statistics	4	0	4
2	15A54401	Managerial Economics and Financial Analysis	4	0	4
3	15A01407	Fluis Mechanics and Hydraulic machinery	4	0	4
4	15A03401	Manufacturing Technology	4	0	4
5	15A03402	Thermal Engineering-I	4	0	4
6	15A03403	Machine Drawing	2	4	4
7	15A03404	Manufacturing Technology Lab	0	4	2
8	15A01408	Fluid Mechanics & Hydraulic Machinery Lab	0	4	2
		Total	**22**	**12**	**28**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem	T	P	C
	4	0	4

PROBABILITY AND STATISTICS (15A51401)

(Common for CIVIL, MECH & CHEM)

	Course Objectives: To impart knowledge on
1	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 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.

UNIT – III

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 – 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 Operati
on of □ - 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.

	Course outcomes:
C01	Understanding the fundamentals of probability and Distributions.
C02	Usage of statistical techniques like testing of hypothesis
C03	They can able to understand the different sample testslike t-test, F-test and Chi-square test.
C04	Analysis of Statistical Quality Control charts
C05	They can able to analyse the Queuing theory problems and draw appropriate inferences.

TEXT BOOKS:

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
2. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.

REFERENCES:

1. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
5. Probability and Statistics by R.A. Jhonson and Gupta C.B.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	1	2	3			1	2	2	2		2
CO2	2	3		2		2				1	2	2	2		2
CO3	2	3	1	2	1							2	2	1	
CO4	2	3	1	2	1						2	2	2	1	2
CO5	2	3	1	2						1			2	1	2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):ANANTAPURAMU

II Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	4	**0**	**4**

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS (15A54401)

	Course Objectives: To impart knowledge on
1	The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Demand Analysis: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting -Relationship of Managerial Economics with Financial Accounting and Management.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)- Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting

Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

UNIT V: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

The students are required to submit any one of the following- two assignments/ a mini project/submission of any two case studies in the subject.

	Course Outcomes:
CO 1	After completion of this course, the student will able to understand various aspects of Managerial Economics.
CO 2	Study the functions of productions and cost analysis.
CO 3	Analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.
CO 4	Understanding the concept of capital and methods and evaluation of capital budgeting.
CO 5	They can able to study the concept of financial accounting and its analysis

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Ahuja H.L Managerial economics. S.Chand, 3/e, 2013
3.

REFERENCES

1. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2013

2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2013.

3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.

4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2	1	1				2		1	2		1
CO2	3	2	2		1							1			1
CO3		2		2	1						2		2	1	1
CO4	3	2	2								2	1		1	1
CO5		2		2						2	2	1	2	1	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	4	**0**	**4**

FLUID MECHANICS AND HYDRAULIC MACHINERY (15A01407)

	Course Objectives:
1	The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
2	To understand the importance of dimensional analysis.
3	To understand the importance of various types of flow in pumps and turbines.

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

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.

Course Outcomes:

C01	Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
C02	Studying the losses and measurement of flow in pipes.
C03	Deriving equations when jet strikes on various and positions on vanes
C04	Can critically analyse the performance of pumps .
C05	Analyse the performance of turbines.

TEXT BOOKS :

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. Standard book house
2. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.
3. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.

REFERENCE BOOKS :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &Sons
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	2						2	3		2
CO2				1								2		1	
CO3	3					2							3		2
CO4		3		1	1							2		1	
CO5			3												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem **T P C**

4 0 4

MANUFATURING TECHNOLOGY (15A03401)

	Course Objectives: To impart knowledge on
1	Principle, procedure and applications of casting and welding processes.
2	Principle, procedure and applications of powder metallurgy process.

UNIT – I

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

CASTING: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Moulding Materials, Cores.

UNIT – II

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, Causes and Remedies of Casting Defects. Casting processes 1) Centrifugal 2) Die 3) Investment.

UNIT – III

Welding: Classification of welding process types of welds and electrodes, welded joints and their characteristics, design of welded joints, Gas welding-types of flames, welding process, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Oxy – Acetylene Gas cutting, Plasma Cutting, Inert Gas welding.

UNIT- IV

TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Electronic beam welding, Ultrasonic welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive non-destructive testing of welds.

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.

	Course Outcomes: Ability to
CO1	Learn the basic operation of various methods of melting and casting.
CO2	Learn how various principles of gating and different casting processes and its remedies.
CO3	Study the classification of welding processes and types of welds.
CO4	Learn the types of welds and its defects , remedies destructive non-destructive testing of welds.
CO5	Study the types, properties and processes of plastic.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao/TMH
2. Manufacturing Technology/ kalpak Jian, 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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3		2			2	3		3		3		3
CO2	3	3		3						3		3		3	
CO3			3		3			2	3	2	3		3		3
CO4		3		3						1		3		3	
CO5	3		3		1			2	3		3		3		3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):ANANTAPURAUM

II Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	4	**0**	**4**

THERMAL ENGINEERING – I (15A03402)

	Course Objectives: To impart knowledge on
1	Testing and performance of IC Engines
2	Air compressors, fuel systems.

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

Fuel System: 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

Fuels and Combustion:

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.

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.**

Course Outcomes: On successful completion of the course, the student will be able to,	
CO1	To be able to understand working of different I.C Engines and recognize basic elements and subsystems of an I.C. Engine
CO2	To be able to know about S.I Engine fuel air requirements and understand fuel supply systems in an S.I Engine.
CO3	Ability to understand necessity and functioning of cooling, lubrication and ignition system of an I.C. Engine.
CO4	To be able to understand in-cylinder combustion in S.I and C.I Engines and know about the parameters that influence normal and abnormal combustions.
CO5	To be able to know about working principle of various types of air compressors and solve problems related to reciprocating air compressor

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1						2			3			3	
CO2					3				1			3			
CO3	1									2			2		2
CO4		1					1		1						
CO5	1							2			3		2	3	2
CO6		1			3				1	2			2		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	2	**4**	**4**

MACHINE DRAWING (15A03403)

Course Objectives: To impart knowledge on	
C2 02.1	Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members.
C2 02.2	They are able to know the component behavior subjected to fluctuating loads.
C2 02.3	Analyze the Design of riveted joints and Bolted joints
C2 02.4	They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts.
C2 02.5	Students are able to know the Design of keys, couplings.

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

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, flanged &protected flanged joint.
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, and foot step bearings.

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

	Course Outcomes: Ability to
C01	Understand drafting fundamentals and standards.
C02	Interpret drawings and extract required information
CO3	Create part drawings and sectional views of machine components.
CO4	Develop assembly drawings from part drawings.
CO5	Carry out tolerance analysis and specify appropriate tolerances for machine design applications

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3									3				1
CO2	2									3			3		
CO3	2				3			2				3			1
CO4										3		3		3	
CO5											3				

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem

T	P	C
0	3	2

MANUFACTURING TECHNOLOGY LAB (15A03404)

Course Objectives: To make the student to know	
1	Design and manufacture of simple patterns.
2	Arc welding, gas welding and resistance welding equipment for the fabrication of welded joints.
3	Pipe bending and injection moulding equipment

Minimum of 12 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.
3. Bending and other operations

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

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	Course Outcomes: Ability to
C01	Design and manufacturing of simple pattern
C02	Control sand properties in foundry
C03	Operate arc welding, spot welding equipment.
CO4	Create a cavity in sand using mould
C05	Study about the injection moulding

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			2		2								2
CO2	2			3						2			3	1	
CO3						3			2						2
CO4		2					2					2		1	
CO5	2				2										

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem	**T**	**P**	**C**
	0	**3**	**2**

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB (15A01408)

Course Objectives:	
1	The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

LIST OF EXERCISES:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

Course Outcomes:	
CO1	Ability to use the measurement equipments for flow measurement.
CO2	Ability to Determine Coefficient of discharge for a small orifice and an external mouth piece and loss of head.
CO3	Calibration on rectangular and triangular Notch.
CO4	Verifying the Bernoulli’s equation, determine the impact of jet on vanes.
CO5	Performance test on turbines and pumps.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	2				1		2	3		2
CO2				1	1									1	2
CO3	3					2									
CO4		3		1	1										
CO5			3			2				1		2			

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. ME- I Semester

S.No	Subject Code	SUBJECT	T	P	CREDITS
1	15A03501	Dynamics of Machinery	4	0	4
2	15A03502	Machine Tools	4	0	4
3	15A03503	Industrial Engineering & Management	4	0	4
4	15A03504	Design of Machine Members – I	4	0	4
5	15A03505	Thermal Engineering - II	4	0	4
6	15A03506	Heat Transfer	4	0	4
7	15A03507	Thermal Engineering Lab	0	4	2
8	15A03508	Heat Transfer Lab	0	4	2
	15A55501	Advanced Communication Skills Lab (Audit)		4	0
		Total	24	12	28

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF

MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	4

DYNAMICS OF MACHINERY (15A03501)

Course Objectives: To impart knowledge on	
1	Analysis of forces acting in mechanisms
2	Effects of unbalance forces
3	Modeling and analyzing the vibration behavior of spring mass damper system
4	The principles in mechanisms used for governing of machines

UNIT I

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

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.

UNIT II

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

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.

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.

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 inline and radial engines for primary and secondary balancing.

UNIT V

Vibration: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly‟s method, Raleigh‟s method. Torsional vibrations - two and three rotor systems.

	Course Outcomes: Ability to
CO1	Determine the forces acting on various linkages when a mechanism is subjected to external forces.
CO2	Identify and correct the unbalances of rotating body
CO3	Analyze the vibratory motion of SDOF systems.
CO4	Reduce the magnitude of vibration and isolate vibration of dynamic systems
CO5	Determine dimensions of Governors for speed control.

Text Books:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.

2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

Reference Books:

1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.

2. The theory of Machines, J.E. Shiegley, McGraw Hill .

3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.

4. Theory of Machines by R.S Khurm, S.Chand Publications

NOTE: *End Exam should be conducted in Drawing Hall*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3					1				1				
CO2	3		1	2		1			1	3			2		
CO3								1				1		3	
CO4	3		1		2	1	1				1		2		
CO5			1					1		3					

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF

MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

MACHINE TOOLS (15A03502)

	Course Objectives:
1	To create awareness on various mechanical measuring instruments.
2	To make student familiar with various operations on machine tools
3	To make the students familiar with the drilling operations
4	Usage of the instruments to measure the linear and angular measurements
5	To gain the practical experience on the machines

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, coolants, machinability – economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

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 and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

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.

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 – comparison of grinding, lapping and honing. machining time calculations.

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 Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications.

Course Outcomes:	
CO1	Hands on experience on lathe machine to perform turning, facing, threading operations.
CO2	Practical exposure on flat surface machining, milling and grinding operations.
CO3	Skill development in drilling and threading operations.
CO4	Linear and angular measurements exposure.
CO5	Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc

Text Books:

1. Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013

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, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st 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 Press Taylor and Francies .

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2			3		3		2		3
CO2		3								3		2		3	
CO3	2		3			2			2		3				3
CO4		3										2		3	
CO5	1					2			1	3			2		

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF

MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester	L	T	P	C
	3	1	0	4

INDUSTRIAL ENGINEERING & MANAGEMENT (15A03503)

	Course Objectives:
1.	To impart knowledge on work study techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools.
2.	To impart knowledge on the material management.

UNIT I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor‟s Scientific Management, Fayol‟s Principles of Management, Douglas Mc-Gregor‟s Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg‟s Two factor Theory of Motivation, Maslow‟s Hierarchy of Human needs – Systems Approach to Management.

Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and 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 – Matrix Approach Plant Layout: Definition, Objectives, Organization, Types of Production, Types of Plant Layout – Various Data Analyzing Forms – Travel Chart, Optimization of Layout-Load Distance Model & CRAFT-Materials Handling Function-Objectives - Types-Selection Criteria of Material Handling Equipment.

UNIT III

Work Study – Definition, Objectives, Method Study – Definition, Objectives, Steps Involved – Various Types of Associated Charts – Differences between Micromotion and Memomotion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations, Differences with Time Study – Applications.

UNIT IV

Material Management – Objectives, Inventory – functions, types, associated cost, inventory classification techniques- ABC Analysis; Inventory Models- Deterministic models- EOQ Model – Models with one Price Break and Multiple Price Breaks- shortages are not allowed – Stochastic Models – Demand may be Discrete Variable or Continuous Variable – Instantaneous Production. Instantaneous Demand and Continuous Demand and No Set-up Cost Stores Management and Stores Records- Purchase Management, Duties of Purchase Manager, Associated forms

UNIT V

Human Resource Management-Functions of HRM, Job Evaluation, Merit Rating- Difference with Job Evaluation, Different Methods of Merit Ratings, Wage Incentives, Different Types of Incentive Schemes Inspection & Quality Control: Differences between Inspection & Quality Control. Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance and Evaluation Procedure Marketing Management- Introduction, Marketing vs Selling, Market Segmentation.

COURSE OUTCOMES: At the end of the course students will be able to	
CO1	Use knowledge and comprehension in management tools to apply in technical organizations.
CO2	To understand where the plant is to be located based on facilities available 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.
CO3	Ability to apply various work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement.
CO4	To understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances, importance of Inventory control to ensure their availability with minimum capital lock up.
CO5	To introduce the basic principles of group dynamics and associated concepts required for HRM in organizations. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process. TQM circles to find solutions to problems in industry towards continuous improvement in the system.

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2.

3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International

Publishers, 1st edition, 2011.

Reference Books:

1. Industrial Engineering and production management, MartindTelsang S.Chand.

2. *Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.*
3. *Work Study by ILO(International Labour Organization)*
4. *Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005*
5. *Production and Operations management, PanneerSelvam, PHI,2004.*
6. *Statistical Quality Control by EL Grantt, McGrawhil*
7. *Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			3			2		2			3		3	
CO2		3		3	2			3		3			3		2
CO3	3		3			3		3			3				2
CO4		3			1		2			3		3		3	
CO5	1		3		3	3			2		3		3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

III Year B.Tech. M.E. I-Sem	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

DESIGN OF MACHINE MEMBERS-I (15A03504)

	Course Objectives:
1	To familiarize the various steps involved in the Design Process.
2	To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3	To learn to use standard practices and standard data.
4	To learn to use catalogues and standard machine components.

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.

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.

UNIT – III

Design Of Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

Design Of 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.

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.

UNIT-V

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

	Course Outcomes:
CO1	Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members.
CO2	They are able to know the component behavior subjected to fluctuating loads.
CO3	Analyze the Design of riveted joints and Bolted joints.
CO4	They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts.
CO5	Students are able to know the Design of keys, couplings.

Text Books:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
2. Machine Design,Schaum"s series,TMH Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
2. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, NewDelhi.
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 McGraw Hill Publishers
7. Machine Design by Groover – CBS Publications.

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

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2		2								3			2		
CO3			2												
CO4					1		2			1			2		1
CO5								1					1		

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
COURSE STRUCTURE OF
MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

THERMAL ENGINEERING – II (15A03505)

	Course Objectives: To impart knowledge on :
1	Steam generators, nozzles, and turbines.
2	Various Gas Power cycles.

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.

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.

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.
Condensers: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

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.

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, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

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.

Course Outcomes: Ability to	
CO1	Students shall be able to know the Basic concepts of rankine cycles and methods to improve the performance.
CO2	Shall acquire knowledge on principles of working accessories and safety features of stream generators.
CO3	Shall acquire knowledge on stream flow through varying areas and capable of solving related problems and to understand functioning of steam condenser.
CO4	To be able to Determine the efficiency of the impulse and reaction turbine using velocity triangles.
CO5	Analyze gas turbines cycles and compare the operational aspects of jet engines.

Text Books:

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

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.*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				2					3		3	2		3
CO2		1						1			3			3	
CO3	1				2					3		3	1		3
CO4		1									3			3	
CO5	1				2			1		3					3

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	4

HEAT TRANSFER (15A03506)

Course Objectives: To impart knowledge on	
C3 03.1	To impart knowledge on Conduction, convection, radiation, heat transfer during boiling To impart knowledge on and condensation.
C3 03.2	Students able to understand Design of heat exchangers.
C3 03.3	To Describe the concepts of one dimensional steady state heat conduction to various co-ordinates system.
C3 03.4	To Define and explain the laws of radiation and its application.
C3 03.5	To know Boundary layer concept, type of convection flow.

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 – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

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.

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.

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: Film wise and Drop wise 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.

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.

Course Outcomes:	
CO1	To understand the basic laws of heat transfer and electrical analogy.
CO2	To analyze problems involving steady state heat conduction in simple geometries with and without heat generation and analyze heat transfer situations in extended surfaces.
CO3	To evaluate heat transfer coefficients for natural and forced convection situations
CO4	To understand Heat transfer during phase change and estimate heat transfer rates
CO5	To analyze heat exchanger performance by using LMTD and NTU methods.
CO6	To calculate radiation heat transfer between black body surfaces and gray body surfaces**.**

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

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, Kondandaraman, 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.*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		3		2		2		3		3		
CO2		3		3		3		3		2		3		3	1
CO3	3		3		3		3		3				3		1
CO4		3		2				3		3	3			2	
CO5	3			1			1		1	1		3		1	

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester	L	T	P	C
	0	0	3	2

THERMAL ENGINEERING LAB (15A03507)

Course Objectives:	
1	To impart knowledge on working principles of various thermal equipments like compressors, IC Engines, Boilers etc.,
2	To study the working principle of IC engines, performance and characteristics in terms of heat balancing, economical speed variations, air fuel ratio etc.,

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

Course Outcomes:	
CO1	Performance Test on 4-Stroke Diesel and 2-Stroke Petrol engine.
CO2	Able to evaluate the Engine friction of 4-Stroke Multi cylinder Engine and Air/Fuel ratio and Volumetric efficiency of I.C.Engines.
CO3	To calculate the heat balance of the IC Engines.
CO4	To calculate the efficiencies and performance characteristics of the engines.
CO5	Study the boilers and identify parts of the engine parts.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2											3		
CO2						3			2			3		1	2
CO3	3		2		2										
CO4		2					3			3			3		
CO5															

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	2

HEAT TRANSFER LAB (15A03508)

	Course Objectives:
1	To impart knowledge on conducting the heat transfer experiments and practically learns how to find heat transfer coefficients, thermal Conductivity, emissivity and effectiveness.

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
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

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

	Course Outcomes :
CO1	Student can prepare the Guarded plate apparatus.
CO2	Student can get the ideas on Lagged pipe apparatus.
CO3	Student can prepare the Natural convection – vertical cylinder, Emissivity measurement and Stefan-Boltzmann apparatus.
CO4	Student can get the ideas on Forced convection inside tube and Parallel/counter flow heat exchanger apparatus.
CO5	Student can prepare the Pin-fin apparatus, Air-conditioning test rig

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2					3		2		3
CO2		3			3				2			3		1	
CO3	2					2					3				
CO4		3			3				2				2		3
CO5	1		3									3		1	

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. ME- II Semester

S.No	Code No	SUBJECT	T	P	CREDITS
1	15A03601	Metal Forming	4	0	4
2	15A03602	Design of Machine Members – II	4	0	4
3	15A03603	Operations Research	4	0	4
4	15A03604	CAD / CAM	4	0	4
5	15A03605	Automobile Engineering	4	0	4
6	15A03606	**Open Elective** a) Entrepreneurship b) Total Quality Management c) Energy Ecology & Environment	4	0	4
7	15A03607	Machine Tools Lab	0	4	2
8	15A03608	CAD / CAM Lab	0	4	2
		Total	24	8	28

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

III Year B.Tech. M.E. II-Sem

T	P	C
4	0	4

METAL FORMING (15A03601)

	Course Objectives:
1.	The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection.

UNIT 1

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.

UNIT II

Rolling: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills 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.

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.

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.

UNIT V

Unconventional machining process: Introduction– EDM, WEDM, ECM, WJM, AJM, AWJM, LBM, EBM, USM – principle, working and applications.

COURSE OUTCOMES: At the end of the course students will be able to	
CO1	Analyse the effect of parameters influencing metal forming and compare hot working and cold working applications .
CO2	Analyse the effect of forces in rolling process to understand the deformation process of rolling.
CO3	Understand the principles of sheet metal working forging and analyse the forces acting in forging and its applications.
CO4	Understand the applications of and their working principles
CO5	Understand the importance and applications of in conventional machining process like EDM,WEDM,ECM,WJM etc.

Text Books:

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

Reference Books:

1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012
2. Process and materials of manufacturing –Lindberg, PE
3. Welding Process, R.S. Parmar, Khanna Publishers, 2010
4. Manufacturing Technology, R.K. Rajput, Laxmi Publishers

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3				1			3		2		1
CO2	3		2		3				2			2		3	
CO3		3								2				3	
CO4	3		2		3				2			2			
CO5		1		3				1		2	3		2		1

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
COURSE STRUCTURE OF
MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester	L	T	P	C
	3	1	0	4

DESIGN OF MACHINE ELEMENTS– II (15A03602)

	Course Objectives:
1.	To impart knowledge and skills in applying elementary design principles, basic design procedures and use of design data for the design of mechanical elements.
2.	To provide knowledge about the concepts, procedures and the data, to design and analyse machine elements in power transmission systems.
3.	To impart competency to specify, select and design the mechanical components for transmission systems.

UNIT I

Design Of Curved Beams: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C – clamps.

Design Of Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT II

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.

Design Of Power Screws: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT III

Design Of Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT IV

Design Of Spur & Helical Gears: Spur gears- Helical gears – 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.

UNIT V

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

Course Outcomes :	
CO1	Select suitable belt drives and associated elements from manufacturers catalogues under given loading conditions. Stresses applied in different types of beams.
CO2	Analyze springs and power screws subjected to loading.
CO3	Select suitable bearings and its constituents from manufacturers catalogues under given loading conditions.
CO4	Apply the design concepts to estimate the strength of the gear.
CO5	Select suitable engine parts and associated elements from manufacturers catalogues under given loading conditions.

Text Books:

1. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9th edition, 2010.

2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

Reference Books:

1. Machine Design, Schaum"s series, TMH Publishers, New Delhi, 1st edition, 2011

2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013.

3. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi

4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.

5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		1		2		2				3		3	
CO2		2			2		2		1	1	3		3		3
CO3	2		3	1		2		2				3		2	
CO4		3			1				1	3				1	3
CO5	1		3	3	3		2			2	3		3		

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):
ANANTAPUR COURSE STRUCTURE OF
MECHANICAL ENGINEERING**

III Year B.Tech. M.E. – II Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

OPERATIONS RESEARCH (15A03603)

	Course Objectives:
1.	To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I

Introduction to OR and Linear Programming-, 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;

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.

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.

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 Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time

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.

	Course Outcomes : On Successful completion of this program, the students can able to understand:
CO1	Types of OR models, can formulate linear programming problems and can solve LPP by different methods.
CO2	Dual simplex methods and methods used to solve Transportation problems.
CO3	Strategies used in different situations in the games and solve them using various techniques.
CO4	The types of queues, its characteristics and queuing models.
CO5	The sequencing and its types, application of PERT/CPM for project scheduling and concept of crashing the project schedule.
CO6	The Dynamic Programming, Bellman's Principle of Optimality and its applications and Replacement Problems.

Text Books:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.
2. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Gerалld J. Lieberman, TMH, 9th edition,2011.

Reference Books:

1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
2. Operations Research, Wagner, PHI Publications , 2nd edition.
3. Operation Research, J.K.Sharma, MacMilan, 5th edition, 2013.
4. Linear Programming, Susy Phillippose, PHI
5. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.
6. Operations Research: Methods & Problems , Maurice Saseini, Arhur Yaspan& Lawrence Friedman
7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2			2				3		3		3	
CO2		2			2				1		2		2		3
CO3	3		2			3				3		3		3	
CO4		3			2				1		2		2		
CO5		1				1									3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. -II Semester

L	T	P	C
3	1	0	4

CAD / CAM (15A03604)

	Course Objectives:
1.	To impart knowledge on the application of computer in the design and manufacturing.
2.	To impart knowledge on graphical entities of CAD/CAM
3.	To impart fundamental knowledge on computer numerical control.
4	To train the student to develop part programmes for simple components.
5	To introduce the philosophy of group technology and its benefits.
6	To introduce the basics of Flexible Manufacturing Systems and integration of Computer Aided Quality Control with Computer Aided Design and Computer Aided Manufacturing.
7	To impart the concepts of Computer Aided Process Planning
8	To introduce the concepts of Computer Integrated Process Planning and trends in manufacturing.

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, clipping, hidden line / surface removal colour, shading.

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.

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.

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.

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.

	Course Outcomes: Ability to
CO1	Use suitable graphical entities to design a product
CO2	Use CAD software for solid and surface modeling
CO3	Knowledge of various Numerical Control Systems and tools.
CO4	Program and operate CNC Machines.
CO5	Implement coding of parts in Group Technology
CO6	Understand Flexible Manufacturing Systems and integrate various inspection methods with Computer Aided Design and Computer Aided Manufacturing
CO7	Implement suitable Computer Aided Process Planning and other sub-systems for a customized setup.
CO8	Understand about the concepts to develop an integrated production planning systems and the concepts of 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. *Automated Production Systems and CIM by P.Groover Pearson Education, Limited*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	3	3		3					3	2	2		3		
CO3	2	3	2					2	1		2			3	
CO4	1	3	2	1					1			3		3	
CO5	1				2									3	
CO6	1				2			2	1	1	2	1		3	
CO7	1		1		2			1	2	1	1	2	3		
CO8	1		1		1			1	3	2		1			

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	1	0	4

AUTOMOBILE ENGINEERING (15A03605)

Course Objectives:	
C3 04.1	To impart knowledge on Automotive chassis structure, transmission and suspension systems.
C3 04.2	To impart knowledge on Engine and its working.
C3 04.3	To impart knowledge on Fuel supply, cooling and lubrication systems.
C3 04.4	To impart knowledge on Thermodynamic systems.
C3 04.5	Ability to get knowledge on pollution standards and its significance.

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.

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

UNIT III

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.

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.

UNIT V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Modern Techniques in automobiles – 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, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

	Course Outcomes :
CO1	Ability to identify the importance of vehicle frame.
CO2	Ability to understand the thermodynamic principles behind the working of petrol and diesel engines.
CO3	Ability to outline the function and components of clutch and transmission systems.
CO4	Ability to understand the importance of steering and braking systems in automobiles
CO5	Ability to get knowledge on pollution standards and its significance.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers
2. Automobile Engineering BY Joseph Hidner

Reference Books:

1. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.
2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.
3. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.
4. Automotive engines , Newton, Steeds & Garret.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		3		3	3	3			3	2	3	1
CO2		3	2			3		3		3					1
CO3	3			3		3	3				3	3			1
CO4		3	2		3	3			3	3			2	3	1
CO5	3		2				3	3	3			3			1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. –II Semester

L	T	P	C
3	1	0	4

ENTREPRENEURSHIP (15A03606a)
(Open Elective)

	Course Objectives:
1	To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively

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. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.

UNIT II:
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.

UNIT IV:
New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Choosing location and layout, Issues related to Selection of layout.

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. Global aspects of Entrepreneurship.

	Course Outcomes :
CO1	Students can able to know the importance of entrepreneurship in economic developments, ethics and its social responsibility
CO2	They can understand the business plan its scope, implementation in marketing and launching.
CO3	They can able to know the finance resources, motivating, marketing and internet advertising
CO4	Students can understand the problems related to selection of layout.
CO5	They can know the production techniques, inventory and quality control in global aspects

Text Books:

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 5th Edition
2. Dollinger: Entrepreneurship,4/e, Pearson, 2004.

References Books:

1. Vasant Desai: Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Robert J.Calvin: Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola: The Entrepreneurial Connection, TMH, 2001.
5. Bolton & Thompson: Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal :Indian Economy, Wishwa Prakashan 2005.
7. Dutt & Sundaram: Indian Economy. S. Chand, 2005.
8. Srivastava: Industrial Relations & Labour Laws, Vikas, 2005.
9. Aruna Kaulgud: Entrepreneurship Management by. Vikas publishing house, 2003.
10. Thomas W. Zimmerer & Norman M. Scarborough: Essential of Entrepreneurship and small business management, PHI, 4/e, 2005.
11. Mary Coulter: Entrepreneurship in Action, PHI, 2/e, 2005.
12. Kaplan: Patterns of Entrepreneurship, Willey, 2005.
13. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2005.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1						2			1		1			1
CO2			1		2		2		2			1	2		1
CO3		2		3				3		1	2				
CO4	1		1			1								3	
CO5		2				1	2				2				

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. –II Semester

L	T	P	C
3	1	0	4

TOTAL QUALITY MANAGEMENT (15A03606b)
(Open Elective)

Course Objectives: To impart knowledge on	
1	To facilitate the understanding of Quality Management principles and process.

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. Quality Standards – Need for Standardization - Institutions – Bodies of Standardization, ISO 9000 series – ISO 14000 series – Other Contemporary Standards – ISO Certification Process-Third Party Audit

UNIT – II

Process Management- Quality Measurement Systems (QMS) – Developing and Implementing QMS – TQM Tools & Techniques- 7 QC Tools- 7 New QC Tools.

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 – III

Quality Circles – Organization – Focus Team Approach – Statistical Process Control – Process Chart – Ishikawa Diagram – Preparing and using Control Charts.

UNIT – IV

Quality Function Development (QFD) – Elements of QFD – Benchmarking-Types-Advantages & Limitations of Benchmarking – Taguchi Analysis – Loss function - Taguchi Design of Experiments, Robust Design, 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.

Course Outcomes (COs): At the end of the course students will be able to	
CO1	Students understand the importance of the quality, costs of quality, and Basics concepts of quality
CO2	Able to know the TQM principles, employee involvement, team spirit and PDCA cycle.
CO3	They can able to understand the management tools like Six Sigma, Bench Marking.
CO4	Able to know TQM tools like control charts , QFD, Taguchi loss function and TPM.
CO5	The student would be able to apply the tools and techniques of quality management to manufacturing and services processes

TEXT BOOKS:

1Total Quality Management,DakhBesterfield, Pearson Edu.
2. Total Quality Management, K.ShridharBhat, Himalaya.

REFERENCE BOOKS:

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.
3. Quality management, Bedi

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2				3	3	2	2		3	3		3
CO2		2		3		2								2	
CO3			2				3		2			3	3		
CO4	3	2		3				3					3	2	
CO5			2			2				2		3			3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

III Year B.Tech. M.E. –II Semester

L	T	P	C
3	1	0	4

ENERGY ECOLOGY & ENVIRONMENT (15A03606c)
(Open Elective)

	Course Objectives: To impart knowledge on
1	To facilitate the understanding of ENERGY ECOLOGY.
2	Understand the concepts of Energy transactions in biosphere

UNIT-I

Energy source for earth – sun – its radiation – its absorption and reflection. Various renewable and non-renewable resources.

UNIT-II

Boisphere – Energetic of the biosphere – Concepts of Ecology – Components of Ecosystems.

UNIT-III

Energy transactions in biosphere – photo synthesis and producers – Herbivones – Carnivones – decomposers – Energy transfers & food wells.

UNIT-IV

Dependence on abiotic systems – biogeochemical cycles. Elements of Environment – Interrelationships in environmental components.

UNIT-V

Concepts of pollution and affecting the natural balances in energy systems. Energy concepts for a sustainable world bio – systems.

Course Outcomes : At the end of the course students will be able to	
CO1	Understand the Energy source from Nature
CO2	Understand the energy ecology & environment

Text Books:

1. Ecology and Environment, P.D. Sharma Rastogi Publications.
2. A Textbook of Energy Ecology, Environment And Society A. Maheshwari, Geeta Parmer Anmol Publications Pvt. Limited.

Reference Books:

1. Renewable Energy, Environment and Development, Maheshwar Dayal, Konark Publishers Pvt. Ltd.,

2. Energy for a sustainable world, J.Goldenberg, T.B. Johnson, Amulya K.Reddy & Robert Williams Willey Eastern Ltd.,
3. Concepts of Ecology, E.J.Kormondal , Prentice Hall India Ltd.,

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3											2	
CO2		1													

JNTUACOLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF

MECHANICAL ENGINEERING

III Year B.Tech. M.E. II-Sem

L	T	P	C
0	0	3	2

MACHINE TOOLS LAB (15A03607)

	COURSE OBJECTIVES:
1	The course provides students with fundamental knowledge and principles in material removal processes.
2	To demonstrate the fundamentals of machining processes and machine tools.
3	In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, injection moulding machine etc.
4	To develop knowledge and importance of metal cutting parameters.
5	To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.

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.

List of Experiments:

1. Job on Step turning and
2. 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.
10. Study of Injection Moulding Machine.

COURSE OUTCOMES Upon successful completion of this course, the students will be able to	
CO1	Select appropriate machining processes and conditions for different metals.
CO2	Use different machine tools to remove unwanted material from the work piece to produce final shape.
CO3	Use appropriate grinders to give smooth surface for improving the quality of the object.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3				2									
CO2			3							2		2		3	
CO3	2				3			3							2
CO4		3				2					3	2	2		
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):

ANANTAPUR COURSE STRUCTURE OF

MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

CAD / CAM LAB (15A03608)

	Course Objectives: To impart the knowledge on the
1	Usage of computer in design and Manufacturing.
2	Visualization of objects in three dimensions and producing orthographic views, sectional views and auxiliary views of it.

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.

2. **Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.

3. **Assembly modeling:** Feature based and Boolean based modeling surfaces, Assembly Modeling of simple components and Design of simple components.

. 4. **CAM:**

a). Study of various post processors used in NC Machines.

b). Development of NC code for free form and sculptured surfaces using CAM packages.

c). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages. Through RS 232.

Any Four Software Packages from the following:

Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, , CAEFEM, Gibbs CAM, Master CAM etc,

	Course Outcomes : At the end of the course students will be able to
CO1	Use the coordinate systems for the concerned drawings.
CO2	Construct 2-D sketches, interpret the dimensions and the associated annotations in CAD environment
CO3	Construct 2-D sketches for intersections of solids using CAD packages.
CO4	Create solid models of various objects and machine parts
CO5	Construct 3-D modeling by extrusion process using various CAD packages.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2				2					3	
CO2		3		3				3					2		3
CO3	3				3				2					3	
CO4		2		3				3					2		2
CO5		1			1				2				2		1

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU

Course Structure

DEPARTMENT OF MECHANICAL ENGINEERING

IV Year B.Tech. ME- I Semester

S.No	Subject Code	SUBJECT	T	P	CREDITS
1	15A03701	Finite Element Methods	4	0	4
2	15A03702	Refrigeration & Air Conditioning	4	0	4
3	15A03703	Instrumentation & Control Systems	4	0	4
4	15A03704	Automation & Robotics	4	0	4
5	15A03705	Engineering Metrology	4	0	4
6	15A03706	**Elective – I (MOOC)**	4	0	4
7	15A03707	Instrumentation & Metrology Lab	0	4	2
8	15A03708	CAE Lab	0	4	2
9	15A03709	Project Work Part-A	0	2	0
		Total	24	10	28

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):

ANANTAPUR COURSE STRUCTURE OF

MECHANICAL ENGINEERING

IV Year B.Tech. M.E. -I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

FINITE ELEMENT METHODS (15A03701)

Course Objectives: To impart knowledge on	
C4 05.1	Students understand the concepts, and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
C4 05.2	Students evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
C4 05.3	Students develop polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and iso parametric elements.
C4 05.4	Students solve the problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
C4 05.5	Students apply the knowledge to solve problems on steady state heat flow and fluid flow problems inID &2D

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.

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.

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.

UNIT IV

Finite Element Application In Solid Mechanics: Problem modelling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso-parametric, sub-parametric and super- parametric 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.

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 function formulation.

Course Outcomes : After the completion of the course, the student will be	
CO1	Familiar with the concepts, principles and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
CO2	Able to evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
CO3	Able to write polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and isoparametric elements.
CO4	Familiar with triangular and quadrilateral elements and solve problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
CO5	Able to solve problems on steady state heat flow and fluid flow problems inID &2D

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

eference 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, New Delhi.

6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3				1		2				3	
CO2	3		2		3				2		3	2			1
CO3		2		3									2	3	
CO4	3								2	2					1
CO5		2	2									2	2		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF MECHANICAL ENGINEERING

IV Year B.Tech. M.E. - I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

REFRIGERATION AND AIR CONDITIONING (15A03702)

Course Objectives: To impart knowledge on	
1	Working principle of refrigeration and air-conditioning cycle.
2	Fundamentals of psychrometry.
3	Applications of refrigeration and air-conditioning.

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 - Refrigeration Needs of Air Crafts.

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 CycleRefrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT III

Vapor Absorption Refrigeration (VAR) System – Description and Working of NH3 – 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.

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.

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.

Course Outcomes:	
CO1	Ability to understand various refrigeration systems.
CO2	Ability to demonstrate the working of refrigeration equipments.
CO3	Ability to understand various psychometric processes.
CO4	Ability to design the space cooling load.
CO5	Ability to explain the air-conditioning equipment.

Text Books:

1. Refrigeration and Air Conditioning ,CP Arora,TMH, 15th edition, 2013.

2. A Course in Refrigeration and Air conditioning, S.C Arora & 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 Réfrigérant and Psychrometric property Tables and charts are permitted in Exam*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			2	3					1	2		3	2	1
CO2		3	2			2						1			
CO3	3			2	3					1	2		3		1
CO4			2			2					2	1			
CO5		3		2	3					1			3	2	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING

IV Year B.Tech. M.E. -I Semester

L	T	P	C
3	1	0	4

INSTRUMENTATION AND CONTROL SYSTEMS (15A03703)

	Course Objectives: To impart knowledge on
1	Measurement techniques for measuring process parameters in industry and in research.
2	Knowledge in measuring parameters like speed, position, velocity, pressure, force, torque, temperature etc.

UNIT-I

Definition - Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics - sources of error, Classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT-II

Measurement Of Temperature: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators. Measurement Of Pressure: Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.

UNIT - III

Measurement Of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

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.

UNIT -IV

Measurement Of Level: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

Measurement Of Humidity - Moisture content in the gases, sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT - V

Measurement Of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements Of Control Systems: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems.

Course Outcomes):	
CO1	Understand the basic principles and performance characteristics of measurement.
CO2	Apply the basic principles to measure the temperature, pressure with the help of Thermocouple and different pressure gauges
CO3	Student can able to measure Speed, Acceleration and Vibration with the help of various instruments
CO4	Student can able to understand the measurement of Fuel level, measurement of Flow and Humidity, Measure the parameters like Force, Torque, Power and also understand the basic principles, and applications of various control systems
CO5	After completion of the course the student can select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and performance.

TEXT BOOKS:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhaneshl TMH
2. Mechanical Measurements *I* Beckwith, Marangoni, Linehard, Phi/ PE

REFERENCES:

1. Instrumentation, measurement & analysis by B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design by D.S Kumar.
3. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
4. Mechanical and Industrial Measurements / R.K. *Jain/*Khanna Publishers.
5. Instrumentation & mech. Measurements by AK. Tayal ,Galgotia Publications
6. Mechanical Measurements /Sawhani

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3			2				1		2	2		1
CO2	2			2	3			1			2			3	
CO3		2				2				1		2	2		1
CO4				2				1			2			3	
CO5		2								1					1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF MECHANICAL ENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
3	1	0	4

AUTOMATION & ROBOTICS (15A03704)

	Course Objectives: To impart knowledge on
1	Basic principles of automation, tool transfer and implementation of automated flow line
2	Design aspects and analysis of material handling system
3	ways of improving line balance and solving line balancing problems
4	Components, sensing elements used programming techniques and Applications of robots.
5	Fundamentals of Robotics and primary actuating systems, sensors and transducers.

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.

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.

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.

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.

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.

Course Outcomes: Ability to	
CO1	Implement the concepts of a productive system in automation
CO2	Apply the knowledge of automated flow lines for industrial and other applications.
CO3	Design and analysis of material handling systems for automated assembly lines.
CO4	Balance automated assembly lines.
CO5	Design and develop Robot with basic drivers and controllers. select suitable Sensors and transducers for real life or industrial problems.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.

2. Industrial Robotics - M.P. Groover, TMH.

Reference Books:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.

2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.

3. Robotic Engineering , Richard D. Klafter, Prentice Hall

4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006

5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3		1				3		1		1		1	
CO2	1				3		3		1		1	1			3
CO3			3						1					1	
CO4		3		1		1					1		3		3
CO5			3		3	1	3	3		1			3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

COURSE STRUCTURE OF MECHANICAL ENGINEERING

IV Year B.Tech. M.E. - I Semester

L	T	P	C
3	1	0	4

ENGINEERING METROLOGY (15A03705)

	Course Objectives:
1	To introduce the science of measurement and measuring machines commonly used.
2	To impart knowledge about limits, fits and tolerances, geometric dimensioning aspects
3	To introduce the methods of acceptance test for conventional machine tools.
4	To familiarize students with the concepts of Laser metrology and surface roughness.

UNIT I

Limits, Fits And Tolernces : Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – inter-changeability 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 rinciple. Design of Go and No Go gauges.

Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic Comparators and their uses.

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.

UNIT III

Surface Roughness Measurement: 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 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.

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.

UNIT V

Measurement 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.

Course Outcomes : At the end of the course students will be able to	
CO1	Design tolerances and fits for selected product quality and able to measure the parts with various comparators
CO2	Use instruments for linear, angular and flatness measurement
CO3	Choose appropriate method and instruments for inspection of various elements of surface roughness, surface finish, gears and threads and the quality of the machine tool with alignment test can also be evaluated by them
CO4	Build sound knowledge about various transducers working and its applications for various measurements such as displacement, speed, stress-strain, acceleration and vibration.
CO5	Know different techniques to measure temperature, pressure, sound, force, torque and power

Text Books:

(1) Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE

(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, Dhanpat Rai, 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, Mc GrawHill, 2013.
(5) Instrumentation, measurement & analysis ,B.C.Nakra & K K Choudhary, TMH, 6th edition, 2011.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2	1				3	1	2	3		3
CO2		3		3					1					2	
CO3			2			1				2		3			3
CO4	3				2				1		1	1	3	3	
CO5		3	2							1				1	

. **JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR COURSE STRUCTURE OF MECHANICAL ENGINEERING**

IV Year B.Tech. M.E. I-Sem

L	T	P	C
0	0	3	2

INSTRUMENTATION & METROLOGY LAB (15A03707)

	Course Objectives: To impart knowledge on
1	Working principles of linear and angular measuring instruments
2	Measurement of linear and angular dimensions of a typical work piece specimen using the measuring instruments
3	Methods of form measurements

Section A

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Calibration of strain guage for temperature measurement
5. Calibration of thermocouple for temperature measurement
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed
8. Calibration of resistance temperature detector for temperature measurement
9. Study and calibration of a Rotometer for flow measurement
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed
    at various loads
11. Study and calibration of Mcleod gauge for low pressure
12. Study of anemometer

Section B

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

Course Outcomes (COs): Upon successful completion of the labs associated with this theoretical course students will be able to	
CO1	Demonstrate knowledge and understanding of instruments as well as the operating principles of measuring instruments
CO2	Force measurement using strain gauge.
CO3	Measurement of displacement by using light Dependent Resistor
CO4	Measurement of Speed with the help of Transducer
CO5	Calibration of Temperature and unknown weight by using Thermocouple and Load cell respectively.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			3					3		3		2		
CO2			3					3		3		3		1	2
CO3	2			2									3		2
CO4			3						3		3			1	
CO5	2			1				3		3		3	1		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech. M.E. I-Sem

L	T	P	C
0	0	3	2

COMPUTER AIDED ENGINEERING LAB (CAE LAB) (15A03708)

	Course objectives: To impart knowledge on
1	Fundamental knowledge on using software tools like ANSYS, FLUENT, etc., for Engineering Simulation
2	Knowledge on how these tools are used in Industries for solving real time problems
3	Understanding about various fields of engineering where these tools can be effectively used to improve the output of a product.

I. Introduction to Analysis Software Package

II. Structural analysis: (Any four exercises)
1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)
1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any two exercises)
1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated find within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem (in an infinitely long concentric cylinders).

7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

Software can be used: ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

Course Outcomes : At the end of the course students will be able to	
CO1	Acquire knowledge on structural analysis using analysis software packages.
CO2	Acquire knowledge on thermal analysis using analysis software packages.
CO3	Acquire knowledge on fluid flow analysis using analysis software packages.
CO4	Illustrate the utility of the software tools such as ANSYS, CFD etc; in solving real time problems

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2			2	3			2	3	
CO2	3	2			3				2					3	2
CO3		2	3		3	2				3			2		2
CO4	3		3		3				2				2	3	
CO5	3	2				2			2	3			2		2

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU
Course Structure
DEPARTMENT OF MECHANICAL ENGINEERING
IV Year B.Tech. ME- II Semester

S.No	Subject Code	SUBJECT	L	P	CREDITS
1	15A03801	**Elective-II** a) Production & Operations Management b) Applied Solar Energy Engineering c) Energy Ecology & Environment	4	0	4
2	15A03802	**Elective-III** a) Power Plant Engineering b) Design Of Material Handling Equipments c) Advanced Metal Forming Technique	4		4
3	15A03803	**Elective-IV** a) Modern Manufacturing Methods b) Jet Propulsion and Rocket Engineering c) Mechanical vibrations	4	0	4
4	15A03804	**Elective-V** a) Tribology b) Computational Fluid Dynamics c) Energy Management	4	0	4
5	15A03805	Seminar	0	4	2
6	15A03806	Project Work Part- B	0	20	10
		Total	16	24	28

Note : All End Examinations (Theory and Practical) are of Three Hours Duration. Machine Drawing End Examination is Four Hours Duration.
T – Tutorial L – Theory P- Practical / Drawing C - Credits

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

PRODUCTION & OPERATIONS MANAGEMENT (15A03801)(a)
(Elective II)

Course Objectives: To impart knowledge on	
Co1	To increase understanding of the problems and opportunities faced by the operations manager in manufacturing and service operations.
C4 06.2	To develop an ability to apply operations management concepts in a variety of settings.
C4 06.3	To develop an understanding of operations management techniques in order to be able to evaluate recommendations made by technical specialist in the field.
C4 06.4	Identify operational methodologies to asses and improve the organizations performance
C4 06.5	Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations.

UNIT – I

Functions of production planning & controls operations & productivity, productivity measurement, goods and services, Design of goods and services: selection, generating new products, product development, issues in product design.

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.

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, computerised layout: ALDEP, CRAFT, CORELAP.

UNIT – IV

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

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.

UNIT – V

Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques. MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System- Elements of total quality management, Six Sigma Quality Control.

	Course Outcomes:
CO1	Understand and appreciation of principles, and applications related to planning, design and operations of manufacturing/service firm.
CO2	Identify different types of forecasting and different forecasting techniques, and use them for various firm forecast
CO3	Implement mathematical model for facilities, location, and utilize the computerized layouts and also able to distinguish between process layout, product layout
CO4	Identify operational methodologies to asses and improve the organizations performance
CO5	Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations.

TEXT BOOKS :

1. Modern Production / Operations Management by Baffa & Rakesh Sarin, Wiley, 1987
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation Management by Adam & Ebert- PHI Pub.,

REFERENCES :

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		1		1	2		3		1		3	
CO2		3		2		1		3	1		1		3		
CO3	3				1		1			2		1		3	
CO4		2	3	2		1		1		1	1		3		
CO5	3	1			1		1		1			1			

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

APPLIED SOLAR ENERGY ENGINEERING (15A03801) (b)
(Elective II)

	Course Objectives: To impart knowledge on
1	The characteristics and world distribution of solar radiation
2	The solar radiation and measurement techniques
3	The methods of calculation of solar radiation availability at a given location.
	The fundamentals of thermal and direct conversion of solar energy to power.

UNIT – I

SOLAR RADIATION: Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces. Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of timeestimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES: Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS: Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS: Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V

THERMAL POWER: The power concepts- design aspects, thermo-chemical reactor. SOLAR POND AND SOLAR STILLS: Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

	Course Outcomes:
CO1	They can know the world and India energy resources and solar spectrum.
CO2	Students can able measure the solar radiation on earth surface and depletion of solar radiation.
CO3	Understand the geometry of solar radiation and its calculations.
CO4	They can able to know the principles thermodynamic cycles and conversion of solar thermal energy conversion.
CO5	Students can able to know the principles and conversion of solar electrical energy conversion.

Reference Books:

1. Solar Energy Thermal Process Diffice and Beckman
2. Solar Heating and Cooling by Kreith and Kreider
3. Solar Energy Utilization by G.D.Rai
4. Solar Energy Utilization by G.D.Rai , Khanna Publishers.
5. Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.
6. Applied Solar Energy by Meinel and Meinel
7. Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
8. Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		1			3		1		3	2	3	2	2
CO2			2	1			3	2		3					2
CO3		2		1				2	1		3	2	3	2	
CO4			2	1						3		2			
CO5		2		1			3	2	1		3			2	2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

ENERGY ECOLOGY & ENVIRONMENT (15A03801) (c)
(Elective II)

	Course Objectives: To impart knowledge on
1	To facilitate the understanding of ENERGY ECOLOGY.
2	Understand the concepts of Energy transactions in biosphere

UNIT-I

Energy source for earth – sun – its radiation – its absorption and reflection. Various renewable and non-renewable resources.

UNIT-II

Boisphere – Energetic of the biosphere – Concepts of Ecology – Components of Ecosystems.

UNIT-III

Energy transactions in biosphere – photo synthesis and producers – Herbivones – Carnivones – decomposers – Energy transfers & food wells.

UNIT-IV

Dependence on abiotic systems – biogeochemical cycles. Elements of Environment – Interrelationships in environmental components.

UNIT-V

Concepts of pollution and affecting the natural balances in energy systems. Energy concepts for a sustainable world bio – systems.

Course Outcomes : At the end of the course students will be able to	
CO1	Understand the Energy source from Nature
CO2	Understand the energy ecology & environment

REFERENCE BOOKS:

1. Renewable Energy, Environment and Development, Maheshwar Dayal, Konark Publishers Pvt. Ltd.,
2. Ecology and Environment, P.D. Sharma Rastogi Publications.
3. Energy for a sustainable world, J.Goldenberg, T.B. Johnson, Amulya K.Reddy & Robert Williams Willey Eastern Ltd., Concepts of Ecology, E.J.Kormondal , Prentice Hall India

Ltd.,

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

POWER PLANT ENGINEERING (15A03802-a)
(Elective-III)

	Course Objectives:
1	The primary objective of this course is to give the engineering student a basic understanding of Rankine cycle
2	Fundamental concepts of gas turbines with reheat and regeneration
3	To study power plants like steam, hydro, hydel, tidal and nuclear power plants
4	To know the power generation potential calculation
5	To familiarize the student with the operations to run various power plants

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.

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, 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

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.

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.

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.

Course Outcomes:	
CO1	Analyze the efficiency and output of modern Rankin cycle steam power plants with superheat, reheat, regeneration, and irreversibilities.
CO2	Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.
CO3	Explain the major types of steam, hydro, nuclear, tidal power plants and
CO4	Estimate power generation potential.
CO5	Scope of employability in various power plants

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. Power plant Engineering, Ramalingam, Scietech Publishers

2. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

3. A Text Book of Power Plant Engineering, Rajput , Laxmi Publications, 4th edition, 2012.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1		1	1	1		1		1	2	2		
CO2	2		3	3	1				1	1	1		3		1
CO3	2		2		1		1		1					2	1
CO4	2	3		2					1			2	1	2	1
CO5	2	3		1							1			2	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

DESIGN OF MATERIAL HANDLING EQUIPMENTS (15A03802-b)
(Elective – III)

Course Objectives: Students will be able to	
1	Understand about Material handling equipment
2	Understand how to design Hoists
3	Understand the types Conveyors
4	

UNIT I
MATERIALS HANDLING EQUIPMENT
Types, selection and applications

UNIT II
DESIGN OF HOISTS
Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

UNIT III
DRIVES OF HOISTING GEAR
Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

UNIT IV
CONVEYORS
Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

UNIT V
ELEVATORS
Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes: Students will be able to	
CO1	Understand various applications of Material handling equipment

CO2	Get the knowledge about Hoisting gears
CO3	Understand the types Conveyors
CO4	Understand how to design Hoists
CO5	Understand how to design Elevators

REFERENCES

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

5. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.

6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2	1				2	2		2					2		2
CO3			2							2					
CO4													3		
CO5			2	2		3		3			3				2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

ADVANCED METAL FORMING TECHNIQUE (15A03802-c)
(Elective-III)

	Course Objectives: To impart knowledge on
1	The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection

UNIT I
INTRODUCTION TO THEORY OF PLASTICITY AND FORMING

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress-strain relation – Mohr‟s circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – thermo elastic Elasto plasticity – elasto visco plasticity

UNIT II
THEORY AND PRACTICE OF BULK FORMING PROCESSES

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming - Formability of laminated sheet - Overview of FEM applications in Metal Forming analysis.

UNIT III
SHEET METAL FORMING

Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application

UNIT IV
POWDER METALLURGY AND SPECIAL FORMING PROCESSES

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming

UNIT V
ELECTROMAGNETIC FORMING AND ITS APPLICATIONS

Electromagnetic Forming Process – Electro – Magnetic Forming Machines – Process Variables – Coils and Dies – Effect of Resistivity and Geometry – EM tube and sheet forming, stamping, shearing and welding – Applications – Finite Element Analysis of EM forming.

Course Outcomes (COs): At the end of the course students will be able to	
CO1	Students understand the importance of the quality, costs of quality, and Basics concepts of quality
CO2	Able to know the TQM principles, employee involvement, team spirit and PDCA cycle.
CO3	They can able to understand the management tools like Six Sigma, Bench Marking.
CO4	Able to know TQM tools like control charts , QFD, Taguchi loss function and TPM.
CO5	The student would be able to apply the tools and techniques of quality management to manufacturing and services processes

REFERENCES

1. Dieter G.E., Mechanical Metallurgy (Revised Edition II) McGraw Hill Co., 2004
2. Proceedings of International Workshop on EMFT 2010, Anna University
3. Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003.
4. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003
5. SHIRO KOBAYASHI, SOO-IK-oh-ALTAN, T,Metal forming and Finite Element Method, Oxford University Press, 2001.
6. ALTAN.T, SOO-IK-oh, GEGEL, HL – Metal forming, fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1983.
7. Marciniak,Z., Duncan J.L., Hu S.J., „Mechanics of Sheet Metal Forming‟, Butterworth-Heinemann An Imprint of Elesevier, 2006
8. Proc. Of National Seminar on "Advances in Metal Forming" MIT, March 2000
9. SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3				1			3		2		1
CO2	3		2		3				2			2		3	
CO3		3								2				3	
CO4	3		2		3				2			2			
CO5		1		3				1		2	3		2		1

IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	1	0	4

MODERN MANUFACTURING METHODS (15A03803a)

(ELECTIVE –IV)

	Course Objectives: To impart knowledge on
1	To understand the importance and have knowledge of Unconventional machining and forming processes.
2	To have the knowledge of different micro machining methods.
3	To understand the working principles of various Non-traditional methods in machining and forming.

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.

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.

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.

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 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.

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.

	Course Outcomes : At the end of the course students will be able to
CO1	Use the basic manufacturing methods, measurements and apply the principles of a range of modern manufacturing technologies, apply subtractive and additive manufacturing for rapid prototyping
CO2	Describe the specific process characteristics of various modern manufacturing technologies and identify their possible applications and metal removal rate
CO3	Students can able to know the fundamentals of electrochemical machining, its economical concepts and basics of chemical maching.
CO4	They can able to study the principles of EDM,EDG,PM ,its applications.
CO5	They can able to know the applications and limitations of Electron Beam machining and laser Beam Maching.

Text Books:

1. Advanced machining processes, VK Jain, Allied publishers.

2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984

2. Manufacturing Technology, Kalpakzian,Pearson

3. Modern Machining Process , Pandey P.C. and Shah H.S., TMH.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		3			3		1			1	1	3		
CO2		2					2		3	2				1	
CO3	1			2	1			1			3		1		2
CO4		2	3				2			2					2
CO5				2		3			3			1		3	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

IV Year B.Tech. M.E. II Semester

L	T	P	C
3	1	0	4

JET PROPULSION AND ROCKET ENGINEERING (15A03803b)

(Elective IV)

Course Objectives: To impart knowledge on	
1	.Understand the fundamentals of gas turbines
2	Understand the thermodynamics cycles
3	Know about Rocket technology

UNIT-I

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed –parameters of performances –cycle modifications for improvement of performance.

Jet propulsion: Historical sketch-reaction principle –essential features of propulsion devices-Thermal Engines, Classification of –Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications

UNIT-III

Turboprop and Turbojet-1: Thermo dynamic cycles, plant layout, essential components, principles of operation –performance evaluation

Turboprop and Turbojet-II: Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV

Ramjet: Thermo dynamic Cycle, plant lay-out, essential components –principle of operation-performance evaluation –comparison among atmospheric thermal jet engines- serqujet and pulse jet, elementary treatment.

Rocket Engines: Need for applications –Basic principles of operation and parameter s of performance –classification ,solid and liquid propellant rocket engines ,advantages, domains of application – propellants –comparison of propulsion systems.

UNIT-V

Rocket Technology-I: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets ,need for –Feed systems, injectors and expansion nozzles –Rocket heat transfer and ablative cooling.

Rocket Technology- II: Testing & instrumentation –Need for Cryogenics –Advanced propulsion Systems, elementary treatment of Electrical Nuclear and plasma Arc propulsion.

	Course Outcomes : At the end of the course students will be able to
CO1	Understand the thermodynamics cycles
CO2	Understand the fundamentals of gas dynamic theory
CO3	Know about the rocket engines
CO4	Understand the Classification of rocket technology
CO5	Understand the applications of rocket engine

TEXT BOOKS:
1. Gas Turbines and propulsive systems-P.Khajuria & S.P.Dubey / Dhanpat rai pub.
2. Gas Dynamics & Space Propulsion M.C.Ramaswamy / Jaico Publishing House.

REFERENCE BOOKS:
1. Rocket propulsion –Sutton
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3. Gas Turbines-V.Ganesan /TMH.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2		2									3				
CO3							3		2				2	3	
CO4			1		2										3
CO5	2							2				2			

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
MECHANICAL ENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
3	1	0	4

MECHANICAL VIBRATIONS (15A03803c)
(Elective IV)

	Course Objectives: To impart knowledge on
1	Formulating mathematical model for vibration problems.
2	Skills in analyzing the vibration behavior of mechanical systems subjected to loading
3	Vibration control and the equipment used for collecting response data.

UNIT I

Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

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.

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.

UNIT III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

UNIT IV

Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer"s method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

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.

Course Outcomes : At the end of the course students will be able to	
CO1	Familiar with basics of vibrations and able to formulate equations for free vibrations for SDOF with and without damping.
CO2	Familiar with the concepts of forced vibrations and the seismic instruments, accelerometers andvibrometers with the problems involved.
CO3	Able to formulate equations for 2DOF and evaluate the modes of vibration.
CO4	Able to frame and solve the equations for MDOF using various numerical iterative methods.
CO5	Familiar with the concepts of vibrations of continuous systems and whirling of shafts.

Text Books:

1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.

2. Vibration of Mechanical System, 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,

4. Mechanical Vibrations, Singresu S. Rao, Pearson Education, New Delhi.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2	1				3	1	2	3		3
CO2		3		3					1					2	
CO3			2			1				2		3			3
CO4	3				2				1		1	1	3	3	
CO5		3	2							1				1	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
MECHANICAL ENGINEERING

IV Year B.Tech. M.E. II Semester	L	T	P	C
	3	1	0	4

TRIBOLOGY
(15A03804a)

Course Objectives: To impart knowledge on	
1	To introduce tribology as an important design consideration that affects the performance of engine and automotive elements.
2	To teach different bearing types, modeling and performance considerations.
3	To introduce concepts in friction and wear phenomena.

(Elective V)

UNIT I

SURFACES AND FRICTION: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion – Measurement of Friction.

UNIT II

WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals – Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III

LUBRICANTS AND LUBRICATION TYPES: Types, properties, Requirements of Lubricants – Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

UNIT IV

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

UNIT V

SURFACE ENGINEERING AND MATERIALS FOR BEARINGS: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

	Course Outcomes : At the end of the course students will be able to
CO1	Able to analyse the contact surface topography, surface parameters and calculate contact pressure, temperature and film thickness simulate wear.
CO2	Able to understand the types of friction and wear mechanisms and measure them.
CO3	Familiar with lubrication types, properties and use the suitable lubricant.
CO4	Able to solve problems on hydrodynamic and hydrostatic lubrication.
CO5	Familiar with bearing elements, materials, types and applications of triblogy.

Text Books:

1. *I.M. Hutchings, Tribology, "Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.*

Reference Books:

1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.

2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.

3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.

4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.

5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	3	1			2		2	2	1	3
CO2		2		3	2		3		2		3				
CO3								1		2		2			
CO4	3		2		3	1			2		3		2	1	3
CO5		2		3		2	2	1					2		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
MECHANICAL ENGINEERING

IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	1	0	4

COMPUTATIONAL FLUID DYNAMICS
(15A03804b) (ELECTIVE - V)

	Course Objectives:
1.	The course will equip the students with the necessary knowledge to use computational techniques to solve problems related to flow mechanics. In particular, students will have hands-on experience in using computational fluid dynamics to solve engineering problems.

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.

UNIT II

Finite Differences: Discretization, consistency, stability, and fundamentals of fluid flow modelling, Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT III

Errors And Stability Analysis: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, 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.

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.

UNIT V

Simple CFD Techniques: Viscous flows conservation form space marching, relocation techniques, viscous flows, conservation from space marching relocation 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.

Course Outcomes : At the end of this course, the student will be able to:	
CO1	Provide the student with a significant level of experience in the application of knowledge in mathematics and numerical methods to solve heat transfer problems using FDM
CO2	To equip the student demonstrate the ability to use FDM to solve fundamental fluid flow problems and to know implement aspects of Finite Difference Equations.
CO3	To equip the student demonstrate an ability to perform error and stability analysis in CFD and to revisit governing equations of fluid and heat transfer
CO4	To equip the student demonstrate the ability to use appropriate model equations to investigate fluid flow in steady flow cases.
CO5	To equip the student demonstrate the ability to describe viscous and turbulent flows to the application of CFD techniques.

Text Books:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge Uni Press,India.

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2			2		2			3	2	
CO2		3		3		3									
CO3	3	3	2		3					2			3	2	
CO4	3		2	1		3				2			3		
CO5		3	2		1	3		2		2				2	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

IV Year B.Tech.M.E. II Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

ENERGY MANAGEMENT (15A03804c)
(Elective – V)

	Course Objectives: To impart knowledge on
CO1	Energy auditing in engineering and process industry
CO2	Energy conservation.

UNIT - I
ENGINEERING ECONOMICS:
Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest-Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II
DEPRECIATION & COST ANALYSIS:
Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III
PROJECT MANAGEMENT:
Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.
Energy Management Programs:
Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV
ENERGY AUDITING:

Definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

	Course Outcomes (COs): Ability to
CO1	Objectives of management, different costs, money value
CO2	Evaluate the depreciation and cost analysis.
CO3	Apply the principles energy management for conservation.
CO4	Describe the energy rate structures.
CO5	Discussion of energy policies, prices and its trading

Text Books:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

Reference Books:

1. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
2. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
3. The role of Energy Manager, E.E.O., U.K.
4. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
5. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1				2							2	
CO2	2		1		3		2		3		3			2	
CO3		3		2		1		1		2		2	1		3
CO4	2							1					1	2	
CO5				2		1				2					3

Program Educational Objectives (PEOs)

PEO 1	**SUCCESSFUL CAREER**: Graduates of the program will have successful technical or professional career.
PEO 2	**LIFELONG LEARNING:** Graduates of the program will continue to learn and to adopt in a world of constantly evolving technology
PEO 3	**SERVICE TO SOCIETY:** Graduates of the program will have the capability to work with multi - disciplinary teams to implement innovative ideas ethically for uplifting the society.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

UG SYLLABUS FOR

R17
REGULATIONS

Program Outcomes:

1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	**Design/Development Of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	**Environment and Sustain ability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1	Identify, Formulate and Analyze complex Mechanical Engineering problems
PSO 2	Ability to implement the learned principles of Mechanical Engineering to Understand, analyze, evaluate and create more advanced mechanical systems or processes.
PSO 3	Ability to apply Mechanical Engineering Skills and Managerial Skills to Become Entrepreneurs and build the Attitude to innovate.

VISION AND MISSION OF THE DEPARTMENT

VISION :

To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

MISSION:

M1: Providing students with sound mechanical engineering knowledge, practices, skills and training

M2: Enriching the quality of life of students through teaching, research, internships, outreach programs and symposiums.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2017-18
COURSE STRUCTURE

I YEAR I Semester

SNo	Subject code	Subject	L	T	P	C
1	17A15501	English	3	-	-	3
2	17A15101	Mathematics -I	2	2	-	3
3	17A15301	Engineering Chemistry	2	2	-	3
4	17A10101	Environmental Studies	3	-	-	3
5	17A10102	Engineering Mechanics	2	2	-	3
6	17A10501	Problem Solving & Computer Programming	3	-	-	3
7	17A15303	Engineering Chemistry Lab	-	-	4	2
8	17A13501	Engineering Workshop & IT Workshop	-	1	3	2
9	17A15502	English Language Communication Skills Lab.	-	1	3	2
10	17A11301	Comprehensive Objective type Examination	-	-	-	1
		Total	15	9	9	25

I YEAR II Semester

SNo	Subject code	Subject	L	T	P	C
1	17A25501	Technical Communication and Presentation Skills	3	-	-	3
2	17A25101	Mathematics -II	2	2	-	3
3	17A25201	Engineering Physics	2	2	-	3
4	17A20301	Engineering Graphics I	1	1	3	3
5	17A22401	Elements of Electrical and Electronics Engineering	3	-	-	3
6	17A20302	Material Science and Metallurgy	3	-	-	3
7	17A20504	Computer Programming Lab	-	1	3	2
8	17A25202	Engineering Physics Lab	-	-	4	2
9	17A22402	Electrical and Electronics Engineering Lab	-	1	3	2
10	17A29901	Community Service (Audit)	-	-	2	-
11	17A20304	Comprehensive Objective type Examination	-	-	-	1
		Total	14	07	15	25

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II YEAR I SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A35102	**Mathematical Methods**	2	2	-	3
2	17A30106	Mechanics of Solids	2	2	-	3
3	17A30301	Thermodynamics	2	2	-	3
4	17A30302	Kinematics of Machines	2	2	-	3
5	17A30303	Engineering Graphics-II		2	4	3
6	17A30107	Fluid Mechanics and Hydraulics Machinery	2	2	-	3
7	17A39901	**Human Values & Professional Ethics(Audit)**	2	-	-	-
8	17A30304	Material Science and Metallurgy Lab	-	-	2	1
9	17A30108	Fluid Mechanics and Hydraulic Machinery Lab	-	-	2	1
10	17A30109	Mechanics of Solids Lab	-	-	2	1
11	17A30305	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**12**	**10**	**22**

II YEAR II SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A45401	**Managerial Economics and Financial Analysis**	3	-	-	3
2	17A45102	**Probability and Statistics**	2	2	-	3
3	17A40301	Manufacturing Technology	3	-	-	3
4	17A40302	Machine Drawing		2	4	3
5	17A40303	Thermal Engineering- I	2	2	-	3
6	17A40304	Dynamics of Machinery	2	2	-	3
7	17A45103	**Exploratory Data Analysis Lab**	-	1	3	2
8	17A40305	Manufacturing Technology Lab	-	-	2	1
9	17A40306	Computer Aided Drafting Lab	-	-	2	1
10	17A40307	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**9**	**11**	**23**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

III YEAR I SEMESTER

S.No	Code	Subject	L	T	P	C
1	17A50301	Machine Tools	3	-	-	3
2	17A50302	Power Plant Engineering	3	-	-	3
3	17A50303	Design of Machine Members-I	2	2	-	3
4	17A50304	Thermal Engineering- II	2	2	-	3
5	17A50305	Heat Transfer	2	2	-	3
6	17A50306	Metal Forming	3	-	-	3
7	17A59901	**Foreign Language (Audit)**	2	-	-	-
8	17A50307	Machine Tools Lab	-	-	4	2
9	17A50308	Thermal Engineering Lab	-	-	2	1
10	17A50309	Heat Transfer Lab	-	-	2	1
11	17A59902	**Internship / Skill Development (Audit)**	-	-	-	-
12	17A50310	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**17**	**6**	**8**	**23**

III YEAR II SEMESTER

S.No.	CODE	Subject	L	T	P	C
1	17A60301	Industrial Engineering and Management	3	-	-	3
2	17A60302	Design of Machine Members-II	2	2	-	3
3	17A60303	Operations Research	3	-	-	3
4	17A60304	**Automobile Engineering**	3	-	-	3
5	17A60305	Refrigeration and Air Conditioning	2	2	-	3
6	17A60306	**Open Elective I**	3	-	-	3
7	17A65501	**Advanced Communication Skills Lab**	-	1	3	2
8	17A69902	**Fine Arts (Audit)**	2			
9	17A60307	Dynamics Lab	-	-	2	1
10	17A60308	Automobile Engineering / R & A/C Lab	-	-	2	1
11	17A60309	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**18**	**5**	**7**	**23**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING

IV YEAR I SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A70301	CAD /CAM	3	-	-	3
2	17A70302	Finite Element Methods	2	2	-	3
3	17A70303	Instrumentation and Control Systems	3	-	-	3
4	17A70304	Engineering Metrology	3	-	-	3
5	17A70305	**Open Elective***	3	-	-	3
6	17A70306	**Elective – I**	3	-	-	3
7	17A79903	**MOOC-I (Audit)****	-	-	-	-
8	17A70307	CAD/CAM Lab	-	-	2	1
9	17A70308	Instrumentation and Metrology Lab	-	-	2	1
10	17A70309	Computer Aided Engineering Lab	-	-	2	1
11	17A70310	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**17**	**2**	**6**	**22**

Open Elective:
1. **Entrepreneurship**
2. **Rapid Prototyping**
3. **Automation and Robotics**

Elective I:
1. **Design of Experiments**
2. **Advanced Internal Combustion Engineering**
3. **Energy Management**

Note: Project Work shall initiate in IV-I Semester with a target of submission of Abstract and finalization of topic, and the evaluation of project work shall be done in IV-II Semester

*** The student should select the subject in the open elective which is not studied in previous semesters.**

**** The student can select the subject of any discipline for MOOC-I. However the agency will decide by the BoS Chair persons.**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING

IV YEAR II SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A80301	**Elective – I**	3	-	-	3
2	17A80302	**Elective – II**	3	-	-	3
3	17A80303	**Elective – III**	3	-	-	3
4	17A80304	**Elective – IV**	3	-	-	3
5	17A89903	**MOOC-II(Audit)*** **	-	-	-	-
6	17A80305	**Seminar**	-	-	2	1
7	17A80306	**Project Work**	-	-	16	8
8	17A80307	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**-**	**18**	**22**

***** The student should select the subject of discipline centric for MOOC-II. However the agency will decide by the BoS Chair persons.**

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lectures T- Tutorial P – Practical/Drawing C – Credits

Elective I:
1. Production and Operations Management
2. Turbomachinery
3. Quality Concepts in Design

Elective II:
1. Non Conventional Sources of Energy
2. Solar Refrigeration and Air Conditioning
3. Advanced Mechanical Vibrations

Elective III:
1. Total Quality Management
2. Mechatronics
3. Tribology

Elective IV:
1. Modern Manufacturing Methods
2. Design of Heat Transfer Equipments
3. Gas Dynamics

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2017-18
COURSE STRUCTURE

I YEAR I Semester

SNo	Subject code	Subject	L	T	P	C
1	17A15501	English	3	-	-	3
2	17A15101	Mathematics -I	2	2	-	3
3	17A15301	Engineering Chemistry	2	2	-	3
4	17A10101	Environmental Studies	3	-	-	3
5	17A10102	Engineering Mechanics	2	2	-	3
6	17A10501	Problem Solving & Computer Programming	3	-	-	3
7	17A15303	Engineering Chemistry Lab	-	-	4	2
8	17A13501	Engineering Workshop & IT Workshop	-	1	3	2
9	17A15502	English Language Communication Skills Lab.	-	1	3	2
10	17A11301	Comprehensive Objective type Examination	-	-	-	1
		Total	15	9	9	25

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES ******
I B.TECH – I SEMESTER(R-17)
(w.e.f Academic Year 2017-18)

Subject Code	Title of the Subject	L	T	P	C
17A15501	**English**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To enable the students to communicate in English for academic and social purpose
2	To enable the students to acquire structures and written expressions required for their profession.
3	To develop and practice critical and evaluative reading
4	To encourage investigating questions of the humanities through rhetorical study
5	To enhance the study skills of the students with emphasis on LSRW skills

SYLLABUS

UNIT –I

Chapter entitled *Humour* from "Using English"
Chapter entitled "Jagadish Chandra Bose" from <u>New Horizons</u>
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

Chapter entitled *Inspiration* from "Using English"
Chapter entitled "Dhyan Chand" from <u>New Horizons</u>

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

Chapter entitled *Sustainable Development* from "Using English"
Chapter entitled "After Twenty Years" from <u>New Horizons</u>
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

Chapter entitled *Relationships* from "Using English"
Chapter entitled "The Tiger in the Tunnel" from <u>New Horizons</u>
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

Chapter entitled Science and Humanism from "Using English"
Chapter entitled a. "Daffodils" b. "Where the mind is Without Fear" from <u>New Horizons.</u>
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.

	COURSE OUTCOMES
CO1	Develop facility in responding to a variety of situations and contexts calling for purposeful shifts in voice, tone, level of formality, design, medium, and/or structure
CO2	Become effective in the use of different modes of written communication in a professional environment
CO3	Develop capacity to apply different reading methods to evaluate a mass of data on the net and to glean the necessary information
CO4	Learn and use key rhetorical concepts through analyzing and composing a variety of texts
CO5	Well trained in LSRW skills and develop communicative competence

Text Books:

Using English (for detailed study) published by Orient Black Swan, 2013

1. **New Horizons (for non details study) published by Pearson, 2013**

References:

1. **Raymond Murphy's English Grammar with CD,** Murphy, Cambridge University Press, 2012.
2. **Every Day Dialogues in English- Robert J.Dixson, Prentice Hall of India**
3. **Communication Skills, Sanjay Kumar & Pushpalatha** Oxford University Press, 2012.
4. **A Course in Communication Skills**- Kiranmai Dutt & co. Foundation Books, 2012.
5. **Current English grammar and usage-**S M Guptha, PHI, 2013.
6. **A Course in Listening and Speaking-Sasi Kumar.U, U.K.Cambridge**
7. **Powerful Vocabulary Builder-** Anjana Agarwal New Age International Publishers, 2011.
8. **Writing with a Purpose, Tickoo and Sasi Kumar, OUP, 2011**
9. **Oxford Advanced Learners Dictionary, 9th edition, Oxford, 2016.**

Method of Evaluation:

The distribution shall be 40 marks for Internal Evaluation and 60 marks for the External Evaluation. Each Internal examination shall consist of an objective test for 10 marks and a subjective test for 20 marks with duration of 20 and 90 minutes respectively. In addition to that 10 marks will be awarded for assignment.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				3						3				2	1
CO2								3					1		1
CO3				3						3		3	1	2	
CO4								3	3			3	1		1
CO5				3											

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF MATHEMATICS ******
I B.TECH – I SEMESTER
(Common to all Branches)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A15101	MATHEMATICS – I	2	2	0	3

COURSE DESCRIPTION: First order differential equation, higher order linear differential equations; functions of several variables; applications of integration; multiple integrals, vector calculus.

COURSE OBJECTIVES:	
1	To impart knowledge on the advanced concepts of linear differential equations, functions of several variables, applications of derivatives, multiple integrals and vectors calculus.
2	To develop skills in analyzing the problems, designing mathematical models, skills in differentiation, integration, and vectors calculus for the problems in engineering.

UNIT-I:

FIRST ORDER DIFFERENTIAL EQUATIONS (6 periods)
Linear and Bernoulli type, exact equations and reducible to exact. Orthogonal trajectories (Both Cartesian and polar forms). Newton’s law of cooling.

UNIT II:

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS (12 periods)
Method for solution of linear equations- Differential operator *D*, Solution of second order linear homogeneous equations with constant coefficients, Solution of Higher order homogeneous linear equations with constant coefficients, Solution of Non homogeneous linear equations- Operator methods for finding particular integrals- for cases – e^{ax}, sinax, cos ax, x^n, e^{ax} V(x),

xV(x). Method of Variation of parameters. Applications of linear differential equations-Mechanical and Electrical oscillatory circuits and Deflection of Beams.

UNIT – III

Power Series Expansions &Multi-variable Calculus (8 Lectures)

Taylor series, Maclaurin series. Functions of several variables, Continuity, Partial derivatives, Total derivative, Increment theorem, Chain rule, Tangent plane and Normal line, Mixed derivative theorem, Necessary and sufficient conditions for Maxima, Minima and Saddle point, The method of Lagrange multipliers.

UNIT – IV

Multiple Integrals (6 Lectures)

Double integral, Fubini's theorem, Volumes and Areas, Change of variable in a double integral, special case: Polar coordinates, Triple integral, Applications, Change of variables in a triple integral, Surface area, Line integrals, Surface integrals.

UNIT – V

Vector Calculus (12 Lectures)

Vector functions, Continuity and Differentiability of vector functions, Arc length for space curves, Unit tangent vector, Unit normal and Curvature to plane and space curves, Gradient, Directional derivatives, Vector fields, Divergence and Curl of a vector field, vector integrations, Green's Theorem (without Proof), Stokes' Theorem(without Proof), The divergence theorem(without Proof), verifications and applications.

	COURSE OUTCOMES:
CO1	Acquire knowledge in (a) Higher order Differential equations (b) Maximum and minimum values for the functions of several variables (c) Double and triple integrals (d) Differentiation and integration of vector functions. (e) Line and surface volume (f) Transforming integrals from three dimensional surfaces and Volumes on to plane surfaces
CO2	Develop skills in analyzing the (a) methods for differential equation for obtaining appropriate solutions, (b) Properties of oscillatory electrical circuits and heat transfer in engineering systems (c) The variations in the properties of functions near their stationary values (d) Flow patterns of fluids, electrical and magnetic flux and related aspects

CO3	Develop skills in designing mathematical models for (a) R-C and L-R-C oscillatory electrical circuits (b) Mechanical oscillations. (c) Deflection of Beams. (d) Heat transfer and Newton's laws of cooling (e) Engineering concepts involving lengths of curves and areas of planes Flux across surfaces
CO4	Develop analytical skills in solving the problems involving (a) Newton's laws of cooling (b) non homogeneous linear differential equations (c) maximum and minimum values for the functions (d) lengths of curves, areas of surfaces and volumes of solids in engineering (e) transformations of integrals from three dimensional surfaces and volumes on to plane surfaces
CO5	Use relevant mathematical techniques for evaluating (a) various types of particular integrals in differential equations (b) stationary values for multi variable functions (c) multiple integrals in change of variables (d) Integrations of vector functions.

TEXT BOOKS:

1. Engineering Mathematics-I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher
2. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.

REFERENCES:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1													2	2	
CO2	2			3										2	1
CO3	2	3											2	2	
CO4		3												2	1
CO5			3										2	2	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF CHEMISTRY
I B.TECH – I SEMESTER (common to CE & ME)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A15301	**Engineering Chemistry**	**2**	**2**	**-**	**3**

COURSE OBJECTIVES	
1	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.
2	The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
3	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.
4	The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example

UNIT 1 :ELECTROCHEMISTRY

i) Review of electrochemical cells, Numerical calculations.

Batteries: Rechargeable batteries: Lead acid, Ni-Cd, Lithium Ion Batteries, Super capacitors Fuels cells: Fuel cell working principle, classification of fuel cells-Hydrogen-Oxygen and Methanol-Oxygen.

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

iii) Corrosion: definition, Types of Corrosion: Dry Corrosion (Direct Chemical attack), Wet Corrosion, Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating. (10h)

UNIT 2 : POLYMERS

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

Elastomers Natural Rubber, process of natural rubber, vulcanization, 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. Polydispersive index

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

iii) Liquid Crystals: Introduction, classification and applications

iii) Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications.(12h)

UNIT 3 :FUEL TECHNOLOGY

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

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

ii) Liquid Fuels:

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

Power Alcohol: Manufacture, Advantages and Disadvantages 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. Combustion: reaction of ` combustion and related problems. (12h)

UNIT 4 :CHEMISTRY OF ENGINEERING MATERIALS

i) Ceramic: General properties, classification of ceramics

ii) Glass: Manufacture of glass, properties of glass, fracture of glasses, types of glasses.

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

iv) Refractories: Classification, properties of refractories and its failures. Applications of refractories.

v) Lubricants: Theory of lubrication, properties of lubricants and applications

vi) Rocket Propellants: Classification, Characteristics of good propellant. (9h)

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 powder, ionization)

Industrial Use of water for Steam generation, Boilers troubles. Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion. Treatment of Boiler Feed water:

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

External Treatment: Ion-Exchange and Permutit processes.

Demineralization of brackish water: Reverse Osmosis and Electro dialysis (12h)

	COURSE OUTCOMES
CO1	The students 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.
CO2	Understand industrially based polymers, various engineering materials.
CO3	Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. The Students select and apply suitable treatments domestically and industrially.
CO4	They can able to know the chemical properties of engineering materials like ceramics, cement, glass, refractories, rocket propellants, lubricants.
CO5	Understanding the water treatment to reduce the impurities, corrosion of boiler, Internal and external treatment of water.

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 Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi

2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.

3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi

4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu

5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu

6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				1		3									
CO2		2	3										1	2	3
CO3				1	2										
CO4		2				3	3						1	2	3
CO5			3												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF CIVIL ENGINEERING ******
I B.TECH – I SEMESTER
(Common to All Branches)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A10101	**Environmental Studies**	**3**	**-**	**0**	**3**

	COURSE OBJECTIVES
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : 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: 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)

BIODIVERSITY AND ITS CONSERVATION : Introduction 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-sports 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, 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

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. – 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 – V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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.

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, and birds – river, hill slopes, etc..

Course outcomes:	
CO1	Critical thinking: Demonstrate critical thinking skills in relation to environmental affairs.
CO2	Communication: Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of contexts
CO3	Interdisciplinary synthesis: Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
CO4	Ecological literacy: Demonstrate an awareness, knowledge and appreciation of the intrinsic values of ecological processes and communities.
CO5	Sustainability: Demonstrate an integrative approach to environmental issues with a focus an sustainability.

TEXT BOOKS :

(1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palaniswamy – Pearson education
(3) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES :

(1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
(3) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Pubilishing House
(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														1
CO2			3		1		3								1
CO3	2							3				1	2	2	
CO4				3	1		3						2		
CO5		2										1		2	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF CIVIL ENGINEERING ******
I B.TECH – I SEMESTER
(THEORY)

(Common to CIVIL & MECHANICAL)

Subject Code	Title of the Subject	L	T	P	C
17A10102	Engineering Mechanics	2	2	0	3

	COURSE OBJECTIVES
1	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.

COURSE OUTCOMES :	
CO1	To acquire the basic knowledge of the analysis of general structures when external loads are applied.
CO2	To understand the forces and their systems, equilibrium of systems of forces, static analysis of simple plane trusses.
CO3	To know about friction and their types, area moment of inertia, mass moment of inertia
CO4	Ability to know about kinematics, kinetics and concepts of mechanical vibrations.
CO5	To understand the basic concepts in structural mechanics.

TEXT BOOKS:

Engineering Mechanics by Dr.R.K.Bansal, Lakshmi Publications.

(1) Engineering Mechanics by Shames & Rao – Pearson Education.
(2) Engineering Mechanics by Bhavakatti, New age pubilishers

REFERENCES:

(1) Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
(2) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.
(3) Engineering Mechanics by FedrinandL.Singer – Harper Collings Publishers.
(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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		3		3					3	2		
CO2	3	3		3		3			3		2			2	2
CO3				3	3	3	3		3			3	2	2	
CO4	3	3		3							2				
CO5	3	3	3		3		3		3			3	2		2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING ******
I B.TECH – I SEMESTER
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A10501	**Problem Solving and Computer Programming**	3	-	-	3

COURSE OBJECTIVES	
1	The course is designed to provide adequate knowledge on the programming languages and problem solving techniques, complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

UNIT - I

Introduction: Programs and Programming, Programming Languages, Compiler, Interpreter, Loader and Linker, Program Execution, Classification of Programming, Structured Programming Concept, Algorithms, Flowcharts, System Developments.

Fundamentals Algorithms: Exchange the Values between two variables, Counting, Summation of set of numbers, Factorial Computation, Generation of the Fibonacci sequence, Reversing the digits of a integer.

Basics Of C: Introduction**,** Developing Programs in C, A Simple C program, Parts of C Program Revisited.

UNIT – II

Structure of C: Structure of a C Program, Concept of a Variable, Data Types in C, Program Statements, Declaration, Tokens, Operators and Expressions, Type conversion in C.

Input and Output: Introduction, Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Function.

Control Statements: Introduction, Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection, Iteration and Repetitive Execution. Nested Loops.

UNIT – III

Arrays And Strings: Introduction, One-Dimensional Array, Strings, Multidimensional Arrays, Arrays of Strings.

Function: Introduction, Concept of Functions, Using Functions, Call by Value Mechanism, Working with Functions, Passing Arrays to Functions, Scope and Extent, Inline Function, Recursion.

UNIT - IV

Factoring Methods: Finding Square root of a Number, The Smallest Deviser of an Interger, The GCD of Two Integers, Generating Prime Numbers.

Pointers – Introduction, Understanding Memory, Address Operator, Pointer, Void Pointer, Null Pointer, Use of pointer, Arrays and Pointers, Pointers and string, Pointers and string, Pointers to pointers, Array of pointers, Pointers to Function, Dynamic Memory Allocation.

Introduction to Data Structures, Single Linked List.

UNIT – V

User-Defined Data Types and Variables: Introduction, User-defined Data Types, Structures, Union, Enumeration Types.

Files in C: Introduction, Using Files in C, Working with text Files, Working with Binary Fields, Direct File Input and Output, Files of Records, Random Access to Files of Records.

	COURSE OUTCOMES
CO1	Understand concepts of programming language, compiler and develop algorithm and flowchart solutions to simple problems.
CO2	Understand basic C-programming concepts, input and output formats, various control statements.
CO3	Ability to develop programmes using arrays, strings and functions.
CO4	Inscribe various programme writing logics and ability to develop C programmes using pointers.
CO5	Implement to use of user-defined data types, nested structures and implement files operation for a given application.

TEXT BOOKS:

1. Programming in C, PradipDey, Manas Ghosh, Second Edition, OXFORD,
2. How to Solve it by Computer by R.G. Dromey, Pearson.

REFERENCES:

1. Programming in C and Data Structures, Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Pearson Education.
2. Value Range analysis of C programs by simon, Axel by New Age International Publishers.
3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
4. Programming in C – Stephen G. Kochan, III Edition, PearsonEductaion.
5. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition Education / PHI
6. C Programming & Data Structures,E.Balagurusamy,TMH.
7. Complete Reference – C, Herbert Schildt,TMH.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			1		1		3			3			
CO2			3			2		1		1	2		2	1	
CO3			3	3				1							3
CO4		2					3		3	1	2		2		
CO5	1				1					1					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF CHEMISTRY ******
I B.TECH – I SEMESTER(common to ME & CE)

Subject Code	Title of the Lab	L	T	P	C
17A15303	Engineering Chemistry Lab	-	-	4	2

COURSE OBJECTIVES	
1	Will learn practical understanding of the redox reaction
2	Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention
3	Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
4	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 Copper by Iodometry
5. Estimation of Iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Acidity and Alkalinity of Water
7. Determination of pH of various water samples.
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 Chromite indicator (Mohrs method)

COURSE OUTCOMES	
CO1	Would be confident in handling energy storage systems and would be able combat chemical corrosion
CO2	Would have acquired the practical skill to handle the analytical methods with confidence.
CO3	Would feel comfortable to think of design materials with the requisite properties
CO4	Would be in a position to technically address the water related problems.
CO5	Determine viscosity, pH, acidity, corrosion of water

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				3									2		
CO2	2					2								2	1
CO3				3	1									2	
CO4	2		3		1	2							2	2	1
CO5			3	3											

JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. M.E. I-Sem
ENGINEERING WORKSHOP& IT WORKSHOP LAB (17A13501)
Part-A

(Common to All Branches)

Subject Code	Title of the Lab	L	T	P	C
17A13501	Engg. workshop	-	1	3	2

COURSE OBJECTIVES	
1	The objective of this subject is to provide the basic concepts about the engineering workshop trades like Carpentry, Fitting etc.
2	Gain knowledge of the use of various workshop tools and make models in the respective trades.
3	Exposure to power tools

1. TRADES FOR EXERCISES:
At least 2 Exercises in each of the following trades :

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

Course Outcomes	
CO1	Student will be aware of the safety aspects in using the tools
CO2	Student will be able to use the tools for the preparation of models in respective trades of engineering workshop.
CO3	Precautions in making the models will be known by the student.
CO4	Student will be aware of the usage of the power tools for various purposes.
CO5	Knowledge about the measuring instruments will be achieved.

TEXT BOOK: Work shop Manual / P.Kannaiah/ K.L.Narayana/ Scitech Publishers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2			3			2		3	
CO2			2												
CO3		3			3		1				2	2			
CO4				2			1				2		2	3	2
CO5	3		2						3			2			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING ******
I B.TECH – I SEMESTER

Subject Code	Title of the Lab	L	T	P	C
17A13501	**IT workshop Lab**	-	1	3	2

COURSE OBJECTIVES	
1	To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
2	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
3	To learn about Networking of computers and use Internet facility for Browsing and Searching

Preparing your Computer

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

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, and 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

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.

COURSE OUTCOMES	
CO1	Disassemble and Assemble a Personal Computer and prepare the computer ready to use
CO2	Prepare the Documents using Word processors and Prepare spread sheets for calculations using excel
CO3	Prepare Slide presentations using the presentation tool
CO4	Interconnect two or more computers for information sharing
CO5	Access the Internet and Browse it to obtain the required information

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2						3		2	3	
CO2	3														
CO3	3	2	3		2				2						2
CO4										2		2	2		
CO5				2		1			2	2					2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF HUMANITIES
I B.TECH – I SEMESTER(R-17)
English Language Communication Skills Lab
(w.e.f Academic Year 2017-18)

Subject Code	Title of the Lab	L	T	P	C
17A15502	**English Language Communication Skills Lab**	**-**	**1**	**3**	**2**

COURSE OBJECTIVES	
1	To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2	To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3	To provide opportunities for practice in using English in day to day situations
4	To improve the fluency in spoken English and neutralize mother tongue influence
5	To train students to use language appropriately for debate, group discussion and public speaking

UNIT- I

Phonetics – Introduction to Sounds of Speech – Vowels – Consonants – Phonetic Transcription & Orthographic Transcription

UNIT – II

Syllabification – Word Stress – Rules of word stress – Intonation – Falling tone and Rising tone

UNIT – III

Situational Dialogues – Role-play – Expressions in various situations – Self Introduction – Introducing others – Greetings – Apologies – Requests – Giving directions -Social and Professional etiquettes – Telephone Etiquettes

UNIT – IV

JAM – Describing Pictures, Photographs, Products, and Process – Talking about Wishes-Information Transfer.

UNIT – V

Debates - Group Discussions-1

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. Walden Infotech English Language Communication Skills.
2. Clarity Pronunciation Power – Part I (Sky Pronunciation)
3. Clarity Pronunciation Power – part II
4. LES by British council
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. *DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.*
7. Lingua TOEFL CBT Insider, by Dreamtech
8. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
9. Cambridge Advanced Learners' English Dictionary with CD.

COURSE OUTCOMES	
CO1	Better Understanding of nuances of language through audio- visual experience and be independent learners
CO2	The significance of paralinguistic features will be understood by the students and they will try to be intelligible.
CO3	Become good at Inter-personal skills
CO4	Achieve neutral accent and be free from mother tongue influence
CO5	Being an active participant in debates and group discussion, showing ability to express agreement, argument to summarize ideas to elicit the views of others and present own ideas;

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. **Speaking English Effectively**, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. **A Hand book for English Laboratories**, E.Suresh kumar, P.Sreehari, Foundation Books,2011
5. **English Pronunciation in Use. Intermediate & Advanced**, Hancock, M. 2009. CUP
6. **Basics of Communication in English**, Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
7. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
8. **English Pronouncing Dictionary**, Daniel Jones Current Edition with CD.Cambridge, 17th edition, 2011.

Method of Evaluation:

English Language Laboratory Practical Examination:

1. The Practical Examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core Engineering practical sessions.

2. For the Language lab sessions, there shall be a continuous evaluation during the year for 40 sessional marks and 60 year-end Examination marks. Of the 40 marks, 20 marks shall be awarded for day-to-day work and 20 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									3						2
CO2									3	3		3			
CO3														1	
CO4									3	3			1		2
CO5															

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2017-18
COURSE STRUCTURE

I YEAR II Semester

SNo	Subject code	Subject	L	T	P	C
1	17A25501	Technical Communication and Presentation Skills	3	-	-	3
2	17A25101	Mathematics -II	2	2	-	3
3	17A25201	Engineering Physics	2	2	-	3
4	17A20301	Engineering Graphics I	1	1	3	3
5	17A22401	Elements of Electrical and Electronics Engineering	3	-	-	3
6	17A20302	Material Science and Metallurgy	3	-	-	3
7	17A20504	Computer Programming Lab	-	1	3	2
8	17A25202	Engineering Physics Lab	-	-	4	2
9	17A22402	Electrical and Electronics Engineering Lab	-	1	3	2
10	17A29901	Community Service (Audit)	-	-	2	-
11	17A20304	Comprehensive Objective type Examination	-	-	-	1
		Total	14	07	15	25

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES ******
I B.TECH – II SEMESTER(R-17)
Technical Communication and Presentation Skills
(w.e.f Academic Year 2017-18)

Subject Code	Title of the Subject	L	T	P	C
17A25501	**Technical communication and Presentation Skills**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To develop awareness in students of the relevance and importance of technical communication and presentation skills.
2	To prepare the students for placements
3	To sensitize the students to the appropriate use of non-verbal communication
4	To train students to use language appropriately for presentations and interviews
5	To enhance the documentation skills of the students with emphasis on formal and informal writing

SYLLABUS

UNIT 1: Basics of Technical Communication – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

UNIT II

Informal and Formal Conversation - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

UNIT III

Written communication – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication- Art of condensation- summarizing and paraphrasing

UNIT IV

Presentation Skills – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

UNIT V

Interview Skills – The Interview process –Characteristics of the job interview – Pre- interview preparation techniques – Projecting the positive image – Answering Strategies.

	COURSE OUTCOMES
CO1	Become effective technical communicators
CO2	Be job-ready and able to face interviews confidently
CO3	Sensitive use of non-verbal language suitable to different situations in professional Life
CO4	Learn and use keys words, phrases and sentence structures making a mark in interviews and presentation skills
CO5	Effective writing skills with the ability to use different styles for different situations

Text Books:

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma,3rd Edition, O U Press 2015

References:

1.Communication Skills by Pushpalatha & Sanjay Kumar, Oxford Univsesity Press

2.Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/Cambridge University Press.2012.3. **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.

4. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

5. **Successful Presentations** by John Hughes & Andrew Mallett, Oxford.

6. **Winning at Interviews** by Edgar Thorpe and Showick Thorpe, Pearson

7. Winning Resumes and Successful Interviews by Munish Bhargava, Mc Graw Hill

Method of Evaluation:

The distribution shall be 40 marks for Internal Evaluation and 60 marks for the External Evaluation. Each Internal examination shall consist of an objective test for 10 marks and a subjective test for 20 marks with duration of 20 and 90 minutes respectively. In addition to that 10 marks will be awarded for assignment.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															2
CO2									3						2
CO3										3		3	1		2
CO4									3						2
CO5									3			3		1	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF MATHEMATICS ******
I B.TECH – II SEMESTER
(Common to all Branches)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A25101	**MATHEMATICS – II**	**2**	**2**	**0**	**3**

COURSE DESCRIPTION: Fourier series; Fourier integrals and transforms; Laplace transforms; z – transforms; partial differential equations.

	COURSE OBJECTIVES:
1	To impart basic knowledge on Fourier series, Fourier transforms, Laplace Transforms, z-transforms and partial differential equations.
2	To develop skills in analyzing the problems, designing mathematical models, Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations for the problems in engineering.

UNIT- I :
FOURIER SERIES (7 periods)
Fourier series: Determination of Fourier coefficients (Euler's formulae),Fourier series of even and odd functions, convergence of Fourier series (Dirichlet conditions), Half-range Fourier sine and cosine expansions, Parseval's formula, Complex form of Fourier series.

UNIT- II:
FOURIER INTEGRALS AND FOURIER TRANSFORMS(8 periods)
Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms –properties, Inverse transform and finite Fourier transforms.

UNIT-III:
LAPLACE TRANSFORMS (12 periods)
Laplace transforms of standard functions. Properties of Laplace transform. First and second shifting Theorems. Laplace transforms of derivatives and integrals. Inverse transforms. Convolution theorem, inverse Laplace transforms by convolution theorem. Laplace transform of periodic functions, Step and Impulse functions, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT-IV :

Z- TRANSFORMS (9 periods): Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem, Solution of difference equations by Z– transforms.

UNIT – V :

PARTIAL DIFFERENTIAL EQUATIONS (9 periods)

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.

COURSE OUTCOMES: After completion of the course a successful student is able to	
CO1	Acquire basic knowledge in (a) Fourier series and Fourier transforms (b) Fourier integrals (c) Laplace transforms and their applications (d) z- transforms and their applications (e) Solving partial differential equations (f) Heat transfer and wave motion
CO2	Develop skills in Analyzing the (a) Properties of Fourier series for a given function (b) Partial differential equations through different evaluation methods (c) Difference equations through z – transforms (d) Engineering systems and processes involving wave forms and heat transfer
CO3	Develop skills in designing mathematical models for (a) Problems involving heat transfer and wave forms (b) Engineering concepts involving, Fourier transforms, Fourier integrals, (c) Laplace transforms, z-transforms and difference equations
CO4	Develop analytical skills in solving the problems involving (a) Fourier series and Fourier transforms (b) Laplace transforms (c) Z-transforms and difference equations (d)Heat transfer and wave motion
CO5	Use relevant transformation techniques for (a) Obtaining Fourier transforms for different types of functions (b) Laplace transforms (c) Z- transforms (d) Partial differential equations

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3											1		
CO2	3													1	
CO3		3											1	1	
CO4	3				3										
CO5		3	3		3	3							1		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF PHYSICS ******
I B.TECH – II SEMESTER

Subject Code	Title of the Subject	L	T	P	C
17A25201	**ENGINEERING PHYSICS**	2	2		3

	COURSE OBJECTIVES
1	To make a bridge between the physics in school and engineering courses.
2	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.
3	To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications.
4	To understand and employ the concepts of waves & oscillations and acoustics to engineering applications.
5	To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications. Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nano and smart materials, their properties and applications in modern emerging technologies are elicited.
6.	To enlighten the characterization of materials by different techniques, the periodic arrangement of atoms in crystals, Bragg's law and X-Ray diffraction technique.

SYLLABUS

UNIT 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

Physical Optics: Introduction to interference – Colours in thin films – Newton's Rings – Michelson interferometer - Fraunhoffer diffraction due to single slit, double slit – Diffraction grating (Qualitative).

Lasers*:* Introduction – Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients –– Population inversion – Pumping mechanisms - Nd:YAG laser – He-Ne laser – Applications of lasers.

Fiber optics: Introduction – working principle of optical fiber – Numerical aperture and acceptance angle – V- Number - Types of optical fibers –Optical fiber communication system – Attenuation and losses in optical fibers – Applications of optical fibers.

UNIT 2: **WAVES & OSCILLATIONS AND ACOUSTICS**

Waves & Oscillations*:* Categories of waves: Mechanical, electromagnetic, matter and gravitational – Reflection and transmission of waves at a boundary – Free oscillations – Damped Oscillations – Forced oscillations – Resonance – Coupled oscillations.

Acoustics – Absorption coefficient and its measurement – Reverberation time – Sabine's formula – Acoustic Quieting – Methods of Quieting.

UNIT 3: **DIELECTRICS AND MAGNETIC MATERIALS**

Dielectrics*:* Introduction – Dielectric Polarization – Types of Polarization – Lorentz field – Clausius-Mosotti equation – Piezoelectricity – Ferroelectricity – Dielectric strength, loss and breakdown.
Magnetic materials*:* Introduction – Basic definitions – Origin of magnetic moment – Classification of magnetic materials – Hysteresis – Soft and hard magnetic materials – Applications of magnetic materials.

UNIT 4: **ADVANCED MATERIALS**

Superconductors*:* Introduction – Properties of superconductors – Meissner effect– Type I and Type II superconductors – ac and dc Josephson effects – BCS theory (qualitative treatment) – High T_c superconductors – Applications of superconductors.

Nanomaterials: Introduction – Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic – Carbon Nanotubes – Applications of nanomaterials.

Smart Materials: Shape Memory Alloys: Definition – Two phases – One way and two way memory effect – Pseudo elasticity – Applications of shape memory alloys.

UNIT 5: CRYSTALLOGRAPHY AND MATERIAL CHARACTERIZATION
Crystallography*:* Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction – Bragg's law.

Material Characterization: Electron microscopy: SEM, TEM, AFM – Non-destructive testing: objectives – Methods: Pulse-echo method.

	COURSE OUTCOMES
CO1	The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fiber optics.
CO2	The concepts of types of waves and oscillations ,acoustics are highlighted
CO3	The dielectric and magnetic response of materials are focussed.
CO4	The importance of superconducting materials, nano and smart materials along with their engineering applications are well elucidated.
CO5	Characterization of materials by advanced techniques, the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique are focused.

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. Introduction to modern optics – Grant R Fowles
2. A text book on Optics – Brijlal & Subramanyam
3. Laser Fundamentals – William T. Silfvast, Cambridge University Press
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Shape Memory Alloys-Modeling and Engg. Applications – C Lagoudas, Springer
7. Hand Book of Non-destructive evaluation, C.J.Hellier, McGraw-Hill
8. Engineering Physics – V. Rajendran, K.Thyagarajan Tata MacGraw Hill Publishers
9. Engineering Physics – M.R.Srinivasan, New Age Publications
10. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
11. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
12. Engineering Physics – M. Arumugam, Anuradha Publications

Method of Evaluation:
Please mention if it is apart from the regular practice
Data Books Required: Nil

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2								2	1	1
CO2	3				2				3				2		
CO3	3		3	3	2								2	1	1
CO4		3	2		3								2	1	1
CO5	3	3	3	2											

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
I- Year B.Tech. M.E. II-Sem
(MECHANICAL)

Subject Code	Title of the Subject	L	T	P	C
17A20301	**ENGINEERING GRAPHICS**	1	1	3	3

Course Objectives: To impart knowledge on	
C2 02.1	To impart knowledge on Representing any matter/object with the help of picture.
C2 02.2	To impart knowledge on Working drawings
C2 02.3	To impart knowledge on Orthographic drawing of different machine parts.
C2 02.4	To impart knowledge on Developing assembly drawings.
C2 02.5	To impart knowledge on Developing assembly drawings

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance Drawing Instruments and their Use – BIS Conventions in drawing and Lettering.

Curves used in practice:

a) Conic sections including the Rectangular Hyperbola
b) Cycloid, Epicycloid and Hypocycloid –normals and Tangents
c) Involute of a circle –Normals and Tangents
d) Helices –multi start on cylinder and cone

UNIT –II

Principles of orthographic projections – First and Third angle projections Projection of points. Projections of lines inclined to one plane.

UNIT –III

Projection of lines inclined to both reference planes – traces.

UNIT –IV

True length, true angles of projected lines –use of auxiliary planes –profile view, point view. Projection of regular planes inclined to both planes, true shapes.

UNIT –V

Projection of solids inclined to both planes.

	Course Outcomes: After the completion of the course,
CO1	The student will be able to understand the principles of drawing,uses of drawing instruments and able to draw curves in conic section.
CO2	The student will be able to draw orthographic projections and projection of point and lines
CO3	They can able to draw the projection of lines inclined to both the planes.
CO4	They can able to determine the true length and angle of projected lines
CO5	They can able to draw the projection of solids inclined to both the planes

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

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, John&john.

Suggestions:
Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2			2	1	1			1		2	
CO2		3					2	1					3		3
CO3	2		3	2				1	1	2		1		2	3
CO4		3		2			2	1					3		3
CO5	2	3	3	2			2	1	1			1		2	

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING
PART – A

ELECTRICAL ENGINEERING FOR MECHANICAL ENGINEERING
I-B.Tech, II-Sem

Subject Code	Title of the Subject	L	T	P	C
17A22401	Electrical Engineering	3	-	-	3

Course Objectives: To make the students learn about:	
1	The basics of AC & DC Circuits, DC generators & motors.
2	The construction and operation of Transformers, Induction motors and their performance aspects will be studied.

Syllabus:

UNIT – I Introduction to DC & AC Circuits

Ohm's Law, Basic Circuit Components, Kirchhoff's Laws, Types of Sources, Resistive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The J Operator and Phasor Algebra, Analysis of Ac Circuits With Single Basic Network Element.

UNIT-II DC Machines

D.C Generators: Principle of Operation of Dc Machines, Types of D.C Generators, E.M.F Equation in D.C Generator, O.C.C. of a D.C. Shunt Generator

D.C Motors: Principle of Operation of Dc Motors, Types of D.C Motors, Torque Equation, Losses and Efficiency Calculation in D.C Motor- Swinburne's Test.

UNIT-III AC Machines

Transformers: Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.

Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).

Alternators: Principle of Operation-Constructional Details-EMF Equation-Voltage Regulation by Synchronous Impedance Method.

Course Outcomes: After completing the course, the student should be able to :	
CO1	Analyze the basics of AC & DC Circuits and know the performance characteristics of DC generators & motors.
CO2	Study the D.C. Generators, D.C.Motors.
CO3	Gets a thorough knowledge on Transformers, Induction motors & Alternators with which he/she can able to apply the above conceptual things to real-world problems and applications.

TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2			2		2				1		2	1
CO2				1			1		3	2					
CO3		3			3			2			1	1	3		
CO4				1			1							2	
CO5	2							2	3						1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF ECE
I B.TECH – II SEMESTER (Common to ME & CHEM)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
17A22401	**Electronics Engineering**	**3**	**-**	**-**	**3**

COURSE OBJECTIVES: The students will be able to	
1	Understand principle and terminology of electronics.
2	Analyze the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators.
3	Understand the concept of number systems.
4	Understand the concept & principles of logic devices.

SYLLABUS

UNIT I
Diodes and Transistors: Semiconductor Diode, Zener Diodes, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors, Field-Effect Transistors, Transistor Biasing, Transistor Small Signal Analysis, Transistor Amplifiers.

UNIT II
Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Instrumentation Circuits, Active Filters and Oscillators.

UNIT III
Digital Electronics: Number Systems and Codes, Logic Gates, Boolean Theorems, DeMogan's Theorems, Algebraic Simplification, Karnaugh Map Method. Binary Addition, 2's Complement System, Full Adder, BCD Adder. NAND and NOR gate Latches, S-R Flip-Flop, JK Flip-Flop, D Flip-Flop, shift registers and counters.

COURSE OUTCOMES: At the end of this course the student will be able to	
CO1	Apply the concept of science and mathematics to explain the working of diodes and its applications, working of transistor and its characteristics and to analyze and design different transistor biasing circuits.
CO2	Analyze the applications of operational amplifiers.
CO3	Solve problems of various digital logic gates and circuits.
CO4	Correlate the fundamental concepts to various Real life applications of today.

Text Books:

1. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education
2. R.J. Tocci: Digital Systems; PHI, 6e, 2001.
3. R.J. Smith and R.C. Dorf: Circuits, Devices and Systems; John Wiley & Sons, 1992.

References:

1. R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education.
2. Bell, D. A., Electronic Devices and Circuits, Oxford University Press

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1			1		2				2			
CO2		2		3	2					1	3			2	1
CO3			1		2		3		1			1			
CO4					2						3				1
CO5						1				1		1	3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT
I Year B.Tech. M.E.II-Sem

Subject Code	Title of the Subject	L	T	P	C
17A20302	**Material Science and Metallurgy**	**-**	**4**	**0**	**4**

	COURSE OBJECTIVES Students can able to learn about
1	Structure of Metals and types of solids
2	They can understand the equilibrium diagrams,properties and structure of the mild steel an Iron.
3	Heat treatment of steel,properties and structure of ceramic ,composite materials

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.

	COURSE OUTCOMES
CO1	Students can able to Study structure of different material. Select materials for design and construction.
CO2	The importance of structure of materials.
CO3	They can able the study the properties of ferrous and non ferrous materials.
CO4	To study the heat alloys.
CO5	To study about the ceramic and composite materials.

TEXT BOOKS :

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

REFERENCES :

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3		2		2						2		3	
CO2	3			2		2	1			2	2				1
CO3	3	3			2		1								1
CO4			3		2		1		3	2	2			3	
CO5		3	3		2		1		3			2	3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING ******
I B.TECH – I SEMESTER

Subject Code	Title of the Lab	L	T	P	C
17A20504	**Computer Programming Lab**	-	1	3	2

COURSE OBJECTIVES	
1	To work with the compound data types
2	To explore dynamic memory allocation concepts
3	Able to design the flowchart and algorithm for real world problems
4	Able to write C programs for real world problems using simple and compound data types
5	Employee good programming style, standards and practices during program development

LIST OF EXPERIMENTS

Week-1

1) Write a C program to make the following exchange between the variables a-> b -> c->d - > a
2) Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, and division between two variables
3) Write a C program for printing prime numbers between 1 and n.

Week-2

1) Write a C program to construct a multiplication table for a given number.
2) Write a program to reverse the digit of a given integer.
3) Write a C program to find the sum of individual digits of a positive integer.
4) Write a C program to calculate the factorial of a given number

Week-3

1) Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
2) Write a program to calculate tax, given the following conditions:
   a) If income is less than 1,50,000 then no tax.
   b) If taxable income is in the range 1,50,001 – 300,000 then charge 10% tax
   c) If taxable income is in the range 3,00,001 – 500,000 then charge 20% tax
   d) If taxable income is above 5,00,001 then charge 30% tax

Week-4

1) Write a program to print the calendar for a month given the first Week- day of the month.
   Input the first day of the month (Sun=0,Mon=1,Tue=2,Wed=3,.....) :: 3
   Total number of days in the month : 31
   Expected output

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
-	-	-	*1*	*2*	*3*	*4*
5	*6*	*7*	*8*	*9*	*10*	*11*
12	*13*	*14*	*15*	*16*	*17*	*18*
19	*20*	*21*	*22*	*23*	*24*	*25*
25	*26*	*27*	*28*	*29*	*30*	*31*

2) Write a C program to find the roots of a quadratic equation

Week-5

1) Write a program to print the Pascal triangle for a given number
2) Write a C program to find the GCD (greatest common divisor) of two given integers
3) Write a C program to construct a pyramid of numbers.
4) Write C code to define a function cash_dispense, which takes an amount as its input, and returns the number of 1000, 500, 100, 50, 20, 10, 5, 2, 1 rupee denomination that make up the given amount

Week-6

1) Write C code to reverse the contents of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]
2) Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices
   ii) Multiplication of Two Matrices
3) Write a program that will search and find out the position where the given key element exist in a user chosen array and print it as output.

Week-7

1) Write C code to compute the frequency table of survey responses given by 20 users. The survey responses range from 1 to 5 and are stored in an array. For example, 10 responses are stored in the array [1,1,5,2,3,3,5,5,2,2]. The frequency table will be as shown below:
   a. 1 = 2
   b. 2 = 3
   c. 3 = 2
   d. 4 = 0
   e. 5 = 3
2) Write a program to define a function to sort an array of integers in ascending order by using exchange sort.

Week-8

1) Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.

2) Write a C program to determine if the given string is a palindrome or not by using string functions.
3) Write a function that accepts a string and delete the first character.
4) Write a function that accepts a string and delete all the leading spaces.

Week-9 Write a program to accept a string from user and display number of vowels, consonants, digits and special characters present in each of the words of the given string.

Week-10 1) Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as union variable

2) Declare a structure *time* that has three fields *hr, min, secs.* Create two variables,*start_time*and*end_time.* Input there values from the user. Then while *start_time* is not equal to *end_time* display GOOD DAY on screen.

Week-11 1) Write a program to read in an array of names and to sort them in alphabetical order. Use sort function that receives pointers to the functions strcmp, and swap, sort in turn should call these functions via the pointers.

2) Write a program to read and display values of an integer array. Allocate space dynamically for the array using the *malloc().*

3) Write a program to calculate area of a triangle using function that has the input parameters as pointers as sides of the triangle.

Week-12 1) Two text files are given with the names text1 and text2. These files have several lines of text. Write a program to merge (first line of text1 followed by first line of text2 and so on until both the files reach the end of the file) the lines of text1 and text2 and write the merged text to a new file text3.

2) Write a program to split a given text file into n parts. Name each part as the name of the original file followed by .part<n> where n is the sequence number of the part file.

COURSE OUTCOMES	
CO1	Translate algorithms in to programs
CO2	Code and debug programs in C program language using various constructs.
CO3	Formulate problems and implement algorithms in C.
CO4	Able to use different data types in a computer program

Reference Books:

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, Third Edition, Cengage Learning
2. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, Third Edition, Cengage Learning
3. Programming with C RemaTheraja, Oxford
4. “C Test Your Skills”, Kamthane, Pearson Education
5. Programming in C: A Practical Approach, Ajay Mittal, Pearson
6. Problem solving with C, M.T.Somasekhara, PHI
7. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
8. Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		3	2			3	2					
CO2			2				1			2		3		3	1
CO3	3			3		2		3							
CO4				3		2		3	3		3		1		
CO5		3	2		3		1			2					1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
I-B.Tech II-Sem
MECHANICAL

ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING LAB

PART – A: ELECTRICAL ENGINEERING LAB

Subject Code	Title of the Lab	L	T	P	C
17A22402	Electrical Engineering	-	1	3	2

	Course Objectives
1	The DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
2	Various test conditions of single phase transformers.

Syllabus:
The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
2. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
3. Brake Test on 3-Phase Induction Motor (Determination of Performance Characteristics)
4. Regulation of Alternator by Synchronous Impedance Methods.
5. Speed Control of D.C. Shunt Motor by
   a) Armature Voltage Control B) Field Flux Control Method
6. Brake Test on D.C Shunt Motor

Course Outcomes: After completing the course, the student should be able to do the following	
CO1	Learn about DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
CO2	Various test conditions of single phase transformers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			3		1		3					1		
CO2			1						1		1				2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF ECE

I B.TECH – II SEMESTER (Common to ME & CHEM)

Subject Code	Title of the Lab	L	T	P	C
17A22402	**Electronics Engineering**	**-**	**1**	**3**	**2**

COURSE OBJECTIVES The students will be able to	
1	Understand the characteristics of PN junction diode and zener diode.
2	Understand the characteristics of BJT in CE and CB configurations
3	Learn the frequency response of CE Amplifier
4	Exposed to linear and digital integrated circuits

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Full Wave Rectifier with & without filter
4. Wave Shaping Circuits (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting Amplifiers using Op Amps
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs
9. Verification of Truth Tables of RS, JK, T & D flip flops using respective ICs

COURSE OUTCOMES	
CO1	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
CO2	Analyze the application of diode as rectifiers, clippers and clampers.
CO3	Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits.
CO4	Learn the basics of linear integrated circuits and understand characteristics of operational amplifier.
CO5	Learn about available digital ICs and verify truth tables of logic gates and flip flops.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					2				1				1		
CO2	3	1	1				1		1				1		
CO3				3		1		3		2	2			1	2
CO4		1				1						3			
CO5					2			3		2					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF PHYSICS ******
I B.TECH – II SEMESTER

Subject Code	Title of the Lab	L	T	P	C
17A25202	ENGINEERING PHYSICS LABORATORY	4			2

COURSE OBJECTIVES	
1	The Objective of this course is to make the students gain practical knowledge to correlate with the theoretical studies.
2	To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.
3	To train engineering students on basis of measurements and the instruments
4	To equip the students with practical knowledge in electronic, optics, and heat experiments

LIST OF EXPERIMENTS

Any TEN of the following experiments has to be performed during the SEMESTER

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method
2. Determination of dispersive power of prism
3. Determination of thickness of thin object by wedge method
4. Determination of radius of curvature of lens by Newton's rings
5. Laser : Diffraction due to single slit
6. Laser : Diffraction due to double slit
7. Laser: Determination of wavelength using diffraction grating
8. Determination of Numerical aperture of an optical fiber
9. Meldes experiment: Determination of the frequency of tuning fork
10. Sonometer: Verification of the three laws of stretched strings
11. Energy gap of a material using p-n junction diode
12. Electrical conductivity by four probe method
13. Hall effect: Determination of mobility of charge carriers in semiconductor

14. B-H curve
15. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method
16. Determination of dielectric constant and Curie temperature of a ferroelectric material

Note: Out of 10 experiments, two experiments will be performed using virtual laboratory

Data Books Required: Nil

COURSE OUTCOMES	
CO1	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.
CO2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CO4	The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application.
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1				3				1		2	
CO2		2			2							1	2		
CO3	1		3	1			3		2	3	1		2		3
CO4		2				1		3							
CO5			3						2				2	2	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

II YEAR I SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A35102	**Mathematical Methods**	2	2	-	3
2	17A30106	Mechanics of Solids	2	2	-	3
3	17A30301	Thermodynamics	2	2	-	3
4	17A30302	Kinematics of Machines	2	2	-	3
5	17A30303	Engineering Graphics-II		2	4	3
6	17A30107	Fluid Mechanics and Hydraulics Machinery	2	2	-	3
7	17A39901	**Human Values & Professional Ethics(Audit)**	2	-	-	-
8	17A30304	Material Science and Metallurgy Lab	-	-	2	1
9	17A30108	Fluid Mechanics and Hydraulic Machinery Lab	-	-	2	1
10	17A30109	Mechanics of Solids Lab	-	-	2	1
11	17A30305	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**12**	**10**	**22**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

MATHEMATICAL METHODS (17A35102)
(CIVIL, MECH &CHEM)

	Course Objectives:
1	This course aims at providing the student with the concepts 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: 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 Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

Course Outcomes:	
CO1	The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.
CO2	They can able to find out the solutions for algebraic and transcendental equations.
CO3	Able to do the problems on Newton’s, Lagrange’s, Gauss ,Stirling’s & Bessel’s formula.
CO4	Students can able to solve the problems on curve fitting.
CO5	They are able to find solutions for ordinary differential equations.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		3		2			2			1	3	2	3
CO2			3												
CO3	3								2						
CO4		3		3										2	
CO5			3			2							3		3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

MECHANICS OF SOLIDS (17A30106)

	Course Objectives:
1	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 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-deflections of propped cantilevers for simple loading cases.

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.

	Course Outcomes:
CO1	Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
CO2	Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.
CO3	Determining the flexural stresses and shear stresses on different beams.
CO4	Deriving torsion equation for circular shafts and and finding deflection on beams.
CO5	Solving equations for stresses and strains , Applying Lame's theory for cylinders.

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) Mechanics of Materials by Swaroop Adarash, New Age Publications

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 S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	2			3		3
CO2		3			3	2			3	2		3	3	2	3
CO3	3	3								2		3	3	2	3
CO4	3				3	2			3			3		2	
CO5		3				2									

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

THERMODYNAMICS (17A30301)

	Course Objectives
1	To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

UNIT- I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, 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.

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

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

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.

Note: Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychometric Chart permitted

	Course Outcomes
CO1	Describe basic concepts of thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications.
CO2	Analyse how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balance equation to various applications.
CO3	Identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle
CO4	Judge the properties of pure substances and method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance, usage of steam tables and mollier diagrams
CO5	Understand and analyse of ideal gas& gas mixtures, Gas Power Cycles, concept of ideal cycles for different engines and their working principle.

TEXT BOOKS:

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.

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

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2					2			2		2		2
CO2		2	2	1						2		3		2	
CO3	3	2						2		2	2	3	2	2	2
CO4				1				2		2	2		2	2	
CO5			2	1								3			

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

KINEMATICS OF MACHINES (17A30302)

	COURSE OBJECTIVES
1	Analysis of Mechanisms
2	Concept of straight line motion mechanisms and steering gear mechanisms
3	Principles involved in the displacement, velocity and acceleration at a point in a link of a mechanism
4	Concepts of toothed gearing and gear train.
5	Designing of cam profile and analysis of motion of followers.

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, Ackermann's 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, and determination of Coriolis component of acceleration. Klein's 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, Simple problems.

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.

	Course outcomes
CO1	An understanding of concepts of different of mechanism with lower pairs and higher pairs.
CO2	Gain the knowledge of different types of straight line mechanism and steering gear mechanisms.
CO3	Obtain an in depth knowledge of finding displacement ,velocity and acceleration of different Points on different mechanisms using different methods (relative velocity, Instantaneous methods).
CO4	Aquire the knowledge on different gear profiles and calculating the different parameters of gears.Gain the knowledge in designing of gear trains for the required purpose.
CO5	Design and analyse different cam profile for different types of followers.

TEXT BOOKS:

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

REFERENCES :

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Theory of Machines, Thomas Bevan, CBS.
3. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
4. Theory of machines, P.L. Ballaney, Khanna Publishers.
5. Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers
6. Theory of Machines, by R.S. Khurmi & J.K. Gupta S. Chand Pub.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2		1		1		2		1	2		
CO2	3	2	2		2		1	1	1	2	2	1	2	3	
CO3				2	2	1	1		1		2	1		3	
CO4	3	2	2	2	2		1		1	2	2		2	3	
CO5			2					1		2					

JNTUA COLLEGE OF ENGINEERING(AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

II- Year B.Tech. M.E. I-Sem

L	T	P	C
-	2	4	3

ENGINEERING GRAPHICS-II (17A30303)

(MECHANICAL)

Course Objectives: To impart knowledge on	
C2 02.1	To impart knowledge on Representing any matter/object with the help of picture.
C2 02.2	To impart knowledge on Working drawings
C2 02.3	To impart knowledge on Orthographic drawing of different machine parts.
C2 02.4	To impart knowledge on Developing assembly drawings.
C2 02.5	To impart knowledge on Developing assembly drawings

Unit –I

Sections of solids: Sections and Sectional views of Regular solids –Prism, Cylinder, Pyramid, Cone – True shapes.

Development of Regular solids, sphere and transition piece.

Unit –II

Isometric projection: Isometric views of lines, plane figures, Compound solids, Spherical parts.

Unit –III

Conversion of Pictorial views to orthographic views –Conventions.

Unit –IV

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

Unit –V

Perspective projections – Planes and simple solids. Vanishing point Method only.

	Course Outcomes
CO1	The student will be able to draw the sectional views and the true shape of the sectional view of the regular solids like prism, cone, cylinder, pyramid and sphere and develop them.
CO2	The student will be able to draw the 3D pictorial projections/views of the planes, regular solids and compound solids.
CO3	Given with the 3D pictorial views, the student will be able to convert the figure to 2D orthographic view.
CO4	Student will be able to draw the intersecting curves between the solids between the solids like cylinder, cone and prism.
CO5	Student shall develop to draw the perspective projections of planes and regular solids with the help of the given data.

TEXT BOOKS:

3. Engineering Drawing, N.D. Bhat, Charotar Publishers
4. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

5. Engineering Drawing, Johle, Tata McGraw-Hill Publishers.
6. Engineering Drawing, Shah and Rana,2/e, Pearson Education
7. Engineering Drawing and Graphics, Venugopal/New age Publishers
8. Engineering Graphics, John&john.

Suggestions:

Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					3	3							2		2
CO2	3				3	3	3						2	1	
CO3	3					3			3					1	2
CO4	3				3		3		3				2	1	
CO5					3		3		3						2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
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II Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

FLUID MECHANICS AND HYDRAULIC MACHINERY (17A30107)

	Course Objectives:
1	The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
2	To understand the importance of dimensional analysis.
3	To understand the importance of various types of flow in pumps and turbines.

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

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.

C01	**Course Outcomes:** Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
C02	Studying the losses and measurement of flow in pipes.
C03	Deriving equations when jet strikes on various and positions on vanes
C04	Can critically analyse the performance of pumps .
C05	Analyse the performance of turbines.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. Standard book house
2. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.
3. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &Sons
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	2						2	3		2
CO2				1								2		1	
CO3	3					2							3		2
CO4		3		1	1							2		1	
CO5			3												

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II Year B.Tech. M.E. I-Sem

L	T	P	C
2	-	-	-

HUMAN VALUES AND PROFESSIONAL ETHICS (17A39901)

	Course Objectives:
1	To create an awareness on Engineering Ethics and Human Values.
2	To instill Moral and Social Values and Loyalty
3	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.

	Course Outcomes:
CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible and their own ethical values and the social context of problems.
CO4	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
CO5	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. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
3. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
4. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
5. . "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication. Research – Analyzing Ethical Problems in research – Intellectual property Rights(IPR).
6. "Professional Ethics and Human Values" by Prof.D.R.Kiran-

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1		3	1	1					
CO2						1		3	1	1					
CO3						1		3	1	1					
CO4						1		3	1	1					
CO5						1		3	1	1					

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II Year B.Tech. M.E. I-Sem

L	T	P	C
-	-	2	1

MATERIAL SCIENCE AND METALLURGY LAB (17A30304)

Course Objectives:	
1	To impart knowledge on metallographic techniques for studying the microstructures of alloys.

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 – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

Course Outcomes:	
Co1	Ability to relate properties of microstructure.
Co2	Understand various crystal structures.
Co3	To study the thermosetting of ferrous and non ferrous materials.
Co4	To test magnetic defects of material.
Co5	To test the strength of material.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		2	2			3			3			1
CO2		3		2			3			2	3			3	
CO3	3		3		2				3		3	3			
CO4		3				2	3			2					
CO5				2											

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L	T	P	C
-	-	2	1

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB (17A30108)

Course Objectives:	
1	The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

LIST OF EXERCISES:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

Course Outcomes:	
CO1	Ability to use the measurement equipments for flow measurement.
CO2	Ability to Determine Coefficient of discharge for a small orifice and an external mouth piece and loss of head.
CO3	Calibration on rectangular and triangular Notch.
CO4	Verifying the Bernoulli's equation, determine the impact of jet on vanes.
CO5	Performance test on turbines and pumps.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	2				1		2	3		2
CO2				1	1									1	2
CO3	3					2									
CO4		3		1	1										
CO5			3			2				1		2			

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II Year B.Tech. M.E. I-Sem

L	T	P	C
-	-	2	1

MECHANICS OF SOLIDS LAB (17A30109)

	Course Objectives:
1	The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures.

LIST OF EXERCISES:

2. Tension test.
3. Bending test on (Steel/Wood) Cantilever beam.
4. Bending test on simple support beam.
5. Torsion test.
6. Hardness test.
7. Shear test

	Course Outcomes:
CO1	Ability to perform different destructive testing.
CO2	Ability to characteristic materials.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	1		1		1		1		1
CO2	1	2	2	1	2	1		1		1		1		1	
CO3															
CO4															
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPURAUM

MECHANICAL ENGINEERING DEPARTMENT

II YEAR II SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A45401	**Managerial Economics and Financial Analysis**	3	-	-	3
2	17A45102	**Probability and Statistics**	2	2	-	3
3	17A40301	Manufacturing Technology	3	-	-	3
4	17A40302	Machine Drawing		2	4	3
5	17A40303	Thermal Engineering- I	2	2	-	3
6	17A40304	Dynamics of Machinery	2	2	-	3
7	17A45103	**Exploratory Data Analysis Lab**	-	1	3	2
8	17A40305	Manufacturing Technology Lab	-	-	2	1
9	17A40306	Computer Aided Drafting Lab	-	-	2	1
10	17A40307	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**9**	**11**	**23**

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II Year B.Tech. M.E. II-Sem

L	T	P	C
3	-	-	3

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS (17A45401)

	Course Objectives: To impart knowledge on
1	The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Demand Analysis: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behaviour- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting –

Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

UNIT V: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

Course Outcomes:	
CO 1	After completion of this course, the student will able to understand various aspects of Managerial Economics.
CO 2	Study the functions of productions and cost analysis.
CO 3	Analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.
CO 4	Understanding the concept of capital and methods and evaluation of capital budgeting.
CO 5	They can able to study the concept of financial accounting and its analysis

TEXT BOOKS:

1.Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.

2. Ahuja H.L Managerial economics. S.Chand, 3/e, 2013

REFERENCES:

1. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage,

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2	1	1				2		1	2		1
CO2	3	2	2		1							1			1
CO3		2		2	1						2		2	1	1
CO4	3	2	2								2	1		1	1
CO5		2		2						2	2	1	2	1	1

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L	T	P	C
2	2	-	3

PROBABILITY AND STATISTICS (17A4510)

(Common for CIVIL, MECH & CHEM)

Course Objectives: To impart knowledge on	
1	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 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.

UNIT – II

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 – 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 $\overline{\square}$ - 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.

Course outcomes:	
C01	Understanding the fundamentals of probability and Distributions.
C02	Usage of statistical techniques like testing of hypothesis
C03	They can able to understand the different sample testslike t-test, F-test and Chi-square test.
C04	Analysis of Statistical Quality Control charts
C05	They can able to analyse the Queuing theory problems and draw appropriate inferences.

TEXT BOOKS:

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
2. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.

REFERENCES:

1. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
5. Probability and Statistics by R.A. Jhonson and Gupta C.B.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	1	2	3			1	2	2	2		2
CO2	2	3		2		2				1	2	2	2		2
CO3	2	3	1	2	1							2	2	1	
CO4	2	3	1	2	1						2	2	2	1	2
CO5	2	3	1	2						1			2	1	2

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II Year B.Tech. M.E. II-Sem

L	T	P	C
3	-	-	3

MANUFACTURING TECHNOLOGY
(17A40301)

	Course Objectives: To impart knowledge on
1	Principle, procedure and applications of casting and welding processes.
2	Principle, procedure and applications of powder metallurgy process.

UNIT – I

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

CASTING: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Moulding Materials, Cores.

UNIT – II

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, Causes and Remedies of Casting Defects. Casting processes 1) Centrifugal 2) Die 3) Investment.

UNIT – III

Welding: Classification of welding process types of welds and electrodes, welded joints and their characteristics, design of welded joints, Gas welding-types of flames, welding process, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Oxy – Acetylene Gas cutting, Plasma Cutting, Inert Gas welding.

UNIT- IV

TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Electronic beam welding, Ultrasonic welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive non-destructive testing of welds.

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.

	Course Outcomes: Ability to
CO1	Learn the basic operation of various methods of melting and casting.
CO2	Learn how various principles of gating and different casting processes and its remedies.
CO3	Study the classification of welding processes and types of welds.
CO4	Learn the types of welds and its defects , remedies destructive non-destructive testing of welds.
CO5	Study the types, properties and processes of plastic.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao/TMH
2. Manufacturing Technology/ kalpak Jian, 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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3		2			2	3		3		3		3
CO2	3	3		3						3		3		3	
CO3			3		3			2	3	2	3		3		3
CO4		3		3						1		3		3	
CO5	3		3		1			2	3		3		3		3

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II Year B.Tech. M.E. II-Sem

L	T	P	C
-	2	4	3

MACHINE DRAWING (17A40302)

Course Objectives: To impart knowledge on	
C2 02.1	Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members.
C2 02.2	They are able to know the component behavior subjected to fluctuating loads.
C2 02.3	Analyze the Design of riveted joints and Bolted joints
C2 02.4	They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts.
C2 02.5	Students are able to know the Design of keys, couplings.

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

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, flanged &protected flanged joint.
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, and foot step bearings.

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.

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

	Course Outcomes: Ability to
C01	Understand drafting fundamentals and standards.
C02	Interpret drawings and extract required information
CO3	Create part drawings and sectional views of machine components.
CO4	Develop assembly drawings from part drawings.
CO5	Carry out tolerance analysis and specify appropriate tolerances for machine design applications

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3									3				1
CO2	2									3			3		
CO3	2				3			2				3			1
CO4										3		3		3	
CO5											3				

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II Year B.Tech. M.E. II-Sem

L	T	P	C
2	2	-	3

THERMAL ENGINEERING – I (17A40303)

Course Objectives: To impart knowledge on	
1	Testing and performance of IC Engines
2	Air compressors, fuel systems.

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

Fuel System: 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

Fuels and Combustion:

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.

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.

	Course Outcomes: On successful completion of the course, the student will be able to,
CO1	To be able to understand working of different I.C Engines and recognize basic elements and subsystems of an I.C. Engine
CO2	To be able to know about S.I Engine fuel air requirements and understand fuel supply systems in an S.I Engine.
CO3	Ability to understand necessity and functioning of cooling, lubrication and ignition system of an I.C. Engine.
CO4	To be able to understand in-cylinder combustion in S.I and C.I Engines and know about the parameters that influence normal and abnormal combustions.
CO5	To be able to know about working principle of various types of air compressors and solve problems related to reciprocating air compressor.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.
   Students are advised to refer the text book of “Internal Combustion Engine Fundamentals” by John B. Heywood

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1						2			3			3	
CO2					3				1			3			
CO3	1									2			2		2
CO4		1					1		1						
CO5	1							2			3		2	3	2
CO6		1			3				1	2			2		

JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	2	-	3

DYNAMICS OF MACHINERY (17A40304)

Course Objectives: To impart knowledge on	
1	Analysis of forces acting in mechanisms
2	Effects of unbalance forces
3	Modeling and analyzing the vibration behavior of spring mass damper system
4	The principles in mechanisms used for governing of machines

UNIT I

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.
Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.
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.

UNIT II

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

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.

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.

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 inline and radial engines for primary and secondary balancing.

UNIT V

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

	Course Outcomes: Ability to
CO1	Determine the forces acting on various linkages when a mechanism is subjected to external forces.
CO2	Identify and correct the unbalances of rotating body
CO3	Analyze the vibratory motion of SDOF systems.
CO4	Reduce the magnitude of vibration and isolate vibration of dynamic systems
CO5	Determine dimensions of Governors for speed control.

TEXT BOOKS:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.
2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

REFERENCES:

1. Theory of machines, thomas bevan, pearson, 3rd edition,2012.
2. The theory of machines, j.e. shiegley, mcgraw hill .
3. Theory of machines and mechanisms of shigley et.al. Oxford international student edition.
4. Theory of machines by r.s khurm, s.chand publications

NOTE: *End Exam should be conducted in Drawing Hall*

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3					1				1				
CO2	3		1	2		1			1	3			2		
CO3								1				1		3	
CO4	3		1		2	1	1				1		2		
CO5			1					1		3					

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR

MECHANICAL ENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
-	1	3	2

EXPLORATORY DATA ANALYSIS LAB (17A45103)

	Course Objectives: To impart knowledge on
1	Focuses on analyzing and summarizing the main characteristics of data sets including visual methods.
2	Explores techniques for formulating hypothesis about data for testing and for new data collection and experiments

List of lab assignments:

1. The basics of analytic graphics and the base plotting system in R.
2. Advanced graphing systems available in R: the Lattice system and the ggplot2 system
3. Clustering and dimension reduction techniques to make graphical displays of very high dimensional data
4. A complete EDA Analysis using R
5. Plotting and Coloring in R

	Course Outcomes: Ability to
CO1	Use the R programming language with relative facility
CO2	Command the use of the basic Plotting Systems used in R
CO3	Analyze Data Sets using the Principles of Exploratory Data Analysis
CO4	Explain the Visual Information contained in the R-generated Graphs
CO5	Explain and present the Findings in the Data Sets, after the Analysis is complete

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					2							3			1
CO2		1		2						1			3		
CO3	2	1							3		2				1
CO4					2	1				1				1	
CO5	2		3			1									

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem

L	T	P	C
-	-	2	1

MANUFACTURING TECHNOLOGY LAB (17A40305)

Course Objectives: To make the student to know	
1	Design and manufacture of simple patterns.
2	Arc welding, gas welding and resistance welding equipment for the fabrication of welded joints.
3	Pipe bending and injection moulding equipment

Minimum of 12 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.
3. Bending and other operations

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

Course Outcomes: Ability to	
C01	Design and manufacturing of simple pattern
C02	Control sand properties in foundry
C03	Operate arc welding, spot welding equipment.
CO4	Create a cavity in sand using mould
C05	Study about the injection moulding

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			2		2								2
CO2	2			3						2			3	1	
CO3						3			2						2
CO4		2					2					2		1	
CO5	2				2										

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

II Year B.Tech. M.E. II-Sem

L	T	P	C
-	-	2	1

Computer Aided Drafting Lab (17A40306)

	Course Objectives: To impart knowledge on
1	To develop skill to use software to create 2D and 3D models.

List of Exercises:

Using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.).
2. Creation of simple figures like polygon and general multi-line figures. 2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a simple steel truss.
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing isometric projection of simple objects.
9. Creation of 3-D models of simple objects.
10. Obtaining 2-D multi-view drawings from 3-D model. \

	Course Outcomes: Ability to
C01	Use the coordinate systems for the concerned drawings.
C02	Construct 2-D sketches, interpret the dimensions and the associated annotations in CAD environment
C03	Construct 2-D sketches for intersections of solids using CAD packages
C04	Create solid models of various objects and machine parts.
C05	Construct 3-D modeling by extrusion process using various CAD packages.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		2					3	2					
CO2			2										3		2
CO3		3			2	1					2			3	
CO4			2												
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING DEPARTMENT

III YEAR I SEMESTER

S.No	Code	Subject	L	T	P	C
1	17A50301	Machine Tools	3	-	-	3
2	17A50302	Power Plant Engineering	3	-	-	3
3	17A50303	Design of Machine Members-I	2	2	-	3
4	17A50304	Thermal Engineering- II	2	2	-	3
5	17A50305	Heat Transfer	2	2	-	3
6	17A50306	Metal Forming	3	-	-	3
7	17A59901	**Foreign Language (Audit)**	2	-	-	-
8	17A50307	Machine Tools Lab	-	-	4	2
9	17A50308	Thermal Engineering Lab	-	-	2	1
10	17A50309	Heat Transfer Lab	-	-	2	1
11	17A59902	**Internship / Skill Development (Audit)**	-	-	-	-
12	17A50310	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**17**	**6**	**8**	**23**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. I-Sem

L	T	P	C
3	-	-	3

MACHINE TOOLS (17A50301)

	Course Objectives:
1	To create awareness on various mechanical measuring instruments.
2	To make student familiar with various operations on machine tools
3	To make the students familiar with the drilling operations
4	Usage of the instruments to measure the linear and angular measurements
5	To gain the practical experience on the machines

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, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

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 and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

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.

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 – comparison of grinding, lapping and honing. machining time calculations.

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 Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications.

	Course Outcomes:
CO1	Hands on experience on lathe machine to perform turning, facing, threading operations.
CO2	Practical exposure on flat surface machining, milling and grinding operations.
CO3	Skill development in drilling and threading operations.
CO4	Linear and angular measurements exposure.
CO5	Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc

Text Books:

1. Workshop Technology – Vol II, B.S.Raghu Vamshi, Dhanpat Rai & Co, 10th edition, 2013

2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition

Reference Books:

1. Manufacturing Technology-Kalpakzian- Pearson

2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012

3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st 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, Wiley Edn,2013

8. Machine Technology Machine tools and operations by Halmi A Yousuf & Harson, CRC Press Taylor and Francies .

Data Books Required: No

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2			3		3		2		3
CO2		3								3		2		3	
CO3	2		3			2			2		3				3
CO4		3										2		3	
CO5	1					2			1	3			2		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech. M.E. I-Sem

L	T	P	C
3	-	-	3

POWER PLANT ENGINEERING (17A50302)

	Course Objectives:
1	The primary objective of this course is to give the engineering student a basic understanding of Rankine cycle
2	Fundamental concepts of gas turbines with reheat and regeneration
3	To study power plants like steam, hydro, hydel, tidal and nuclear power plants
4	To know the power generation potential calculation
5	To familiarize the student with the operations to run various power plants

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, and 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.

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, 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.

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.

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.

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.

	Course Outcomes:
CO1	Analyze the efficiency and output of modern Rankin cycle steam power plants with superheat, reheat, regeneration, and irreversibility's.
CO2	Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.
CO3	Explain the major types of steam, hydro, nuclear, tidal power plants and
CO4	Estimate power generation potential.
CO5	Scope of employability in various power plants

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. Power plant Engineering, Ramalingam, Scietech Publishers

2. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

3. A Text Book of Power Plant Engineering, Rajput , Laxmi Publications, 4th edition, 2012.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1		1	1	1		1		1	2	2		
CO2	2		3	3	1				1	1	1		3		1
CO3	2		2		1		1		1					2	1
CO4	2	3		2					1			2	1	2	1
CO5	2	3		1							1			2	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech. M.E. I-Sem

L	T	P	C
2	2	-	3

DESIGN OF MACHINE MEMBERS-I (17A50303)

	Course Objectives:
1	To familiarize the various steps involved in the Design Process.
2	To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3	To learn to use standard practices and standard data.
4	To learn to use catalogues and standard machine components.

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 – Tensional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

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.

UNIT – III

Design of Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

Design Of 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.

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.

UNIT-V

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

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

	Course Outcomes:
CO1	Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members.
CO2	They are able to know the component behavior subjected to fluctuating loads.
CO3	Analyze the Design of riveted joints and Bolted joints.
CO4	They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts.
CO5	Students are able to know the Design of keys, couplings.

Text Books:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
2. Machine Design,Schaum's series,TMH Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
2. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, NewDelhi.
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 McGraw Hill Publishers
7. Machine Design by Groover – CBS Publications.

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech.M.E. I Semester

L	T	P	C
2	2	-	3

THERMAL ENGINEERING – II (17A50304)

Course Objectives: To impart knowledge on :	
1	Steam generators, nozzles, and turbines.
2	Various Gas Power cycles.

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.

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.

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 PressureRatio. 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.

Condensers: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

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.

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, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

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.

	Course Outcomes: Ability to
CO1	Students shall be able to know the Basic concepts of rankine cycles and methods to improve the performance.
CO2	Shall acquire knowledge on principles of working accessories and safety features of stream generators.
CO3	Shall acquire knowledge on stream flow through varying areas and capable of solving related problems and to understand functioning of steam condenser.
CO4	To be able to Determine the efficiency of the impulse and reaction turbine using velocity triangles.
CO5	Analyze gas turbines cycles and compare the operational aspects of jet engines.

Text Books:

1. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.

2. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013.

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				2					3		3	2		3
CO2		1						1			3			3	
CO3	1				2					3		3	1		3
CO4		1									3			3	
CO5	1				2			1		3					3

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2017-18

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

**** DEPARTMENT OF MECHANICAL ENGINEERING ****

III Year B.Tech.M.E. I Semester

L	T	P	C
2	2	-	3

HEAT TRANSFER (17A50305)

Course Objectives: To impart knowledge on	
C3 03.1	To impart knowledge on Conduction, convection, radiation, heat transfer during boiling To impart knowledge on and condensation.
C3 03.2	Students able to understand Design of heat exchangers.
C3 03.3	To Describe the concepts of one dimensional steady state heat conduction to various co-ordinates system.
C3 03.4	To Define and explain the laws of radiation and its application.
C3 03.5	To know Boundary layer concept, type of convection flow.

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 – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation.

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.

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.

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: Film wise and Drop wise 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.

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.

Course Outcomes:	
CO1	To understand the basic laws of heat transfer and electrical analogy.
CO2	To analyze problems involving steady state heat conduction in simple geometries with and without heat generation and analyze heat transfer situations in extended surfaces.
CO3	To evaluate heat transfer coefficients for natural and forced convection situations
CO4	To understand Heat transfer during phase change and estimate heat transfer rates
CO5	To analyze heat exchanger performance by using LMTD and NTU methods.
CO6	To calculate radiation heat transfer between black body surfaces and gray body surfaces.

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

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, Kondandaraman, 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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		3		2		2		3		3		
CO2		3		3		3		3		2		3		3	1
CO3	3		3		3		3		3				3		1
CO4		3		2				3		3	3			2	
CO5	3			1			1		1	1		3		1	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech. M.E. I-Sem

L	T	P	C
3	-	-	3

METAL FORMING (17A50306)

	Course Objectives:
1	The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection.

UNIT- 1

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.

UNIT -II

Rolling: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills 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.

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.

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.

UNIT -V

Unconventional machining process: Introduction– EDM, WEDM, ECM, WJM, AJM, AWJM, LBM, EBM, USM – principle, working and applications.

Course outcomes: At the end of the course students will be able to:	
CO1	Analyse the effect of parameters influencing metal forming and compare hot working and cold working applications .
CO2	Analyse the effect of forces in rolling process to understand the deformation process of rolling.
CO3	Understand the principles of sheet metal working forging and analyse the forces acting in forging and its applications.
CO4	Understand the applications of and their working principles
CO5	Understand the importance and applications of in conventional machining process like EDM,WEDM,ECM,WJM etc.

Text Books:

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

Reference Books:

1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012

2. Process and materials of manufacturing –Lindberg, PE

3. Welding Process, R.S. Parmar, Khanna Publishers, 2010

4. Manufacturing Technology, R.K. Rajput, Laxmi Publishers

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3				1			3		2		1
CO2	3		2		3				2			2		3	
CO3		3								2				3	
CO4	3		2		3				2			2			
CO5		1		3				1		2	3		2		1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech. M.E. I-Sem

L	T	P	C
-	-	4	2

MACHINE TOOLS LAB (17A50307)

	COURSE OBJECTIVES:
1	The course provides students with fundamental knowledge and principles in material removal processes.
2	To demonstrate the fundamentals of machining processes and machine tools.
3	In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, injection moulding machine etc.
4	To develop knowledge and importance of metal cutting parameters.
5	To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.

List of Experiments:

1. Job on Step turning and
2. 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 Planing

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.

10. Study of Injection Moulding Machine.

COURSE OUTCOMES Upon successful completion of this course, the students will be able to	
CO1	Select appropriate machining processes and conditions for different metals.
CO2	Use different machine tools to remove unwanted material from the work piece to produce final shape.
CO3	Use appropriate grinders to give smooth surface for improving the quality of the object.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3				2									
CO2			3							2		2		3	
CO3	2				3			3							2
CO4		3				2					3	2	2		
CO5															

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech.M.E. I Semester

L	T	P	C
-	-	2	1

THERMAL ENGINEERING LAB (17A50308)

	Course Objectives:
1	To impart knowledge on working principles of various thermal equipments like compressors, IC Engines, Boilers etc.,
2	To study the working principle of IC engines, performance and characteristics in terms of heat balancing, economical speed variations, air fuel ratio etc.,

List of Experiments:

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

Course Outcomes:	
CO1	Performance Test on 4-Stroke Diesel and 2-Stroke Petrol engine.
CO2	Able to evaluate the Engine friction of 4-Stroke Multi cylinder Engine and Air/Fuel ratio and Volumetric efficiency of I.C.Engines.
CO3	To calculate the heat balance of the IC Engines.
CO4	To calculate the efficiencies and performance characteristics of the engines.
CO5	Study the boilers and identify parts of the engine parts.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2											3		
CO2						3			2			3		1	2
CO3	3		2		2										
CO4		2					3			3			3		
CO5															

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****** DEPARTMENT OF MECHANICAL ENGINEERING ******

III Year B.Tech.M.E. I Semester

L	T	P	C
-	-	2	1

HEAT TRANSFER LAB (17A50309)

NOTE*: Thermal Engineering data books are permitted in the examinations*

	Course Objectives:
1	To impart knowledge on conducting the heat transfer experiments and practically learns how to find heat transfer coefficients, thermal Conductivity, emissivity and effectiveness.

List of Experiments:

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

4.Thermal Conductivity of metal (conductor).

5.Heat transfer in pin-fin

6.Experiment on Transient Heat Conduction

7.Heat transfer coefficient in forced convection.

8.Heat transfer coefficient in natural convection

9.Experiment on Parallel and counter flow heat exchanger.

10. Emissivity of a gray body through Emissivity apparatus.

11. Experiment on Stefan Boltzman Apparatus.

12. Heat transfer in drop and film wise condensation.

13. Experiment on Critical Heat flux apparatus.

14. Study of heat pipe and its demonstration.

15. Study of Two – Phase flow.

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

	Course Outcomes :
CO1	Student can prepare the Guarded plate apparatus.
CO2	Student can get the ideas on Lagged pipe apparatus.
CO3	Student can prepare the Natural convection – vertical cylinder, Emissivity measurement and Stefan-Boltzmann apparatus.
CO4	Student can get the ideas on Forced convection inside tube and Parallel/counter flow heat exchanger apparatus.
CO5	Student can prepare the Pin-fin apparatus, Air-conditioning test rig

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Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2					3		2		3
CO2		3			3				2			3		1	
CO3	2					2					3				
CO4		3			3				2				2		3
CO5	1		3									3		1	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING

III YEAR II SEMESTER

S.No.	CODE	Subject	L	T	P	C
1	17A60301	Industrial Engineering and Management	3	-	-	3
2	17A60302	Design of Machine Members-II	2	2	-	3
3	17A60303	Operations Research	3	-	-	3
4	17A60304	Computational Fluid Dynamics	3	-	-	3
5	17A60305	Refrigeration and Air Conditioning	2	2	-	3
6	17A60306	**Automobile Engineering**	3	-	-	3
7		**Open Elective I**	2			
8	17A65501	**Advanced Communication Skills Lab**	-	1	3	2
9	17A60307	Dynamics Lab	-	-	2	1
10	17A60308	Automobile Engineering / R & A/C Lab	-	-	2	1
11	17A60309	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**18**	**5**	**7**	**23**

Open Elective:
1. **Solar Thermal Energy Conversion**
2. **Product Design and Development Strategies**
3. **Alternative fuels for I.C Engines**

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DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
3	-	-	3

INDUSTRIAL ENGINEERING & MANAGEMENT (17A60301)

	Course Objectives:
1.	To impart knowledge on work study techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools.
2.	To impart knowledge on the material management.

UNIT- I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.
Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and 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 – Matrix Approach Plant Layout: Definition, Objectives, Organization, Types of Production, Types of Plant Layout – Various Data Analyzing Forms – Travel Chart, Optimization of Layout-Load Distance Model & CRAFT-Materials Handling Function-Objectives - Types-Selection Criteria of Material Handling Equipment.

UNIT- III

Work Study – Definition, Objectives, Method Study – Definition, Objectives, Steps Involved – Various Types of Associated Charts – Differences between Micromotion and Memomotion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations, Differences with Time Study – Applications.

UNIT- IV

Material Management – Objectives, Inventory – functions, types, associated cost, inventory classification techniques- ABC Analysis; Inventory Models- Deterministic models- EOQ Model –Models with one Price Break and Multiple Price Breaks- shortages are not allowed – Stochastic Models – Demand may be Discrete Variable or Continuous Variable – Instantaneous Production. Instantaneous Demand and Continuous Demand and No Set-up Cost Stores Management and Stores Records- Purchase Management, Duties of Purchase Manager, Associated forms

UNIT –V

Human Resource Management-Functions of HRM, Job Evaluation, Merit Rating- Difference with Job Evaluation, Different Methods of Merit Ratings, Wage Incentives, Different Types of Incentive Schemes Inspection & Quality Control: Differences between Inspection & Quality Control. Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards- Importance and Evaluation Procedure Marketing Management- Introduction, Marketing vs Selling, Market Segmentation.

COURSE OUTCOMES: At the end of the course students will be able to	
CO1	Use knowledge and comprehension in management tools to apply in technical organizations.
CO2	To understand where the plant is to be located based on facilities available 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.
CO3	Ability to apply various work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement.
CO4	To understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances, importance of Inventory control to ensure their availability with minimum capital lock up.
CO5	To introduce the basic principles of group dynamics and associated concepts required for HRM in organizations. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process. TQM circles to find solutions to problems in industry towards continuous improvement in the system.

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

References:

1. Industrial Engineering and production management, MartindTelsang S.Chand.
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.
3. Work Study by ILO(International Labour Organization)
4. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005
5. Production and Operations management, PanneerSelvam, PHI,2004.
6. Statistical Quality Control by EL Grantt, McGrawhil
7. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			3			2		2			3		3	
CO2		3		3	2			3		3			3		2
CO3	3		3			3		3			3				2
CO4		3			1		2			3		3		3	
CO5	1		3		3	3			2		3		3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
2	2	-	3

DESIGN OF MACHINE ELEMENTS– II (17A60302)

	Course Objectives:
1.	To impart knowledge and skills in applying elementary design principles, basic design procedures and use of design data for the design of mechanical elements.
2.	To provide knowledge about the concepts, procedures and the data, to design and analyse machine elements in power transmission systems.
3.	To impart competency to specify, select and design the mechanical components for transmission systems.

UNIT –I

Design Of Curved Beams: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

Design Of Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT- II

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.

Design Of Power Screws: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures.

UNIT- III

Design Of Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT -IV

Design Of Spur & Helical Gears: Spur gears- Helical gears – 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.

UNIT- V

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

	Course Outcomes :
CO1	Select suitable belt drives and associated elements from manufacturers catalogues under given loading conditions. Stresses applied in different types of beams.
CO2	Analyze springs and power screws subjected to loading.
CO3	Select suitable bearings and its constituents from manufacturers catalogues under given loading conditions.
CO4	Apply the design concepts to estimate the strength of the gear.
CO5	Select suitable engine parts and associated elements from manufacturers catalogues under given loading conditions.

Text Books:

1. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9th edition, 2010.

2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

References:

1. Machine Design, Schaum"s series, TMH Publishers, New Delhi, 1st edition, 2011

2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013.

3. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi

4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.

5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		1		2		2				3		3	
CO2		2			2		2		1	1	3		3		3
CO3	2		3	1		2		2				3		2	
CO4		3			1				1	3				1	3
CO5	1		3	3	3		2			2	3		3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. – II Semester

L	T	P	C
3	-	-	3

OPERATIONS RESEARCH (17A60303)

	Course Objectives:
1.	To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT- I

Introduction to OR and Linear Programming-, 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.

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 -Travelling Salesman problem.

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.

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 Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time.

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.

Course Outcomes : On Successful completion of this program, the students can able to understand:	
CO1	Types of OR models, can formulate linear programming problems and can solve LPP by different methods.
CO2	Dual simplex methods and methods used to solve Transportation problems.
CO3	Strategies used in different situations in the games and solve them using various techniques.
CO4	The types of queues, its characteristics and queuing models.
CO5	The sequencing and its types, application of PERT/CPM for project scheduling and concept of crashing the project schedule.
CO6	The Dynamic Programming, Bellman's Principle of Optimality and its applications and Replacement Problems.

Text Books:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.

2. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Gerالld J. Lieberman, TMH, 9th edition,2011.

References:

1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
2. Operations Research, Wagner, PHI Publications , 2nd edition.
3. Operation Research, J.K.Sharma, MacMilan, 5th edition, 2013.
4. Linear Programming, Susy Phillippose, PHI
5. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.
6. Operations Research: Methods & Problems , Maurice Saseini, Arhur Yaspan& Lawrence Friedman
7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2			2				3		3		3	
CO2		2			2				1		2		2		3
CO3	3		2			3				3		3		3	
CO4		3			2				1		2		2		
CO5		1				1									3

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	-	-	3

COMPUTATIONAL FLUID DYNAMICS (17A60304)

	Course Objectives:
1.	The course will equip the students with the necessary knowledge to use computational techniques to solve problems related to flow mechanics. In particular, students will have hands-on experience in using computational fluid dynamics to solve engineering problems.

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.

UNIT –II

Finite Differences: Discretization, consistency, stability, and fundamentals of fluid flow modelling, Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT –III

Errors And Stability Analysis: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, 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

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.

UNIT –V

Simple CFD Techniques: Viscous flows conservation form space marching, relocation techniques, viscous flows, conservation from space marching relocation 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.

Course Outcomes : At the end of this course, the student will be able to:	
CO1	Provide the student with a significant level of experience in the application of knowledge in mathematics and numerical methods to solve heat transfer problems using FDM
CO2	To equip the student demonstrate the ability to use FDM to solve fundamental fluid flow problems and to know implement aspects of Finite Difference Equations.
CO3	To equip the student demonstrate an ability to perform error and stability analysis in CFD and to revisit governing equations of fluid and heat transfer
CO4	To equip the student demonstrate the ability to use appropriate model equations to investigate fluid flow in steady flow cases.
CO5	To equip the student demonstrate the ability to describe viscous and turbulent flows to the application of CFD techniques.

Text Books:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.
2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.

References:

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2			2		2			3	2	
CO2		3		3		3									
CO3	3	3	2		3					2			3	2	
CO4	3		2	1		3				2			3		
CO5		3	2		1	3		2		2				2	

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester
REFRIGERATION AND AIR CONDITIONING (17A60305)

L	T	P	C
2	2	-	3

Course Objectives: To impart knowledge on	
1	Working principle of refrigeration and air-conditioning cycle.
2	Fundamentals of psychrometry.
3	Applications of refrigeration and air-conditioning.

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 - Refrigeration Needs of Air Crafts.

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

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT- III

Vapour Absorption Refrigeration (VAR) System – Description and Working of NH3 – 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.

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.

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.

	Course Outcomes:
CO1	Ability to understand various refrigeration systems.
CO2	Ability to demonstrate the working of refrigeration equipments.
CO3	Ability to understand various psychometric processes.
CO4	Ability to design the space cooling load.
CO5	Ability to explain the air-conditioning equipment.

Text Books:

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

References:

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			2	3					1	2		3	2	1
CO2		3	2			2						1			
CO3	3			2	3					1	2		3		1
CO4			2			2					2	1			
CO5		3		2	3					1			3	2	1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. -II Semester

L	T	P	C
3	-	-	3

AUTOMOBILE ENGINEERING (17A60306)

Course Objectives:	
C3 04.1	To impart knowledge on Automotive chassis structure, transmission and suspension systems.
C3 04.2	To impart knowledge on Engine and its working.
C3 04.3	To impart knowledge on Fuel supply, cooling and lubrication systems.
C3 04.4	To impart knowledge on Thermodynamic systems.
C3 04.5	Ability to get knowledge on pollution standards and its significance.

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.

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.

UNIT- III

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.

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.

UNIT- V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control–Modern Techniques in automobiles – 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, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

	Course Outcomes :
CO1	Ability to identify the importance of vehicle frame.
CO2	Ability to understand the thermodynamic principles behind the working of petrol and diesel engines.
CO3	Ability to outline the function and components of clutch and transmission systems.
CO4	Ability to understand the importance of steering and braking systems in automobiles
CO5	Ability to get knowledge on pollution standards and its significance.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers
2. Automobile Engineering BY Joseph Hidner

Reference Books:

1. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.
2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.
3. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.
4. Automotive engines , Newton, Steeds & Garret.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		3		3	3	3			3	2	3	1
CO2		3	2			3		3		3					1
CO3	3			3		3	3				3	3			1
CO4		3	2		3	3			3	3			2	3	1
CO5	3		2				3	3	3			3			1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	-	-	3

OPEN ELECTIVE I (a)
SOLAR THERMAL ENERGY CONVERSION

Course Objectives: To impart knowledge on	
1	The characteristics and world distribution of solar radiation
2	The solar radiation and measurement techniques
3	The methods of calculation of solar radiation availability at a given location.
4	The fundamentals of thermal and direct conversion of solar energy to power.

UNIT I

ENERGY RESOURCES AND SOLAR SPECTRUM: World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the earth, energy flux, solar constant for earth, green house effect.

UNIT II

SOLAR RADIATION AND MEASUREMENT: Solar radiation on the earth surface - Extraterrestrial radiation characteristics, Terrestrial radiation, solar insolation, spectral energy distribution of solar radiation. Depletion of solar radiation - Absorption, scattering. Beam radiation, diffuse and Global radiation. Measurement of solar radiation – Pyranometer, Pyrheliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E).

UNIT III

SOLAR RADIATION GEOMETRY AND CALCULATIONS : Solar radiation geometry - Earth-Sunangles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability.

UNIT IV

SOLAR THERMAL ENERGY CONVERSION :Thermodynamic cycles – Carnot – Organic, reheat, regeneration and supercritical Rankine cycles - Brayton cycle – Stirling cycle – Binary cycles – Combined cycles. Solar thermal power plants - Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electric-power plant, central tower receiver power plant.

UNIT V

SOLAR ELECTRICAL ENERGY CONVERSION :Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

Course Outcomes:	
CO1	They can know the world and India energy resources and solar spectrum.
CO2	Students can able measure the solar radiation on earth surface and depletion of solar radiation.
CO3	Understand the geometry of solar radiation and its calculations.
CO4	They can able to know the principles thermodynamic cycles and conversion of solar thermal energy conversion.
CO5	Students can able to know the principles and conversion of solar electrical energy conversion.

REFERENCES

1. Foster .R, Ghassemi M., Cota A., “Solar Energy”, CRC Press, 2010.
2. Duffie .J.A, Beckman W.A. “Solar Engineering of Thermal Processes”,
3rd ed., Wiley, 2006. 3. De Vos .A, “Thermodynamics of Solar Energy Conversion”, Wiley-VCH, 2008.
4. Garg .H.P, Prakash .J, “Solar Energy Fundamentals and Applications”, Tata McGraw-Hill, 2005.
5. Kalogirou .S, “Solar Energy Engineering”, Processes and Systems, Elsevier, 2009.
6. Petela .R, “Engineering Thermodynamics of Thermal Radiation for Solar Power”, McGraw-Hill Co., 2010.
7. Yogi Goswami .D, Frank Kreith, Jan F. Kreider, “Principles of Solar Engineering”, Second Edition, Taylor & Francis, 2003.
8. Andrews .J, Jelley .N, “Energy Science”, Oxford University Press, 2010.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		1			3		1		3	2	3	2	2
CO2			2	1			3	2		3					2
CO3		2		1				2	1		3	2	3	2	
CO4			2	1						3		2			
CO5		2		1			3	2	1		3			2	2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	-	-	3

OPEN ELECTIVE I (b)

PRODUCT DESIGN AND DEVELOPMEN STRATEGIES

	Course Objectives: To impart knowledge on
1	To study the basic concepts of product design and development process
2	To study the applicability of product design and development in industrial applications
3	To study the key reasons for design or redesign.

UNIT I

Introduction: Classification/ Specifications of Products -Product life cycle. Product mix - Introduction to product design- Modern product development process- Innovative thinking- Morphology of design.

UNIT II

Conceptual Design: Generation- selection & embodiment of concept- Product architecture. Industrial design: process, need- Robust Design: Taguchi Designs & DOE- Design Optimization.

UNIT III

Design for Mfg & Assembly: Methods of designing for Mfg & Assy- Designs for Maintainability- Designs for Environment- Product costing- Legal factors and social issues- Engg ethics and issues of society related to design of products.

UNIT IV

Value Engineering / Value Analysis. : Definition, Methodology- Case studies- Economic analysis: Qualitative & Quantitative

Ergonomics / Aesthetics: Gross human autonomy- Anthropometry- Man-Machine interaction- Concepts of size and texture, colour . Comfort criteria- Psychological & Physiological considerations.

UNIT V

Creativity Techniques: Creative thinking, conceptualization, brain storming- primary design, drawing, simulation, detail design.

Concurrent Engg - Rapid prototyping - Tools for product design – Drafting / Modeling software- CAM Interface- Patents & IP Acts. Overview, Disclosure preparation.

	Course Outcomes :
CO1	They can able to understand the classification of products, product life cycle and product design.
CO2	Students can able to know the conceptual, Industrial , Robust designs.
CO3	They can able know the Design for Mfg & Assembly and Envoronment, understanding the legal, social factors & Engg. Ethics.
CO4	Students can able to do value and economic analysis importance of Ergonomics
CO5	They can able to use creative techniques in design,uses of concurrent engineering and understanding of Patents & IP Acts.

References:

1. Karl T Ulrich, Steven D Eppinger , " Product Design & Development." Tata McGrawhill New Delhi 2003

2. David G Ullman, "The Mechanical Design Process." McGrawhill Inc Singapore 1992 N J M Roozenberg , J Ekels , N F M Roozenberg " Product Design Fundamentals and Methods ." John Willey & Sons 1995

3. Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development." 1 / e 2004 , Pearson Education New Delhi

4. L D Miles "Value Engineering."

5. Hollins B & Pugh S "Successful Product Design." Butter worths London.

6. Baldwin E N & Neibel B W "Designing for Production." Edwin Homewood Illinois

7. Jones J C "Design Methods." Seeds of Human Futures. John Willey New York.

8. Bralla J G "Handbook of Product Design for Manufacture, McGrawhill NewYork

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2			1	2		3			2		1
CO2		2						2			3				
CO3			3				1			3		2		3	
CO4		2			2			2			3		2		1
CO5				2								2			1

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. - II Semester

L	T	P	C
3	-	-	3

OPEN ELECTIVE I (c)
ALTERNATIVE FUELS FOR I.C. ENGINES

	Course Objectives: To impart knowledge on
1	Qualities of engine fuels,its availability and merits,demerits of various fuels
2	Properties of alchoholic,gaseous fuels and production methods .
3	Properties of vegetable oils and quality .

UNIT-I
Introduction: solid fuels, gases fuels, liquid fuels, chemical structure of petroleum, petroleum refining process, important requisite qualities of engine fuels, SAE rating of fuels.

UNIT-II
FUELS: Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, Producer gas, Bio gas and Vegetable oils - Use in I.C.Engines-Merits and Demerits of various fuels.

UNIT-III
ALCOHOL FUELS: Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle -Reformed alcohols.
Alcohols in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines - Surface ignition engines - Ignition accelerators - Manufacture of alcohol fuels.

UNIT-IV
GASEOUS FUELS: Hydrogen - Properties - Use in C.I Engines - Use in S.I Engines - Storage methods - Safety precautions -Production methods.
Production of Producer gas and bio gas - Raw materials - Gasification - Properties - Cleaning up the gas -Use in S.I. and fuel engines, LPG & Natural gas - Properties - Use in S.I. and C.I. Engines.

UNIT-V
VEGETABLE OILS: Properties - Esterification - Performance in Engines.
FUEL QUALITY: Fuel quality standards for Automotive Engines - Lead free gasolines, low and ultra -low sulphur diesels, LPG, CNG, and Biodiesels.

	Course Outcomes :
CO1	Students able to understand the structure of petroleum and types of fuels
CO2	Able to know the merits and demerits of different fuels uses in I.C Engines
CO3	Analyse the performance of alcoholic fuels in S.I. and C.I.Engines
CO4	Able to know the properties of hydrogen use in S.I and C.I. Engines
CO5	Estimate the performance of vegetable oils in engines and also fuel quality

TEXT BOOKS:

1. Internal combustion engines by V . Ganesan, Tata McGraw Hill book cop. 2007
2. Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications,1997.

REFERENCES:

1. Osamu Hirao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and sons, 1988.
2. Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2				3	2				1	3		3	
CO2			2		1		2				1		3		
CO3	1	2		3	1	3	2		2		1	3	3	3	2
CO4			2			3					1			3	
CO5		2					2		2		1				2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. II-Sem

L	T	P	C
-	1	3	2

ADVANCED COMMUNICATIONS SKILLS LAB (17A65501)

	Course Objectives:
1	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.
2	Further, they would be required to communicate their ideas relevantly and coherently in writing.
3	To prepare all the students for their placements.
4	To initiate them into greater use of the computer in resume preparation, report writing, format making etc.
5	To train them to use language effectively to face interviews, group discussions, public speaking.

UNIT-I: COMMUNICATIVE COMPETENCY

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary for competitive purpose
4. Spotting errors

UNIT-II: TECHNICAL WRITING

1. Report writing
2. Curriculum vitae
3. E-mail writing
4. Abstract & Synopsis Writing
5. Reviewing (Book/Film)

UNIT-III: PRESENTATIONAL SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation
4. Stage dynamics
5. Body Language

UNIT-IV: CORPORATE SKILLS

1. Telephonic skills
2. Net Etiquettes
3. SMART Goal setting
4. Time Management
5. Negotiation Skills

UNIT-V: GETTING READY FOR JOB

1. Group discussions-II
2. Interview skills
3. Answering Strategies
4. Mock Interviews

MINIMUM REQUIREMENT FOR ELCS LAB:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 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:

10. Walden Infotech English Language Communication Skills.
11. Clarity Pronunciation Power – Part I (Sky Pronunciation)
12. Clarity Pronunciation Power – part II
13. LES(Learn English Select) by British council
14. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
15. *DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.*
16. Lingua TOEFL CBT Insider, by Dreamtech

17. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
18. Cambridge Advanced Learners' English Dictionary with CD.

	Course Outcomes:
CO1	Accomplishment of sound vocabulary and its proper use contextually.
CO2	Flair in Writing and felicity in written expression.
CO3	Effective Speaking Abilities for enhanced job prospects.
CO4	Able to use technology to enhance job opportunities.
CO5	Develop language competency and become confident users of English in interviews, Group Discussions, and Public Speaking.

REFERENCE BOOKS:

The software consisting of the prescribed topics elaborated above should be procured and used.

DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

1. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
2. **Train2success.com**

a) **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.

b) **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009.

c) Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/Cambridge University Press.2012.

d) **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.

e) **Practice Psychometric Tests**: How to familiarize yourself with genuine recruitment tests, 2012.

f) **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

g) **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

h) **English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.**

i) **Word Power Made Handy,** Shalini Verma, S Chand Publications, 2011.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2	3		2	3	2		2			3	2	2
CO2		3	2					2	2	2					2
CO3	3			3		2	2	2					3	2	
CO4	3	3	2				2		2	2				2	2
CO5	3	3	2	3		2	2			2			3		2

Method of Evaluation:

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 40 sessional marks and 60 year-end Examination marks. Of the 40 marks, 20 marks shall be awarded for day-to-day work and 20 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

III Year B.Tech. M.E. II-Sem

L	T	P	C
-	-	2	1

DYANAMICS LAB (17A60307)

	Course Objectives:
1.	To supplement the principles learnt in kinematics and Dynamics of Machinery.
2.	To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS

1. Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
2. Determination of Mass moment of inertia of Fly wheel and Axle system.
3. Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
4. Cams – Cam profile drawing, Motion curves and study of jump phenomenon.
5. Determination of torsional natural frequency of single and Double Rotor systems. Undamped and Damped Natural frequencies.
6. Multi degree freedom suspension system – Determination of influence coefficient.
7. Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.
8. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
9. Determination of natural Frequency and verification of Laws of springs
10. Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.

Course Outcome	
1.	Ability to demonstrate the principles of kinematics and dynamics of machinery
2.	Determine the Mass moment of inertia, Range sensitivity.
3.	Drawing of Cam profile, determination of torsional ,undamped and damped natural frequencies.
4.	Determining of influence of coefficient and balancing of rotating ,reciprocating masses.
5.	Verify the laws of springs and forced vibration of cantilever beam.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					2	3			2				1		
CO2	3	2		1	2			3	2		2		1	2	3
CO3					2	3					2		1	2	3
CO4	2	2		1		3		2	1		2			1	3
CO5	1	2		1				1	1					1	

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DEPARTMENT OF MECHANICAL ENGINEERING

Automobile Engineering and R&A/c Lab (17A60308)

III Year B.Tech. M.E. II-Sem

L	T	P	C
-	-	2	1

AUTOMOBILE ENGINEERING LAB

	Course Objectives:
1.	To conduct performance test and emission test on the IC engines.
2.	To prepare the Heat Balance Test on SI and CI Engines.

List Of Experiments

1. Performance and emission test on two wheeler SI engine
2. Performance and emission test on automotive multi-cylinder SI engine
3. Performance and emission test on automotive multi-cylinder CI engine
4. Heat balance test on automotive multi-cylinder SI engine
5. Heat balance test on automotive multi-cylinder CI engine

	Course Outcomes:
CO1	Ability to control the emission and use of different equipments to conduct performance test.
CO2	Ability to perform the test on CI and SI engine using heat balance sheet.
CO3	Students gain the knowledge on various refrigeration systems.
CO4	Ability to calculate the COP of various refrigeration systems.
CO5	Ability to understand and perform test on air-conditioning equipment.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			1				2			3	3	1	
CO2	3		2												2
CO3	3				1					2	2			1	
CO4		2		2		2			2				3		
CO5			2												

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DEPARTMENT OF MECHANICAL ENGINEERING

Automobile Engineering and R&A/c Lab (17A60308)

III Year B.Tech. M.E. II-Sem

L	T	P	C
-	-	2	1

R & AC LAB

	Course Objectives:
1.	To conduct C.O.P test on the V.C.R.S and effective performance ratio of VCR
2.	To Evaluate efficiency of Air – Washer test rig and Cooling Tower.

REFRIGERATION LAB

List of Experiments

1.Determination of cop of water cooler using R-134 as a refrigerent

2. Find out the pull-down characteristics of V.C.R.S.using R-134, Calculation of Ice making

3.Find Electrolux Vapor Absorption Refrigeration system.

4. Determination of c.o.p of VCRS when nozzle is fixed at inlet of evaporator.

5. Determination of c.o.p of VCRS when diffuser is fixed at inlet of condenser

6. .Determination of cop of VCRS using R-134 as a refrigerent

7. Evaporative condensing Test rig .

8. Find out the pull-down characteristics of V.C.R.S ,Ice making of Vapour compression Refrigeration system

AIR –CONDITIONING LAB

List of Experiments

1. Study the Humidification and Dehumidification process
2. Find out the Efficiency of the Air – Washer test rig.
3. Study on Gas charging unit
4. Find out the over –all efficiency of Cooling Tower.
5. Find out the capacity and by – pass factor of the window air conditioning.
6. Study the various processes and by – pass factor by using Air conditioning test Rig.
7. Air-conditioner Trainer (Dust Type)

Refrigeration &Air conditioning Lab

Course Objectives:	
CO1	To determine the COP of the Refrigeration systems.
CO2	Determination of the C.O.P of vapor Absorption Refrigeration system.
CO3	Determination of the cooling capacity and C.O.P. of evaporative condensing test rig.
CO4	Study of evaporators and condensers device.
CO5	Find out the Efficiency of the Air-washer test rig.
CO6	Find out the capacity and by-pass factor of the window air conditioning.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			3					2				3		
CO2		3			2	1					3				
CO3	3		2				2							2	
CO4		3		3		1				2					3
CO5			2		2		2					3	3		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

MECHANICAL ENGINEERING

IV YEAR I SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A70301	CAD /CAM	3	-	-	3
2	17A70302	Finite Element Methods	2	2	-	3
3	17A70303	Instrumentation and Control Systems	3	-	-	3
4	17A70304	Engineering Metrology	3	-	-	3
5	17A70305	**Open Elective***	3	-	-	3
6	17A70306	**Elective – I**	3	-	-	3
7	17A79903	**MOOC-I (Audit)****	-	-	-	-
8	17A70307	CAD/CAM Lab	-	-	2	1
9	17A70308	Instrumentation and Metrology Lab	-	-	2	1
10	17A70309	Computer Aided Engineering Lab	-	-	2	1
11	17A70310	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**17**	**2**	**6**	**22**

Open Elective:
1. **Entrepreneurship**
2. **Rapid Prototyping**
3. **Automation and Robotics**

Elective I:
1. **Design of Experiments**
2. **Advanced Internal Combustion Engineering**
3. **Energy Management**

Note: Project Work shall initiate in IV-I Semester with a target of submission of Abstract and finalization of topic, and the evaluation of project work shall be done in IV-II Semester

*** The student should select the subject in the open elective which is not studied in previous semesters.**

**** The student can select the subject of any discipline for MOOC-I. However the agency will decide by the BoS Chair persons.**

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IV Year B.Tech. M.E. -I Semester

L	T	P	C
3	-	-	3

CAD / CAM (17A70301)

	Course Objectives:
1.	To impart knowledge on the application of computer in the design and manufacturing.
2.	To impart knowledge on graphical entities of CAD/CAM
3.	To impart fundamental knowledge on computer numerical control.
4	To train the student to develop part programmes for simple components.
5	To introduce the philosophy of group technology and its benefits.
6	To introduce the basics of Flexible Manufacturing Systems and integration of Computer Aided Quality Control with Computer Aided Design and Computer Aided Manufacturing.
7	To impart the concepts of Computer Aided Process Planning
8	To introduce the concepts of Computer Integrated Process Planning and trends in manufacturing.

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, clipping, hidden line / surface removal colour, shading.

UNIT -II

Geometric Modelling: 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.

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.

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.

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.

	Course Outcomes: Ability to
CO1	Use suitable graphical entities to design a product
CO2	Use CAD software for solid and surface modeling
CO3	Understand Flexible Manufacturing Systems and integrate various inspection methods with Computer Aided Design and Computer Aided Manufacturing
CO4	Implement suitable Computer Aided Process Planning and other sub-systems for a customized setup.
CO5	Understand about the concepts to develop an integrated production planning systems and the concepts of manufacturing systems.
CO6	Understand Flexible Manufacturing Systems and integrate various inspection methods with Computer Aided Design and Computer Aided Manufacturing
CO7	Implement suitable Computer Aided Process Planning and other sub-systems for a customized setup.
CO8	Understand about the concepts to develop an integrated production planning systems and the concepts of 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

References:

1. Automated Production Systems and CIM by P.Groover Pearson Education, Limited.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	3	3		3					3	2	2		3		
CO3	2	3	2					2	1		2			3	
CO4	1	3	2	1					1			3		3	
CO5	1				2									3	
CO6	1				2			2	1	1	2	1		3	
CO7	1		1		2			1	2	1	1	2	3		
CO8	1		1		1			1	3	2		1			

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IV Year B.Tech. M.E. -I Semester

L	T	P	C
2	2	-	3

FINITE ELEMENT METHODS (17A70302)

Course Objectives: To impart knowledge on	
C4 05.1	Students understand the concepts, and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
C4 05.2	Students evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
C4 05.3	Students develop polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and iso parametric elements.
C4 05.4	Students solve the problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
C4 05.5	Students apply the knowledge to solve problems on steady state heat flow and fluid flow problems inID &2D

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.

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.

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.

UNIT -IV

Finite Element Application In Solid Mechanics: Problem modelling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso-parametric, sub-parametric and super-parametric 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.

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 function formulation.

Course Outcomes : After the completion of the course, the student will be	
CO1	Familiar with the concepts, principles and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
CO2	Able to evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
CO3	Able to write polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and isoparametric elements.
CO4	Familiar with triangular and quadrilateral elements and solve problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
CO5	Able to solve problems on steady state heat flow and fluid flow problems inID &2D

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

References:

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, New Delhi.
6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3				1		2				3	
CO2	3		2		3				2		3	2			1
CO3		2		3									2	3	
CO4	3								2	2					1
CO5		2	2									2	2		

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IV Year B.Tech. M.E. -I Semester

L	T	P	C
3	-	-	3

INSTRUMENTATION AND CONTROL SYSTEMS (17A70303)

	Course Objectives: To impart knowledge on
1	Measurement techniques for measuring process parameters in industry and in research.
2	Knowledge in measuring parameters like speed, position, velocity, pressure, force, torque, temperature etc.

UNIT-I

Definition - Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of error.
Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT-II

Measurement of Temperature: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators.
Measurement of Pressure: Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. Conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.

UNIT - III

Measurement Of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .
Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

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.

UNIT -IV

Measurement Of Level: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

Measurement Of Humidity - Moisture content in the gases, sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT - V

Measurement Of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements Of Control Systems: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems

	Course Outcomes):
CO1	Understand the basic principles and performance characteristics of measurement.
CO2	Apply the basic principles to measure the temperature, pressure with the help of Thermocouple and different pressure gauges
CO3	Student can able to measure Speed, Acceleration and Vibration with the help of various instruments
CO4	Student can able to understand the measurement of Fuel level, measurement of Flow and Humidity, Measure the parameters like Force, Torque, Power and also understand the basic principles, and applications of various control systems
CO5	After completion of the course the student can select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and performance.

TEXT BOOKS:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhaneshl TMH
2. Mechanical Measurements *I* Beckwith, Marangoni, Linehard, Phi/ PE

REFERENCES:

1. Instrumentation, measurement & analysis by B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design by D.S Kumar.
3. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
4. Mechanical and Industrial Measurements / R.K. *Jain/*Khanna Publishers.
5. Instrumentation & mech. Measurements by AK. Tayal ,Galgotia Publications
6. Mechanical Measurements /Sawhani

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3			2				1		2	2		1
CO2	2			2	3			1			2			3	
CO3		2				2				1		2	2		1
CO4				2				1			2			3	
CO5		2								1					1

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IV Year B.Tech. M.E. - I Semester

L	T	P	C
3	-	-	3

ENGINEERING METROLOGY (17A70304)

	Course Objectives:
1	To introduce the science of measurement and measuring machines commonly used.
2	To impart knowledge about limits, fits and tolerances, geometric dimensioning aspects
3	To introduce the methods of acceptance test for conventional machine tools.
4	To familiarize students with the concepts of Laser metrology and surface roughness.

UNIT- I

Limits, Fits and Tolerances: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – inter-changeability 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.

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.

UNIT –III

Surface Roughness Measurement: 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 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.

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.

UNIT-V

Measurement 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.

Course Outcomes : At the end of the course students will be able to	
CO1	Know different techniques to measure temperature, pressure, sound, force, torque and power
CO2	Use instruments for linear, angular and flatness measurement
CO3	To analys appropriate method and instruments for inspection of various elements of surface roughness, surface finish, gears and threads and the quality of the machine tool with alignment test can also be evaluated by them
CO4	Build sound knowledge about various transducers working and its applications for various measurements such as displacement, speed, stress-strain, acceleration and vibration.
CO5	Design tolerances and fits for selected product quality and able to measure the parts with various comparators

Text Books:

(1) Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE

(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.

References:

(1) Engineering Metrology, Mahajan, Dhanpat Rai, 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, Mc GrawHill, 2013.

(5) Instrumentation, measurement &analysis ,B.C.Nakra & K K Choudhary, TMH, 6th edition, 2011.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2	1				3	1	2	3		3
CO2		3		3					1					2	
CO3		3	2			1				2		3			3
CO4	3				2				1		1	1	3	3	
CO5			3							1				1	

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IV Year B.Tech. M.E. –I Semester

L	T	P	C
3	-	-	3

(Open Elective)

ENTREPRENEURSHIP (17A70305)

Course Objectives:	
1	To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively

UNIT -I:
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. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.

UNIT- II:
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.

UNIT- IV:
New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Choosing location and layout, Issues related to Selection of layout.

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. Global aspects of Entrepreneurship.

Course Outcomes :	
CO1	Students can able to know the importance of entrepreneurship in economic developments, ethics and its social responsibility
CO2	They can understand the business plan its scope, implementation in marketing and launching.
CO3	They can able to know the finance resources, motivating, marketing and internet advertising
CO4	Students can understand the problems related to selection of layout.
CO5	They can know the production techniques, inventory and quality control in global aspects

Text Books:

2. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 5th Edition
3. Dollinger: Entrepreneurship,4/e, Pearson, 2004.

References:

1. Vasant Desai: Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Robert J.Calvin: Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola: The Entrepreneurial Connection, TMH, 2001.
5. Bolton & Thompson: Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal :Indian Economy, Wishwa Prakashan 2005.
7. Dutt & Sundaram: Indian Economy. S. Chand, 2005.
8. Srivastava: Industrial Relations & Labour Laws, Vikas, 2005.
9. Aruna Kaulgud: Entrepreneurship Management by. Vikas publishing house, 2003.
10. Thomas W. Zimmerer & Norman M. Scarborough: Essential of Entrepreneurship and small business management, PHI, 4/e, 2005.
11. Mary Coulter: Entrepreneurship in Action, PHI, 2/e, 2005.
12. Kaplan: Patterns of Entrepreneurship, Willey, 2005.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1						2			1		1			1
CO2			1		2		2		2			1	2		1
CO3		2		3				3		1	2				
CO4	1		1			1								3	
CO5		2				1	2				2				

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DEPARTMENT OF MECHANICAL ENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
3	-	-	3

(Open Elective)

RAPID PROTOTYPING (17A70305)

	Course Objectives: Impart knowledge on
1	Product development using rapid prototyping processes
2	Rapid prototyping processes

UNIT-I

Introduction: Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Application.
Selective Laser Sintering: Type of machine, Principle of operation, Process parameters, Data preparation for SLS, Applications.

UNIT-II

Fusion Deposition Modelling: Principle, Process parameter,Path generation, Application
Solid Ground Curing: Principle of operation, Machine details, Applications.

UNIT-III

Laminated Object Manufacturing: Principle Of Operation, LOM materials.
Process details, application.
Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, Object Quadra systems.

UNIT-IV

Laser Engineering Net Shaping (Lens)
Rapid Tooling: Indirect Rapid tooling -Silicon rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

UNIT-V

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

Allied Processes: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification-data transfer to solid models.

Course Outcomes :	
CO1	They can study the history, survey and growth of rp and stereo lithograthy systems.
CO2	Understand the fusion deposition modelling and solid ground curing.
CO3	Students can learn about the LOM materials and concepts modelers
CO4	They can understand the importance of rapid tooling.
CO5	They can able to optimize the rapid manufacturing process and allied processes.

TEXT BOOKS:

1. Rapid Prototyping and Tooling by Hari Prasad & K.S. Badhrinarayan/ Page Turners
2. Paul F. Jacobs- "**Stereo lithography and other RP & M Technologies**", SME, NY 1996.
3. Flham D.T & Dinjoy S.S - "**Rapid Manufacturing**" Verlog London 2001.
4. Lament wood, "**Rapid automated",** Indus press New York

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2		3										
CO2	1					2		2		1	2		2		2
CO3		3		1		2			1			3		3	
CO4	1		2		3		3				2	3			
CO5										1				3	

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(Open Elective)

AUTOMATION & ROBOTICS (17A70305)

	Course Objectives: To impart knowledge on
1	Basic principles of automation, tool transfer and implementation of automated flow line
2	Design aspects and analysis of material handling system
3	ways of improving line balance and solving line balancing problems
4	Components, sensing elements used programming techniques and Applications of robots.
5	Fundamentals of Robotics and primary actuating systems, sensors and transducers.

. **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.

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.

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.

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.

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.

Course Outcomes: Ability to	
CO1	Implement the concepts of a productive system in automation
CO2	Apply the knowledge of automated flow lines for industrial and other applications.
CO3	Design and analysis of material handling systems for automated assembly lines.
CO4	Balance automated assembly lines.
CO5	Design and develop Robot with basic drivers and controllers. select suitable Sensors and transducers for real life or industrial problems.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.

References:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3		1				3		1		1		1	
CO2	1				3		3		1		1	1			3
CO3			3						1					1	
CO4		3		1		1					1		3		3
CO5			3		3	1	3	3		1			3		

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Elective – I (a)

DESIGN OF EXPERIMENTS (17A70306)

	Course Objectives:
1	In this course students will be exposed to theories and methodologies in design and analysis of experiments and get hands on experience by applying various techniques on examples/data in industries and scientific researches.

UNIT -I

Introduction to experimental design principles, simple comparative experiments, introduction to R language and its applications in DOE problems.

UNIT- II

Single factor experiments, randomized blocks, Latin square designs and extensions, introduction to R language. Introduction to factorial designs, two levels, 2k factorial designs, confounding and blocking in factorial designs, applications to manufacturing problems.

UNIT- III

Fractional factorial designs, two-level, three-level and mixed-level factorials and fractional factorials, applications to quality control problems. Regression models including multiple regression models and its application to transportation scheduling problems.

UNIT -IV

Response surface methodology, parameter optimization, robust parameter design and its application to control of processes with high variability. Random and mixed effects models, nested and split plot and strip plot designs and its application to semiconductor manufacturing problem.

UNIT- V

Repeated measures design, analysis of covariance and its applications in comparing alternatives. Design of computer experiments and the applications in industrial engineering problems.

Course Outcomes : On successful completion of this course units students will be able to	
CO1	Understand the issues and principles of design of experiments (DOE) and construct optimal or good designs for a range of practical experiments.
CO2	Acquires knowledge on full factorial designs, 2k factorial designs, blocking and confounding in 2k factorial design.
CO3	Possess the knowledge of analysis of second order response and multiple responses
CO4	Obtain an in-depth knowledge of crossed array design, combined array design.
CO5	acquires the knowledge in experimentation process and can list out the guidelines for designing the experiments and recognizing the data analysis and computing program languages in design of experiment (DOE).

Text books:

1. Montgomery, D. C., 2005, Design and Analysis of Experiments, 6th Edition, John Wiley and Sons.
2. Box, G. E. P., Hunter, J.S., and Hunter, W. G., 2005, Statistics For Experiments, 2nd Edition,
3. John Wiley and Sons. Hicks, C. R., and Turner, K.V., 1999, Fundamental Concepts in The Design of Experiments, 5th Edition, Oxford University Press.

References:

4. Myers, R. H., and Montgomery, D. C., 2002, Response Surface Methodology: Process and Product Optimization Using Designed Experiments, 2nd Edition, John Wiley and Sons.
5. Anderson & McLean, 1984, Design of Experiments, a Realistic Approach. Marcel Dekker.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			2		1				1		2			1
CO2		1		2		1			3		2	2		1	
CO3			2		3		2		3				3	1	
CO4										1					
CO5		1						3			2				

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3	-	-	3

Elective-1(b)

Advanced Internal Combustion Engineering (17A70306)

	Course Objectives
1	To update the knowledge in engine exhaust emission control and alternate fuels.
2	To enable the students to understand the recent developments in IC Engines.

UNIT-I
Spark Ignition Engines:
Air-fuel ratio requirements, Design of carburetor –fuel jet size and venture size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

UNIT-II
Compression Ignition Engines:
Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNIT-III
Engine Exhaust Emission Control:
Formation of NOX , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOX ,) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms.

UNIT-IV

Alternate Fuels: Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas , Liquefied Petroleum gas, Hydrogen , Properties , Suitability, Engine Modifications, Performance , Combustion and emission Characteristics of SI and CI Engines using these alternate fuels.

UNIT-V

Recent Trends: Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

Course Outcomes : Ability to	
CO1	Students can know the requirements of Air –Fuel ratio, design parameters of carburetor, fuel jet, venture size and factors affecting knock, combustion chambers.
CO2	Analyze performance of SI and CI Engines
CO3	Recognize emission control norms.
CO4	Use alternate fuels in IC engines.
CO5	They can able to know the Recent Developments in Different type of engines.

Text Books:

1. Heinz Heisler,'Advanced Engine Technology," SAE International Publications, USA,1998

2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill ,2007

REFERENCES:

1. John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill 1988

2. Patterson D.J. and Henein N.A,"Emissions from combustion engines and their control," Ann Arbor Science publishers Inc, USA, 1978

3. Gupta H.N, "Fundamentals of Internal Combustion Engines" ,Prentice Hall of India,2006

4. Ultrich Adler ," Automotive Electric / Electronic Systems, Published by Robert Bosh GmbH,1995

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1	2		1	2					2		3
CO2			2	1			1		2	3		1	2		
CO3	1	3			2	3		2	2			1		2	
CO4											2				
CO5															

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3	-	-	3

Elective – I(c)
ENERGY MANAGEMENT (17A70306)

	Course Objectives: To impart knowledge on
CO1	Energy auditing in engineering and process industry
CO2	Energy conservation.

UNIT - I
Engineering Economics:
Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest-Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II
Depreciation & Cost Analysis:
Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III
Project Management:
Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.
Energy Management Programs: Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in

manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT – IV

Energy Auditing: Definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

Energy Policy, Supply, Trade& Prices:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

Course Outcomes (COs): Ability to	
CO1	Objectives of management, different costs, money value
CO2	Evaluate the depreciation and cost analysis.
CO3	Apply the principles energy management for conservation.
CO4	Describe the energy rate structures.
CO5	Discussion of energy policies, prices and its trading

Text Books:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

Reference Books:

1. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
2. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
3. The role of Energy Manager, E.E.O., U.K.
4. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1				2							2	
CO2	2		1		3		2		3		3			2	
CO3		3		2		1		1		2		2	1		3
CO4	2							1					1	2	
CO5				2		1				2					3

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IV Year B.Tech. M.E. - I Semester

L	T	P	C
-	-	2	1

CAD / CAM LAB (17A70307)

	Course Objectives: To impart the knowledge on the
1	Usage of computer in design and Manufacturing.
2	Visualization of objects in three dimensions and producing orthographic views, sectional views and auxiliary views of it.

List of Experiments:

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.
2. **Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.
3. **Assembly modeling:** Feature based and Boolean based modeling surfaces, Assembly Modeling of simple components and Design of simple components.
4. CAM**:**
   a) Study of various post processors used in NC Machines.
   b) Development of NC code for free form and sculptured surfaces using CAM packages.
   c) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages.

Through Any Four Software Packages from the following: Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, , CAEFEM, Gibbs CAM, Master CAM etc,.

Course Outcomes : At the end of the course students will be able to	
CO1	Use the coordinate systems for the concerned drawings.
CO2	Construct 2-D sketches, interpret the dimensions and the associated annotations in CAD environment
CO3	Construct 2-D sketches for intersections of solids using CAD packages.
CO4	Create solid models of various objects and machine parts
CO5	Construct 3-D modeling by extrusion process using various CAD packages.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2				2					3	
CO2		3		3				3					2		3
CO3	3				3				2					3	
CO4		2		3				3					2		2
CO5		1			1				2				2		1

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IV Year B.Tech. M.E. I-Sem

L	T	P	C
-	-	2	1

INSTRUMENTATION & METROLOGY LAB (17A70308)

	Course Objectives: To impart knowledge on
1	Working principles of linear and angular measuring instruments
2	Measurement of linear and angular dimensions of a typical work piece specimen using the measuring instruments
3	Methods of form measurements

Section A

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Calibration of strain guage for temperature measurement
5. Calibration of thermocouple for temperature measurement
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed
8. Calibration of resistance temperature detector for temperature measurement

Section B

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

Course Outcomes (COs): Upon successful completion of the labs associated with this theoretical course students will be able to	
CO1	Demonstrate knowledge and understanding of instruments as well as the operating principles of measuring instruments
CO2	Force measurement using strain gauge.
CO3	Measurement of displacement by using light Dependent Resistor
CO4	Measurement of Speed with the help of Transducer
CO5	Calibration of Temperature and unknown weight by using Thermocouple and Load cell respectively.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			3					3		3		2		
CO2			3					3		3		3		1	2
CO3	2			2									3		2
CO4			3						3		3			1	
CO5	2			1				3		3		3	1		

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IV Year B.Tech. M.E. I-Sem

L	T	P	C
-	-	2	1

COMPUTER AIDED ENGINEERING LAB (CAE LAB) (17A70309)

	Course objectives: To impart knowledge on
1	Fundamental knowledge on using software tools like ANSYS, FLUENT, etc., for Engineering Simulation
2	Knowledge on how these tools are used in Industries for solving real time problems
3	Understanding about various fields of engineering where these tools can be effectively used to improve the output of a product.

I. Introduction to Analysis Software Package

II. Structural analysis: (Any four exercises)
1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)
1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any two exercises)

1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated find within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem (in an infinitely long concentric cylinders).
7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

Software can be used: ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

Course Outcomes : At the end of the course students will be able to	
CO1	Acquire knowledge on structural analysis using analysis software packages.
CO2	Acquire knowledge on thermal analysis using analysis software packages.
CO3	Acquire knowledge on fluid flow analysis using analysis software packages.
CO4	Illustrate the utility of the software tools such as ANSYS, CFD etc; in solving real time problems

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3			2			2	3			2	3	
CO2	3	2			3				2					3	2
CO3		2	3		3	2				3			2		2
CO4	3		3		3				2				2	3	
CO5	3	2				2			2	3			2		2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

COURSE STRUCTURE OF

MECHANICAL ENGINEERING

IV YEAR II SEMESTER

S.No.	Code	Subject	L	T	P	C
1	17A80301	**Elective – I**	3	-	-	3
2	17A80302	**Elective – II**	3	-	-	3
3	17A80303	**Elective – III**	3	-	-	3
4	17A80304	**Elective – IV**	3	-	-	3
5	17A89903	**MOOC-II(Audit)*** **	-	-	-	-
6	17A80305	**Seminar**	-	-	2	1
7	17A80306	**Project Work**	-	-	16	8
8	17A80307	**Comprehensive Objective type Examination**	-	-	-	1
		Total	**12**	**-**	**18**	**22**

***** The student should select the subject of discipline centric for MOOC-II. However the agency will decide by the BoS Chair persons.**

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lectures T- Tutorial P – Practical/Drawing C – Credits

Elective I:
1. Production and Operations Management
2. Turbomachinery
3. Quality Concepts in Design

Elective II:
1. Non Conventional Sources of Energy
2. Solar Refrigeration and Air Conditioning
3. Advanced Mechanical Vibrations

Elective III:
1. Total Quality Management
2. Mechatronics
3. Tribology

Elective IV:
1. Modern Manufacturing Methods
2. Design of Heat Transfer Equipments
3. Gas Dynamics

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IV Year B.Tech.M.E. II Semester

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3	-	-	3

Elective-I (a)
PRODUCTION & OPERATIONS MANAGEMENT (17A80301)

Course Objectives: To impart knowledge on	
C4 06.1	To increase understanding of the problems and opportunities faced by the operations manager in manufacturing and service operations.
C4 06.2	To develop an ability to apply operations management concepts in a variety of settings.
C4 06.3	To develop an understanding of operations management techniques in order to be able to evaluate recommendations made by technical specialist in the field.
C4 06.4	Identify operational methodologies to asses and improve the organizations performance
C4 06.5	Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations.

UNIT – I

Functions of production planning & controls operations & productivity, productivity measurement, goods and services, Design of goods and services: selection, generating new products, product development, issues in product design.

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.

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, computerised layout: ALDEP, CRAFT, CORELAP.

UNIT – IV

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

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.

UNIT – V

Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.
MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).
Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-
Elements of total quality management, Six Sigma Quality Control.

	Course Outcomes:
CO1	Understand and appreciation of principles, and applications related to planning, design and operations of manufacturing/service firm.
CO2	Identify different types of forecasting and different forecasting techniques, and use them for various firm forecast
CO3	Implement mathematical model for facilities, location, and utilize the computerized layouts and also able to distinguish between process layout, product layout
CO4	Identify operational methodologies to asses and improve the organizations performance
CO5	Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations.

TEXT BOOKS:

1. Modern Production / Operations Management by Baffa & Rakesh Sarin, Wiley, 1987
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation Management by Adam & Ebert- PHI Pub.,

REFERENCES:

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		1		1	2		3		1		3	
CO2		3		2		1		3	1		1		3		
CO3	3				1		1			2		1		3	
CO4		2	3	2		1		1		1	1		3		
CO5	3	1			1		1		1			1			

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Elective-I (b)

TURBO MACHINERY (17A80301)

	Course Objectives: To impart knowledge on
1	Classification of turbo machines.
2	Types of pump, compressor, fan, and turbine.
3	Efficiencies and performance of turbo machines.

UNIT – I:
Fundamentals of Turbo machines: Classification, Applications Thermodynamic analysis; Isentropic flow, Energy transfer; Efficiencies; static and Stagnation conditions; continuity equation; Euler's flow through variable cross sectional area; unsteady flow in turbo machines.

UNIT –II:
Steam Nozzles: Effect of back – pressure on the analysis; Design of nozzles.
Steam Turbines of C & C –D nozzles : Impulse Turbines: work done and velocity triangles; Efficiencies; Constant Reaction Blading; Design of blade passages, angles and height; Secondary flow; leakage losses; Thermodynamic analysis of steam turbines.

UNIT – III:
Gas Dynamics: Fundamentals thermodynamic concepts; Isentropic conditions; Mach number and Area – Velocity relation; Dynamic pressure; normal shock relations for perfect gas; supersonic flow, oblique shock waves ; normal shock recovery ; detached shocks ; Aerofoil theory.
Centrifugal Compressor: Types; Velocity triangles and efficiencies; Blade passage design; Diffuser and pressure recovery; slip factor; stanitz and stodolas formulae; Effect of inlet mach number; Prewirl; performance.

UNIT – IV:
Axial Flow Compressors: Flow analysis, work and velocity triangles ; Efficiencies; Thermodynamic analysis; stage pressure rise ; Degree of reaction ; stage loading ; general design, effect of velocity incidence ; performance.
Cascade Analysis: Geometry and Terminology; Blade forces, Efficiency; losses; free and forced vortex blades.

UNIT – V:

Axial Flow Gas Turbines: Work done; velocity triangles and efficiencies; thermodynamic flow analysis; degree of reaction; Zweifels relation; Design cascade analysis – Soderberg – Hawthrone – ainley-correlations; secondary flow; Free-vortex blades; Blade angles for variable degree of reaction; Actuator disc theory; stresses in blades; Blade assembling; materials and cooling of blades; performance; Matching of compressor and turbine; off-design performance.

Course Outcomes:	
CO1	Basic understanding of fluid flow and thermodynamics in association with turbomachinery
CO2	Design of nozzles,flow,flow features,pressure variation
CO3	Isentropic flow with area variations,normal shock concept, relations, numerical problems.
CO4	Types, surging, slip factor,velocity triangles and efficiences of centrifugal compressor. Design of axial flow gas turbines, performance
CO5	Flow analysis, design and performance of axial flow compressors. Elementary cascade theory, blade forces and efficiency.

REFERENCES:

1) Fundamentals of Turbo machines – Shephard
2) Practise on Turbomachines – G. Gopalakrishnan & D. Prithviraj, SciTech Publishers, Chennai.
3) Theory and practice of steam turbines – Kearton
4) Gas Turbines – Theory and practice – Zucrow
5) Elements of Gas Dynamics – Liepman and Roshkow
6) Elements of Gas Dynamics – Yahya
7) Turbines, Pumps, Compressors – Yahya
8) Axial Flow Compressors – Horlock.
9) Gas Turbines- Cohen, Roger & Sarvanamuttu

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3	1		1		2						3	
CO2		3			3		1		2				3		
CO3	3		2	1		1		2							
CO4		3			3		1		2					3	
CO5			1	1		1		2					3		

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Elective-I (c)

QUALITY CONCEPTS IN DESIGN (17A80301)

	Course Objectives: To impart knowledge on
1	To impart knowledge on various concepts in engineering design and principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis and various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

UNIT -I

DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION

Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging,Metal Forming, Machining and Welding

UNIT -II

DESIGN FOR QUALITY

Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT -III

FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA 9 Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist-Advanced methods: systems modeling, mechanical embodiment principles-FMEA method-linking fault states to systems modeling - Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services.

UNIT -IV

DESIGN OF EXPERIMENTS

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2 K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios.

UNIT-V

STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution.

Course Outcomes :	At the end of the course students will be able to
CO1	Acquire knowledge in various quality concepts and principles while developing products or services
CO2	Evolve solutions by conducting experiments and to apply the QFD for various applications
CO3	Apply FMEA and Six Sigma Concepts in the industrial applications.
CO4	Acquire knowledge in analyzing the data while solving the problems through various techniques such as ANOVA, Taguchi etc.
CO5	Use SPC tools in industries and to improve the reliability of the system

REFERENCES:

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
3. Product Design And Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGRAW-HILL- 3 rd Edition, 2003.
4. The Management and control of Quality-6 th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com).
5. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.
6. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
7. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1	2				1	2				3		
CO2		3			3					2				3	
CO3	2			3				1	3				3		
CO4	1	3	1		3					2				3	
CO5		3		1				1	1						

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Elective-II (a)

NON-CONVENTIONAL SOURCES OF ENERGY (17A80302)

	Course Objectives: To impart knowledge on
1	To impart the knowledge of basics of different non conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.

UNIT – I
SOLAR ENERGY:
Availability of solar energy, Measurement of sunshine, solar radiation data, estimation of average solar radiation, the black body, absorptance and emittance, Kirchoff's law. Reflection from surfaces, Solar energy selection, selective surfaces, Construction of solar flat plate and evacuated tube collectors, Performance of solar energy collectors, Solar heating and cooling.

UNIT – II
WIND ENERGY:
Wind mills and wind turbine systems, Classification of wind machines: Horizontal & Vertical axis configuration. High and low solidity rotors, Elements of wind mills and wind turbine systems, Aerodynamic models, Rankine Froud Actuator disc model, Betz limit, angular momentum wake rotation theory, Aerofoil sections and their characteristics, Estimation of power output and energy production.

UNIT – III
OCEAN THERMAL ENERGY:
Ocean thermal energy sources, Ocean thermal energy power plant development, Closed and open cycles. Advantages and operating difficulties.

TIDAL & WAVE ENERGY

Tidal power sources, Conventional and latest design of tidal power system, The ocean wave, Oscillating water column (Japanese) and the Dam, Atol design.

UNIT – IV

GEOTHERMAL ENERGY :

Earth as source of heat energy, stored heat and renewability of earth's heat, Nature and occurrence of geo thermal field, Classification of thermal fields, Model of Hyper thermal fields & Semi thermal fields, drilling hot water measurements.

UNIT – V

FUEL CELL ENERGY:

Description, properties and operation of fuel cells, Major components & general characteristics of fuel cells, Indirect methanol fuel cell systems. Phosphoric acid fuel cell systems and molten carbonate fuel cell systems.

BIOMASS ENERGY:

Types of conversion techniques for the production of solid, liquid and gaseous fuels by chemical and biochemical methods, and Biomass gasifiers- Selection of a model and size, Technical, Climatic, geographical and economic issues.

Course Outcomes (COs): At the end of the course students will be able to	
CO1	Availability of solar energy, its measurement and performance.
CO2	They know the importance of wind energy and types of wind machines and its output.
CO3	Understand the different non conventional sources and the power generation techniques to generate electricity like ocean and tidal.
CO4	They can know the energy resources of earth
CO5	Properties ,Operation of different types of fuel cells and techniques for the production of solid liquid and gaseous fuels.

REFERENCES:

1. Principles of Solar Engineering: F.Kreith&J.F.Krieder/Mc.Graw Hill Book Co
2. Wind Energy conversion Systems: L.C.Freris, Prentice Hall, Inc..
3. Non-conventional Energy Sources: G.D. Rai
4. Energy Technology: S. Rao & B.B. Parulekar
5. Geo thermal energy: H.Christopher&H.Armstead.
6. Photo Voltaic Energy Systems, Design&Applications: Mathew Buresch, Mc Graw Hill Book Co..
7. Bio Gas Technology, A Practical Hand Book: K.C.Khendelwal&S.S.Mahdi Mc Graw Hill Book Co..
8. Hand Book of Batteries and Fuel cells: David Linden, Mc Graw Hill Book Co..
9. Energy Conversion Systems: H.A.Sorenson: John Wiely & S.jons
10. Renewable Energy Sources & Conversion technology: Bansal.K: Leemann&Meliss
11. Energy technology Hand Book: EdD.M.Considine
12. Principles of energy conversion AW.Culp

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1					1	2	1	1		2	
CO2			3		3					3	2		3		3
CO3	2	3							1			1		3	
CO4	1		2	1						1	3		3		3
CO5		1	1		3				1			1		1	

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Elective-II (b)

L	T	P	C
3	-	-	3

SOLAR REFRIGERATION AND AIR CONDITIONING (17A80302)

	Course Objectives: To impart knowledge on
1	To enable the students to calculate the cooling load for different applications of refrigeration and air-conditioning
2	To impact the knowledge on principles of psychrometry.
3	To develop the knowledge of students in utilizing solar energy for the design and application of refrigeration and air-conditioning

UNIT - I
Review of Psychometric and (Air-conditioning) cooling load calculations-outline of Vapour Compression Refrigeration Systems – Cycle on p-h and T-o charts – C.O.P – Simple problems using property tables.

UNIT - II
Principle of working of vapour Absorption Refrigeration, steam jet refrigeration, thermoelectric refrigeration – classification of refrigerants – Desirable properties of ideal refrigerant - Properties of solvent - Solvent refrigerant combination properties.

UNIT - III
Solar cooling systems: vapour compression systems, Rankine cycle, Striling cycle, using P.V.Modules. Solar operated vapour absorption systems – vapour jet refrigeration systems.

UNIT - IV
Solar thermal energy storage - Active and passive systems TROMBE wall – equivalent thermal circuit - Solar green houses.
Solar cooling and dehumidification: Desiccant cooling - Solid and liquid desiccants - improving desiccant cycles - hybrid systems.

UNIT - V

Non –mechanical systems - Australian Rock system – Solar assisted Heat Pump – Economics of solar cooling systems.

Simulation of solar thermal systems - Salient features of DYNSYS, TRNSYS – model formulation – flow diagram of cooling systems.

	Course Outcomes (COs): At the end of the course students will be able to
CO1	Be apply the knowledge of psychrometry in cooling load calculations
CO2	Be able to understand about vapour compression refrigeration systems and its performance by using various parameters.
CO3	Be able to understand about various absorption systems and steam jet refrigeration
CO4	Posses the knowledge of different solar cooling systems and Able to understand different types of solar thermal energy storages
CO5	Design and demonstrate the ability to evaluate and simulation of solar thermal system and solar heat pump.

REFERENCES:

1. A course in Refrigeration & Air –conditioning, S.Domakundwar & S.C.Arora
2. Principles of Solar engineering, F.Kreith &J.F.Kreider, Mc Graw Hill Book company
3. Solar Cooling & Heating Volumes, I,II,III., T.Negat Vezirogulu
4. Entrepreneurship Development in New & Renewable Energy Technologies APPC & IREDA

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		2	3				1				3	2	3
CO2	3		3			1					1			3	
CO3		3			3				1						
CO4	3		2	2		1					1		3		
CO5		1	1											1	3

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Elective-II (c)
ADVANCED MECHANICAL VIBRATIONS (17A80302)

L	T	P	C
3	-	-	3

Course Objectives: To impart knowledge on	
1	Formulating mathematical model for vibration problems.
2	Skills in analyzing the vibration behavior of mechanical systems subjected to loading
3	Vibration control and the equipment used for collecting response data.

UNIT -I

Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

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.

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.

UNIT- III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

UNIT -IV

Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

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.

Course Outcomes : At the end of the course students will be able to	
CO1	Familiar with basics of vibrations and able to formulate equations for free vibrations for SDOF with and without damping.
CO2	Familiar with the concepts of forced vibrations and the seismic instruments, accelerometers andvibrometers with the problems involved.
CO3	Able to formulate equations for 2DOF and evaluate the modes of vibration.
CO4	Able to frame and solve the equations for MDOF using various numerical iterative methods.
CO5	Familiar with the concepts of vibrations of continuous systems and whirling of shafts.

Text Books:

1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.
2. Vibration of Mechanical System, C. Nataraj, Cenage Learning, 1st edition, 2012.

References:

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,
4. Mechanical Vibrations, Singresu S. Rao, Pearson Education, New Delhi.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2	1				3	1	2	3		3
CO2		3		3					1					2	
CO3			2			1				2		3			3
CO4	3				2				1		1	1	3	3	
CO5		3	2							1				1	

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Elective-III (a)
TOTAL QUALITY MANAGEMENT (17A80303)

Course Objectives: To impart knowledge on	
1	To facilitate the understanding of Quality Management principles and process.

UNIT- I
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT- II
TQM PRINCIPLES
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT -III
TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT -IV
TQM TOOLS AND TECHNIQUES II
Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT- V
QUALITY SYSTEMS
Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing -QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

Course Outcomes (COs): At the end of the course students will be able to	
CO1	Students understand the importance of the quality, costs of quality, and Basics concepts of quality
CO2	Able to know the TQM principles, employee involvement, team spirit and PDCA cycle.
CO3	They can able to understand the management tools like Six Sigma, Bench Marking.
CO4	Able to know TQM tools like control charts , QFD, Taguchi loss function and TPM.
CO5	The student would be able to apply the tools and techniques of quality management to manufacturing and services processes

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th
2. Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2				3	3	2	2		3	3		3
CO2		2		3		2								2	
CO3			2				3		2			3	3		
CO4	3	2		3				3					3	2	
CO5			2			2				2		3			3

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Elective-III (b)

MECHATRONICS (17A80303)

	Course Objectives: To impart knowledge on
1	To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT-I

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.

UNIT-II

8085 MICROPROCESSOR AND 8051 MICROCONTROLLER

Introduction – Architecture of 8085– Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT-III

PROGRAMMABLE PERIPHERAL INTERFACE

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT- IV

PROGRAMMABLE LOGIC CONTROLLER

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT-V

ACTUATORS AND MECHATRONIC SYSTEM DESIGN

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

Course Outcomes : At the end of the course students will be able to	
CO1	Students can able to understand the concepts,need and importance of mechatronics.
CO2	They can able to know the concepts of 8085 microprocessor, 8051 microcontroller
CO3	They can able to understand the Programmable peripheral Interface
CO4	Students can able to know the structure, programming and selection of PLC
CO5	They can able to know the working principle and design concepts of actuators, mechatronic system.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008 2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2		2	3		2				3			3	3		
CO3					2					3		3	2	3	
CO4				2										2	
CO5			3			2						3	1	1	2

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L	T	P	C
3	-	-	3

Elective-III (c)

TRIBOLOGY (17A80303)

Course Objectives: To impart knowledge on	
1	To introduce tribology as an important design consideration that affects the performance of engine and automotive elements.
2	To teach different bearing types, modeling and performance considerations.
3	To introduce concepts in friction and wear phenomena.

UNIT-I
Engineering Surfaces Topography of Engineering Surfaces – Surface parameters- Geometric – Statistical parameters – Measurements - Surface contact - Types of contact – Hert'z theory of elastic contact. Surface modification - Transformation hardening - Thermo-chemical process - Laser - Electron beams and Plasma treatment.

UNIT-II
Friction and wear Friction – Laws of friction - Stick-slip phenomenon- Friction characteristics of metals and non-metals - Adhesion and Ploughing theory of friction- Measurement of friction. Wear - Wear mechanisms – Interfacial wear and Chemical wear-Wear measurements- Ferrograpghy and oil analysis.

UNIT-III
Lubricants and Lubrication regimes Types of Lubricants - Physical Properties – Viscosity, Viscosity Index - Testing principles - Lubricant additives. Lubrcation regimes- Lamda ratio – Hydrodynamic – Elastohydrodynamic - Hydrostatic - Boundary and Solid lubrication.

UNIT-IV
Hydrodynamic Lubrication Fluid film in simple shear – Mechanism of pressure development in a convergent film– Pressure induced and velocity induced flows- Reynolds equation for fluid film lubrication – Long bearing and short bearing approximations- Load carrying capacity - Sommerfield Number – Friction -Thermal equilibrium.

UNIT -V

Materials and Applications Materials for rolling element bearings - Fluid film bearings - Dry bearings. Technological Applications of tribology - Automotive Tribology.

Course Outcomes : At the end of the course students will be able to	
CO1	Able to analyse the contact surface topography, surface parameters and calculate contact pressure, temperature and film thickness simulate wear.
CO2	Able to understand the types of friction and wear mechanisms and measure them.
CO3	Familiar with lubrication types, properties and use the suitable lubricant.
CO4	Able to solve problems on hydrodynamic and hydrostatic lubrication.
CO5	Familiar with bearing elements, materials, types and applications of triblogy.

TEXT BOOKS:

1. Prasanta Sahoo, (2009) Engineering Tribology, PHI Learning Private Limited.

REFERENCES:

1. Bowden, F.P. & Tabor, D.,(2001) Friction and Lubrication of solids, Oxford University press.
2. Neale, M.J., Tribology ,(1999), Hand Book, Butterworth.
3. Fuller D.D., (1999),Theory and practice of Lubrication for engineers, John Wiley sons.
4. Bharat Bhushan, (2002), Introduction to tribology, John Wiley and Sons. Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	3	1			2		2	2	1	3
CO2		2		3	2		3		2		3				
CO3								1		2		2			
CO4	3		2		3	1			2		3		2	1	3
CO5		2		3		2	2	1					2		

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DEPARTMENT OF MECHANICAL ENGINEERING

IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	-	-	3

Elective-IV (a)

MODERN MANUFACTURING METHODS (17A80304)

	Course Objectives: To impart knowledge on
1	To understand the importance and have knowledge of Unconventional machining and forming processes.
2	To have the knowledge of different micro machining methods.
3	To understand the working principles of various Non-traditional methods in machining and forming.

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.

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.

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.

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 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.

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.

Course Outcomes : At the end of the course students will be able to	
CO1	Use the basic manufacturing methods, measurements and apply the principles of a range of modern manufacturing technologies, apply subtractive and additive manufacturing for rapid prototyping
CO2	Describe the specific process characteristics of various modern manufacturing technologies and identify their possible applications and metal removal rate
CO3	Students can able to know the fundamentals of electrochemical machining, its economical concepts and basics of chemical maching.
CO4	They can able to study the principles of EDM,EDG,PM ,its applications.
CO5	They can able to know the applications and limitations of Electron Beam machining and laser Beam Maching.

TEXT BOOKS:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.

REFERENCES:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian,Pearson
3. Modern Machining Process , Pandey P.C. and Shah H.S., TMH.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		3			3		1			1	1	3		
CO2		2					2		3	2				1	
CO3	1			2	1			1			3		1		2
CO4		2	3				2			2					2
CO5				2		3			3			1		3	

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IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	-	-	3

Elective-IV (b)

DESIGN OF HEAT TRANSFER EQUIPMENTS (17A80304)

Course Objectives: To impart knowledge on	
1	The course covers analysis and design of heat exchangers, fluid flow equipment and some interphase contacting devices.

UNIT - I

DESIGN OF HEAT EXCHANGERS**:** Exchangers-mean temperature differences for parallel and counter flow- effectiveness method (N.T.U)-keys and London charts.

DESIGN OF CONDENSERS: Types overall heat transfer coefficients- temperature distribution and heat flow in a condenser-pressure drop in a condenser –extended fin surfaces-consideration of fouling factor-L.M.T.D. correction factor.

UNIT - II

DESIGN OF EVAPORATORS: Temperature distribution and heat flow in an evaporator-pressure drop- factor to be consider in the design of heat transfer equipment-types of heat consideration of fouling factor –correction factor**.**

DESIGN OF COMPRESSORS: Types-equivalent shaft work-volumetric efficiency-factors affecting total volumetric efficiency –compound compression with inter cooling**-** rotary compressors-surging.

UNIT - III

DESIGN OF COOLING TOWERS AND SPRAY PONDS: Classification-performance of cooling towers – analysis of counter flow cooling towers- enthalpy-temperature diagram of air and water- cooling ponds- types of cooling ponds –cross flow cooling towers- procedure for calculation of outlet conditions.

UNIT - IV

DESIGN OF DUCTS: Continuity equation-Bernoulli's equation-pressure losses-frictional charts- coefficient of resistance for fillings- duct sizing methods.

DESIGN OF FANS: Standard air-fan horsepower-fan efficiency-similarity laws-fan laws-performance coefficients- theoretical expression for total pressure drop by a fan-centrifugal fan-axial flow fan-system resistance.

UNIT - V

PIPING SYSTEM:

Requirements of a good piping system-pressure drop in pipes-moody chart-refrigerant piping-discharge line-liquid line-suction line-piping arrangement.

Course Outcomes : At the end of the course students will be able to	
CO1	Ability to design and analyze the performance of heat exchangers and condensers.
CO2	They can able to know the to design evaporators and compressors
CO3	Ability to design and analyze reactor heating and cooling systems etc.
CO4	Students can understand how to design the ducts and fans.
CO5	They know the requirements of pressure drop, discharge and suction in a pipes.

REFERENCES:

1. Heat and mass transfer by Arora & Domkundwar.
2. Refrigeration & Air-Conditioning by P.L.Ballaney
3. .Refrigeration & Air-Conditioning by C.P.Arora.
4. .Refrigeration & Air-Conditioning by Stoecker

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2			1			2	2	2	
CO2	2	2	1	2		2			2			2	2	2	
CO3	2	2	2	2	2	2			1			2	2	2	
CO4					1							2			
CO5															

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IV Year B.Tech. M.E. -II Semester

L	T	P	C
3	-	-	3

Elective-IV (c)

GAS DYNAMICS (17A80304)

	Course Objectives: To impart knowledge on
1	To impart the basic concepts of dynamics and thermodynamics of gas flow.
2	To provide students with an insight into the applications of compressible flows
3	Investigating of basic characteristics of compressible supersonic flow and normal shock waves by comparing with incompressible flow and their applications.

UNIT-I

Introduction : Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow. Properties of atmosphere, standard atmosphere, relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT-II

Isentropic Flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed. maximum speed, variation of Compressibility with mach number.

UNIT-III

Variable Area Flow: Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying backpressures. Flow in constant area duct: Adiabatic and isothermal- flow calculation of pressure, temperature, density, Mach number relationships. Limiting length of duct for adiabatic and isothermal flow. Fanno line.

Diabatic flow: Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships. Limiting conditions. Rayleigh line.

UNIT-IV

Wave Phenomenon: Pressure disturbances in compressible fluid, type of shock waves — normal, shock. Pressure —density-velocity-temperature and Mach number relations for a plane normal shock- Shock tube-mach reflection — thin area prandtl theory.

UNIT-V

Shock intensity- Rayleigh- Pilot and Prandtl- Pitot equation for normal shock. Introduction to oblique shockwaves and hypersonic flow — Fanno flow.

Course Outcomes: At the end of the course students will be able to	
CO1	Apply the concepts of Gas Dynamics for applications related to Continuum, Continuity, Momentum equation and compressible equation flows.
CO2	They can able to know the properties of the fluid like density, pressure, temperature, variation of compressibility with mach number .
CO3	Formulate and solve problems to determine nozzle efficiency, Fanno flow and Rayliegh flow.
CO4	Study the pressure, density and temperatur distributions in compressible fluid, shock waves and normal shock.
CO5	Determine the strength of oblique shock waves on wedge shaped bodies concave corners.

TEXT BOOKS:

1. Gas dynamics through problems/ Zoeb Hussain/ WILEY EASTERN LTD.
2. Fundamentals of Compressible Flow / S.M. Yahya / New Age International Publishers, 2004.

REFERENCES:

1. Gas dynamics / E. Radha Krishnan / P.H.I Publication/4th Edition / 2012
2. Gas Dynamics for engineers / P Balachandran / PHI / Eastern Economy Edition /2012.
3. Gas Dynamics/ H.W. Lipman and A. Rashkho/ John Wiley / 1963.
4. Gas Dynamics/Cambel and Jennings / McGraw Hill / 1958.
5. Fundamentals of Gas Dynamics / Robert D. Zucker & Oscar Biblarz / Wiley India / 2 Edition.
6. Gas Dynamics and Jet Propulsion I S L Somasundaram / New age International Publishers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1		2	1			1	1	1	1	2		
CO2	2	3		2	2	1			1			1		2	
CO3	2	3	2	2	2	1			1		1	1	2	2	2
CO4	1		3	2	2	1			1			1			
CO5															

Program Educational Objectives (PEOs):

PEO 1	**SUCCESSFUL CAREER**: Graduates of the program will have successful technical or professional career.
PEO 2	**LIFELONG LEARNING:** Graduates of the program will continue to learn and to adopt in a world of constantly evolving technology
PEO 3	**SERVICE TO SOCIETY:** Graduates of the program will have the capability to work with multi -disciplinary teams to implement innovative ideas ethically for uplifting the society.

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COURSE STRUCTURE

I Year Semester - 0

Semester - 0 (Theory - 8, Lab -7) Common for All Branches of Engineering				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1		Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-12-0
2		Career Counseling	MC	4-0-4-0
3		Orientation to all branches -- career options, tools, etc.	MC	6-0-0-0
4		Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	4-0-6-0
5		Proficiency Modules & Productivity Tools	ES	4-2-4-0
6		Assessment on basic aptitude and mathematical skills	MC	4-0-6-0
7		Remedial Training in Foundation Courses	MC	4-2-4-0
8		Human Values & Professional Ethics	MC	6-0-0-0
9		Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	4-2-4-0
10		Concepts of Programming	ES	4-0-4-0
Total				**40-6-44-0**

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COURSE STRUCTURE

I YEAR I Semester

SEMESTER - 1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A15101	Linear Algebra And Calculus	BS	3-1-0	4
2	19A15301	Engineering Chemistry	BS	2-1-0	3
3	19A10501	Problem Solving & Programming	ES	3-1-0	4
4	19A10302	Engineering Workshop	LC(ES)	0-0-2	1
5	19A10301	Engineering Graphics	ES	1-0-4	3
6	19A15302	Engineering Chemistry Lab	BS	0-0-3	1.5
7	19A10506	Problem Solving & Programming Lab	ES	0-0-3	1.5
Total					**18**

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COURSE STRUCTURE

I YEAR II Semester

SEMESTER - 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A12402	Basic Electrical & Electronics Engineering	ES	3-0-0	3
2	19A15501	Communicative English 1	HS	2-0-0	2
3	19A15102	Differential Equations and Vector Calculus	BS	3-0-0	3
4	19A15203	Engineering Physics	BS	2-1-0	3
5	19A10305	Material science and Metallurgy	ES	3-1-0	4
6	19A10306	Material science and Metallurgy Lab	LC(ES)	0-0-3	1.5
7	19A10307	Mechanical Engineering Workshop	LC(PCC)	0-0-2	1
8	19A12403	Basic Electrical Engineering lab (Part-A - ½ lab)	LC(ES)	0-0-3/2	0.75
		Basic Electronics Engineering lab(Part-B - ½ lab)	LC(ES)	0-0-3/2	0.75
9	19A15502	Communicative English Lab-1	HS	0-0-2	1
10	19A15204	Engineering Physics Lab	BS	0-0-3	1.5
Total					**21.5**

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COURSE STRUCTURE

II YEAR I Semester

Semester – 3 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A20601	Complex Variables, Transforms and PDE	BSC	2-1-0	3
2.	19A20301	Thermodynamics	PCC	2-1-0	3
3.	19A20302	Manufacturing Process	PCC	2-1-0	3
4.	19A21301	Engineering Mechanics	PCC(ES)	2-1-0	3
5.	19A20303	Design thinking and product innovation	BSC/ESC(PSC)	2-0-0	2
6.	19A20304	Machine Drawing	PCC	1-0-4	3
7.	19A20305	Computer Aided Drafting Lab	PCC	0-0-3	1.5
8	19A20306	Manufacturing Process lab	PCC	0-0-3	1.5
9	19A20307	Design thinking and product innovation Lab	PCC	0-0-3	1.5
10.	19A10804	Environmental Science	MC	2-1-0	0
Total					**21.5**

II YEAR IISemester

Semester – 4 (Theory - 6, Lab –2)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A20308	Thermal Engineering	PCC	2-1-0	3
2.	19A20309	Kinematics of Machinery	PCC	2-1-0	3
3.	19A21302	Mechanics of Materials	PCC(ES)	2-1-0	3
4.	19A21303	Fluid Mechanics& Hydraulic Machinery	PCC(ES)	2-1-0	3
5.	19A20603	Numerical Methods, Probability & Statistics	BSC/ESC(BSC)	2-1-0	3
6.	19A20310	Machine Tools	PCC	2-1-0	3
7.	19A20901	Universal Human Values	HSMC	2-0-0	2
8.	19A21304	Mechanics of Materials Lab	PCC(ES)	0-0-3	1.5
9.	19A21305	Fluid Mechanics& Hydraulic Machinery Lab	PCC(ES)	0-0-3	1.5
10.	19A28801	Biology for Engineers	MC	2-1-0	0
Total					**23**

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COURSE STRUCTURE

III.B.Tech I Semester (R19)

Semester – 5 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A50301	Heat Transfer	PCC	2-1-0	3
2.	19A50302	Dynamics of Machinery	PCC	2-1-0	3
3.	19A50303	Operation Research	PCC	2-1-0	3
4.	19A50304	**(Professional Elective-I)** **1.** Power Plant Engineering	PEC-I	2-1-0	3
	19A50305	**2.** Alternative Fuels for IC Engines			
	19A50306	3. Material handling Equipments			
5.	19A50307	**(Open Elective-I)** **1.** Optimization Techniques	OEC-I	2-1-0	3
	19A50308	**2.** Energy Management		2-1-0	
	19A50309	3. Rapid Prototyping		2-1-0	
	19A50514	4. Python Programming		2-0-2	
6.	19A50310	Design of Machine Members-I	PCC	2-0-0	2
7.	19A50311	Thermal Engg. Lab	PCC	0-0-3	1.5
8.	19A55101	Exploratory Data Analysis Lab	HSMC	0-0-3	1.5
9.	19A50312	Machine Tools Lab	PCC	0-0-2	1
10.	19A50313	Socially Relevant Project	PR	0-0-1	0.5
11.	19A55401	Research Methodology	MC	3-0-0	0
				Total	**21.5**

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III.B.Tech II Semester (R19)

Semester – 6 (Theory - 6, Lab –2)					
S.No	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A60301	Modern Manufacturing Methods	PCC	2-1-0	3
2.	19A60302	Design of Machine Members-II	PCC	2-1-0	3
3.	19A65501	English Language Skills	HSMC	3-0-0	3
4.	19A60303	**(Professional Elective-II)** 1. Automobile Engineering	PEC-II	2-1-0	3
	19A60304	2. Turbo Machinery			
	19A60305	3. Productions and Operations Management			
5.	19A60306	**(Open Elective-II)** 1. Solar Energy Systems	OEC-II	2-1-0	3
	19A60307	2. Introduction to Electric and Hybrid Vehicles			
	19A60308	3. Industrial Engineering			
6.	19A65401	**Humanities Elective-I** 1. Managerial Economics and Financial Analysis	HEC-I	2-1-0	3
	19A65402	2. Entrepreneurship and Incubation			
	19A65403	3. Business Ethics and corporate governance			
7.	19A60309	Heat Transfer Lab	PCC	0-0-3	1.5
8.	19A65502	English Language Skills lab	HSMC	0-0-3	1.5
9.	19A60310	Socially Relevant Project	PR	0-0-1	0.5
10.	19A65406	Constitution of India	MC	3-0-0	0
Total					**21.5**

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IV.B.Tech I sem (R19)

Semester –7 (Theory - 5, Labs -2 &Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A70301	Introduction to CAD/CAM	PCC	2-1-0	3
2.	19A70302	Metrology & Measurements	PCC	2-1-0	3
3.	19A70303	**(Professional Elective-III)** 1. Refrigeration & Air-Conditioning	PEC-III	2-1-0	3
	19A70304	2. Mechanics of Composite Materials			
	19A70305	3. Automotive Transmission Systems			
4.	19A70306	**(Open Elective-III)** 1. Wind Energy Systems	OEC-III	2-1-0	3
	19A70307	2. Special Types of Vehicles			
	19A70308	3. Industrial Automation and Control Systems			
5.	19A75401	**Humanities Elective-II** 1. Organizational Behavior	HEC-II	2-1-0	3
	19A75402	2. Management Science			
	19A75403	3. Business Environment			
6.	19A70309	CAD/CAM Lab	PCC	0-0-3	1.5
7.	19A70310	Metrology &Measurements Lab	PCC	0-0-3	1.5
8.	19A70311	Seminar	PCC	0-0-1	0.5
9.	19A70312	Project*	PR	------	1.5
10.	19A70313	Industrial Training/Skill Development/Research Project*	PR	------	2
				Total	**22**

*** Marks shall be awarded in 7th semester, but started at end of 6th semester and complete before beginning of 7th semester.**

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IV. B.Tech II Semester (R19)

Semester –8 (Theory - 2, Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	19A80301	**(Professional Elective-IV)** 1. Total Quality Management	**PEC-IV**	**2-1-0**	**3**
	19A80302	2. Mechanical Vibrations			
	19A80303	3. Robotics and Applications in Manufacturing			
2.	19A80304	**(Open Elective-IV)** 1. Finite Element Methods	**OEC-IV**	**2-1-0**	**3**
	19A80305	2. Energy Conservation and Management			
	19A80306	3. Introduction to Mechatronics			
3.	19A80307	Project	PR	0-0-7	7
				Total	**13**

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COURSE STRUCTURE

I YEAR I Semester

SEMESTER - 1					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1	19A15101	Linear Algebra And Calculus	BS	3-1-0	4
2	19A15301	Engineering Chemistry	BS	2-1-0	3
3	19A10501	Problem Solving & Programming	ES	3-1-0	4
4	19A10302	Engineering Workshop	LC	0-0-2	1
5	19A10301	Engineering Graphics	ES	1-0-4	3
6	19A15302	Engineering Chemistry Lab	BS	0-0-3	1.5
7	19A10506	Problem Solving & Programming Lab	ES	0-0-3	1.5
				Total	**18**

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
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I- Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Linear Algebra & Calculus

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

Bridge Course: Limits, continuity, Types of matrices

Unit 1: Matrices

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, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors, diagonal form and different factorizations of a matrix;
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.

Unit 2: Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof)

Learning Outcomes:

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders
- Analyze the behaviour of functions by using mean value theorems

Unit 3: Multivariable calculus

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies.
- Acquire the Knowledge maxima and minima of functions of several variable
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of Variables.

Unit 4: Multiple Integrals

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates.

Learning Outcomes:

- At the end of this unit, the student will be able to
- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates
- Apply double integration techniques in evaluating areas bounded by region
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries

Unit 5: Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations
- Conclude the use of special function in evaluating definite integrals

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem	**L**	**T**	**P**	**C**
	2	**1**	**0**	**3**

Engineering Chemistry

Subject Code	Title of the Subject	L	T	P	C
19A53101	Engineering Chemistry	2	1	-	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

SYLLABUS

Unit 1: Water Technology **(8 hrs)**

Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – 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 fuel cells

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, 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
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol
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.

UNIT-4 Advanced Engineering Materials (8 hrs)

(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.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	**List** the differences between temporary and permanent hardness of water, **explain**the principles of reverse osmosis and electrodialysis. **compare**quality ofdrinking 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

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 Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi

2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Problem Solving & Programming

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

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.

Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, the analysis of algorithms.

Unit 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 2:

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-Do-while, break and continue, Goto and labels.

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:

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.

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)

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Construct his own computer using parts (L6).
CO2	Recognize the importance of programming language independent constructs (L2)
CO3	Solve computational problems (L3)
CO4	Select the features of C language appropriate for solving a problem (L4)
CO5	Design computer programs for real world problems (L6)
CO6	Organize the data which is more appropriated for solving a problem (L6)

Text Books:
1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2^{nd} Edition, Pearson.

Reference Books:
1. P.Chenna Reddy, " Computer Fundamentals and C Programming" 2018, BS Publications
2. RS Bichkar " Programming with C", 2012, Universities Press.
3. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
0	0	2	1

Engineering Workshop

(COMMON TO CIVIL, MECHANICAL, CHEMICAL)

Course Objective:	
1	To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

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

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

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) Wheel Balancing, tubeless tyre puncture and change of two wheeler tyre.

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

Note:* Students exercise. Remaining all for demonstration.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Apply wood working skills in real world applications. (L3)
CO2	Build different objects with metal sheets in real world applications. (L3)
CO3	Apply fitting operations in various applications. (L3)
CO4	Apply different types of basic electric circuit connections. (L3)
CO5	Understanding the soldering, brazing and principle of automobile wheel balancing, alignment and operation of power tools. (L2)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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2019-20

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C**

1 0 4 3

ENGINEERING GRAPHICS
(COMMON TO CIVIL, MECHANICAL, CHEMICAL)

Course Objectives	
1	Bring awareness that Engineering Drawing is the Language of Engineers.
2	To know how to represent letters and numbers in drawing sheets..
3	To know about the different types of the projections, projection of points, straight lines, planes and regular solids
4	To know sectional views and development of different types of surfaces.
5	To know about the projection of orthographic views, isometric views and isometric projections.

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance
Curves used in practice:

a) Conic sections – Ellipse, Parabola, Hyperbola & Rectangular Hyperbola (general method)
b) Cycloid, Epicycloid and Hypocycloid – Normal and Tangent
c) Involutes – Normal and Tangent

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the Printing of Letters and dimensioning.(L1)
2. Draw the geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
3. Construct the Conic sections and cycloidal curves.(L6)

UNIT –II

Principles of orthographic projections – First and Third angle projections Projection of points., Projections of lines inclined to one plane and inclined to both planes – True length, true angles of projected lines – Projection of regular planes inclined to one plane and both planes by rotational method.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the Orthographic Projection in four quadrants (L2)
2. Project the points, lines and planes (L6)

UNIT –III

Projection of solids inclined to one plane and inclined to both planes by rotational/auxiliary method – Prism, Cylinder, Pyramid, Cone.

Learning Outcomes:

At the end of this unit the student will be able to

1. Project the solids inclined to one or both planes. (L6)
2. draw the solids by auxiliary method. (L6)

UNIT –IV

Sections of solids: Sections and Sectional views of regular solids – Prism, Cylinder, Pyramid, Cone – True shapes

Development of solids- Prism, Cylinder, Pyramid, Cone

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

Learning Outcomes:

At the end of this unit the student will be able to

1. Project the sectional view of regular solids.(L6)
2. Draw the true shapes of the sections.(L2)
3. Draw the development of surfaces of the solids.(L6)
4. Develop the sectional parts of the solids.(L2)

UNIT –V

Orthographic projections: Conversion of Pictorial views to orthographic views – Conventions.

Isometric projection: Isometric views of lines, plane figures, simple and truncated solids – orthographic views into isometric views.

Learning Outcomes:

At the end of this unit the student will be able to

1. Draw the orthographic views with dimensions.
2. Draw the Isometric views and isometric projections.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Draw various curves applied in engineering. (L2)
CO2	Plot the projection of points, Lines and planes.(L2)
CO3	Draw the projections of solids inclined to one or both planes. (L2)
CO4	Draw the sectional views and development of surfaces.(L2)
CO5	Draw the orthographic views, Isometric views and isometric projections. (L3)

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. Engineering Drawing, K.L. Narayana & P. Kannaih, Scitech Publishers, Chennai.

REFERENCES:

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, John & John.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C**
0 0 3 1.5

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

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 Viscometer 1
12. Determination of Flash and Fire points of fuels
13. Determination of Calorific value of gases by Junker's gas Calorimeter

COURSE OUTCOMES	
At the end of this course the student will be able to	
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)

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Problem Solving & Programming Lab

Laboratory Experiments#

1. Basic DOS Commands/Unix Commands
2. Familiarize with windows/Linux Environment.
3. Familiarize with development environment of C Language
4. Design a C program which reverses the number
5. Design a C program which finds the second maximum number among the given list of numbers.
6. Construct a program which finds the kth smallest number among the given list of numbers.
7. Design an algorithm and implement using C language the following exchanges
   a $\leftarrow$ b $\leftarrow$ c $\leftarrow$ d

5. 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.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Construct a Computer given its parts (L6)
CO2	Select the right control structure for solving the problem (L6)
CO3	Analyze different sorting algorithms (L4)
CO4	Design solutions for computational problems (L6)
CO5	Develop C programs which utilize the memory efficiently using programming constructs like pointers.

References:

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", Tata McGraw-Hill, 2nd edition, 2002.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. P.Chenna Reddy, "Computer Fundamentals and C Programming" 2018, BS Publications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-20
COURSE STRUCTURE

I YEAR II Semester

SEMESTER - 2					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1		Basic Electrical & Electronics Engineering	ES	3-0-0	3
2		Communicative English 1	HS	2-0-0	2
3		Differential Equations and Vector Calculus	BS	3-0-0	3
4		Engineering Physics	BS	2-1-0	3
5		Material science and Metallurgy	ES	3-1-0	4
6		Material science and Metallurgy Lab	LC	0-0-3	1.5
7		Mechanical Engineering Workshop	LC	0-0-2	1
8		Basic Electrical Engineering lab (Part-A - ½ lab)	LC	0-0-1.5	0.75
		Basic Electronics Engineering lab(Part-B - ½ lab)	LC	0-0-1.5	0.75
9		Communicative English Lab-1	HS	0-0-2	1
10		Engineering Physics Lab	BS	0-0-3	1.5
				Total	**21.5**

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem	L	T	P	C
	3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
Electrical Engineering

PART- A

Course Objectives:
To make the students learn about:

1	The basics of AC & DC Circuits, DC generators & motors.
2	The construction and operation of Transformers, Induction motors and their performance aspects will be studied.

Syllabus:

UNIT – I
Introduction to DC & AC Circuits
Ohm"s Law, Basic Circuit Components, Kirchhoff"s Laws, Resistive Networks, Series Parallel Circuits, Star-Delta and Delta-Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The „j" Operator and Phasor Algebra, Basic concepts of AC series circuits.

Outcomes : After the completion of the unit the students will be able to
1. Perceive and analyse the basic laws of electrical circuits
2. Apply to basic laws to solve real life problems

UNIT-II
DC Machines
Constructional details of DC Machines
DC Generators: Principle of Operation, EMF equation, Types, O.C.C. of a DC Shunt Generator
DC Motors: Principle of Operation, Types, Torque Equation, Losses and Efficiency Calculation, Swinburne"s Test, concepts of speed control.

Outcomes: After the completion of the unit the students will be able to
1. Apprehend and interpret basic principles of DC machines
2. Evaluate the performance of DC machines

UNIT-III
AC Machines
Transformers: Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.
Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).

Alternators: Principle of Operation, Constructional Details, EMF Equation, Voltage Regulation by Synchronous Impedance Method.

Outcomes : After the completion of the unit the students will be able to
1. Identify different types of AC machines
2. Analyse the performance of various AC machines

Course Outcomes:

After completing the course, the student should be able to :

CO1	Understand the basics of AC & DC circuits and AC & DC machines
CO2	Analyse the circuit elements, various AC and DC machines

TEXT BOOKS:
1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.

REFERENCES:
1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I –Year B.Tech.II -Semester

L	T	P	C
3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRONICS ENGINEERING
PART- B

COURSE OBJECTIVES	
The students will be able to	
1	Understand principle and terminology of electronics.
2	Analyse the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators.
3	Understand the concept of Digital Logic
4	Understand the Concept & Principles of Digital Logic

UNIT I
Diodes and Transistors: Semiconductor Diode, Zener Diode, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors(operating modes, Configurations and Characteristics), Introduction to Transistor Biasing and Transistor as an amplifier, Introduction to Field-Effect Transistors (Configurations and characteristics).

UNIT II
Operational Amplifiers: Op-amp Equivalent Circuit, Ideal and practical Op-amp characteristics, Op-Amp Applications (Inverting amplifier, Non -inverting amplifier, Summing, scaling & averaging amplifiers, integrator, differentiator, Active filters, oscillators and comparators).

UNIT III
Digital Electronics: Number Systems and Codes, Logic Gates, Boolean Theorems, DeMogan‟s Theorems, Algebraic Simplification, Karnaugh Map Method. Binary Addition, 2‟s Complement System, Full Adder, BCD Adder. NAND and NOR gate Latches, S-R Flip-Flop, JK Flip-Flop, D Flip-Flop, Introduction to Shift registers and Counters

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Able to apply the knowledge of diodes, Zener diodes, BJT"s and FET"s for applications of different circuits.
CO2	Analyse the applications of operational amplifiers.
CO3	Solve problems of various digital logic gates and circuits.
CO4	Correlate the fundamental concepts to various Real life applications of today.

Text Books:

1. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education
2. Ramakant A.Gayakwad, Op-Amps and Linear Integrated Circuits, Eastern Economy Edition
3.M.Morris Mano and Michael D.Ciletti, Digital Design, Pearson Education,4^{th} Edition

References:

1. R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education.
2. Bell, D. A., Electronic Devices and Circuits, Oxford University Press
3. 3.R.J. Tocci: Digital Systems; PHI, 6e, 2001.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
2	0	0	2

Communicative English 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*. 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.

COURSE OBJECTIVES	
The students will be able to	
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

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: Innovation: Muhammad Yunus

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:

Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

COURSE OUTCOMES	
At the end of this course the student will be able to	
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

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, 12^{th} Edition, 2011

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Differential Equations and Vector Calculus

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

UNIT 1: 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.

Learning Outcomes:
At the end of this unit, the student will be able to

- Identify the essential characteristics of linear differential equations with constant Coefficients
- Solve the linear differential equations with constant coefficients by appropriate method

UNIT 2: Equations reducible to Linear Differential Equations
Cauchy‟s and Legendre‟s linear equations, simultaneous linear equations with constant coefficients, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:
At the end of this unit, the student will be able to

- Classify and interpret the solutions of linear differential equations
- Formulate and solve the higher order differential equation by analyzing physical situations

UNIT 3: Partial Differential Equations 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.
Learning Outcomes:
At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs

- outline the basic properties of standard PDEs

UNIT4: Vector differentiation

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions
- illustrate the physical interpretation of Gradient, Divergence and Curl

UNIT 5: 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) and applications of these theorems.

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field
- evaluate the rates of fluid flow along and across curves
- apply Green"s, Stokes and Divergence theorem in evaluation of double and triple integrals.

COURSE OUTCOMES	
At the end of this course the student will be able to	
.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

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson

Publishers, 2013.
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O‟neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
11. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
2	1	0	3

Engineering Physics

Subject Code	Title of the Subject	L	T	P	C
	ENGINEERING PHYSICS	2	1		3

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	To understand the concepts of mechanics and employ the applications of oscillations to engineering fields.
3	To familiarize the basic ideas of acoustics and ultrasonic"s with their Engineering applications.
4	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.
5	To evoke interest on applications of superposition effects like interference, diffraction and polarization in engineering.
6.	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.

Unit-1: 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: Introduction to acoustics – 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 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: Lasers and Fiber optics

Lasers: Introduction – Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein"s coefficients – Population inversion – Pumping mechanisms – Nd:YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction to Optical Fibers-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-IV: 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.

Diffraction-Introduction-Fresnel and Fraunhofer diffraction-Fraunhofer diffraction due to single slit and double slit – Diffraction grating- Grating spectra.

Polarization-Polarization by double refraction-Nicol"s Prism--Half wave and Quarter wave plates- Engineering applications of Polarization.

UNIT V: Engineering Materials

Dielectric Materials: Introduction-Dielectric polarization- Dielectric constant- Types of polarizations: Electronic and Ionic, Orientation Polarizations (Qualitative) - Lorentz (Internal) field- Clausius- Mossotti equation-Applications of Dielectrics: Ferroelectricity and Piezoelectricity.

Magnetic Materials: Introduction-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: 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.

COURSE OUTCOMES	
After studying this course, the student will be able to:	
CO1	Understand the basics of mechanics and types of oscillations.
CO2	Explain sound propagation in buildings, acoustic properties of typically used materials in buildings and the use of ultrasonics.
CO3	Apply the different realms of physics in both scientific and technological systems through the study of lasers and fiber optics.
CO4	Analyze different physical phenomena of optics like interference, diffraction and polarization.
CO5	Compare the properties of dielectric, magnetic and nano materials along with their engineering applications.

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. Introduction to modern optics – Grant R Fowles
2. A text book on Optics – Brijlal & Subramanyam
3. Laser Fundamentals – William T. Silfvast, Cambridge University Press
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Hand Book of Non-destructive evaluation, C.J.Hellier, McGraw-Hill
7. Engineering Physics – K.Thyagarajan, MacGraw Hill Publishers
8. Engineering Physics – M.R.Srinivasan, New Age Publications
9. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
10. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
11. Engineering Physics – M. Arumugam, Anuradha Publications

Method of Evaluation:

Please mention if it is apart from the regular practice

Data Books Required: Nil

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

MATERIAL SCIENCE AND METALLURGY

COURSE OBJECTIVES	
1	To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams
2	Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints
3	Explain the methods to change the properties of materials through heat treatment processes
4	Familiarize the principles of powder metallurgy and methods of making composite materials

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.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Know the concept of metallography in studying the microstructures of metals and alloys. (L2)
- Understand the metals and alloys and types of solid solutions.(L2)

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.

Learning Outcomes:

At the end of this unit the student will be able to

- Make use of the principles of construction of binary phase diagrams. (L3)

- Identify various invariant reactions in binary phase diagrams. (L3)

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.

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)
- Understand the importance of non-ferrous metals and alloys in engineering applications. (L2)

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.

Learning Outcomes:

At the end of this unit the student will be able to

- Know the influence of heat treatment in modification of properties of steels. (L2)
- Develop a heat treatment cycle based on properties required. (L3)
- Comprehend the principles of surface hardening methods. (L2)

UNIT – V

Powder Metallurgy: Introduction to powder metallurgy, production of metal powders processing methods compaction of metal powders, sintering, finishing operations.

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.

Learning Outcomes:

At the end of this unit the student will be able to

- Describe the production of metal powders, processing methods and finishing of powder metallurgical products.
- Understand the properties of ceramics and their applications. (L2)
- Summarize the properties and methods of composites and their use. (L2)

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand the crystal structures of metals & alloys and types of solid solutions. (L2)
CO2	Make use of the principles of construction of binary phase diagrams. (L2)
CO3	Select steels, cast irons and nonferrous metals & alloys in engineering for a given application. (L3)
CO4	Apply heat treatment process to different applications. (L3)
CO5	Explain powder metallurgical methods, properties of composite materials and manufacturing methods of composite materials. (L2)

TEXT BOOKS:

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

REFERENCES:

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	3	1.5

MATERIAL SCIENCE AND METALLURGY LAB

COURSE OBJECTIVES	
1	To impart knowledge on metallographic techniques for studying the microstructures of alloys.

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 – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (L4)
CO2	Visualize grains and grain boundaries. (L3)
CO3	Importance of hardening of steels. (L2)
CO4	Evaluate hardness of treated and untreated steels. (L4)
CO5	Differentiate hardness of super alloys, ceramics and polymeric materials.(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												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1.5

MECHANICAL ENGINEERING WORKSHOP

COURSE OBJECTIVES	
1	Familiarize moulding and casting skills.
2	Train on different types welding joints
3	Develop assemble or disassembly skills.
4	Make plastic components
5	Familiarize with use power tools
6	Demonstrate assembly of computer and installation of software

Foundry Practice:

a) Pattern making *
b) Determination of average grain size for sand sample using sieve shaker *
c) Preparation of a green sand mould using single piece pattern *
d) Preparation of a green sand mould using split piece pattern with core * and demonstration of casting.

Welding Practice:

a) Lap joint, butt joint and T joint using arc welding *
b) Lap joint using resistance spot welding *
c) Lap and butt joints using gas welding

Assembling/Disassembling Practice:

a) Bicycle
b) Clutch and carburetor
c) Two wheeler engine parts
d) Desktop Computer and installation of Operating system Software

Manufacture of a Plastic Component

a) Use of injection moulding machine *
b) Use of blow moulding machine *

Manufacturing any two domestic utility products with any material by above methods (2 Sessions) Use of Power Tools

Drilling, Cutting, Plaining, Finishing, Etc, on wood or metals
Black Smithy

a) Preparation of L. Nail *
b) Preparation of S- Hook *
c) Preparation of Poker

Note: * Students exercise. Remaining all for demonstration.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Make moulds for sand casting
CO2	Develop different weld joints
CO3	Assemble or disassemble of machine components
CO4	Make plastic components
CO5	Use power tools for different applications

Text Books:
1. K. Venkata Reddy Workshop Mannual 6th Ed., B.S. Publishers, 2013.
2. B.L. Juneja Workshop practice 1st Ed., Cengage, 2015.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem	**L**	**T**	**P**	**C**
	0	**0**	**1.5**	**0.75**

BASIC ELECTRICAL ENGINEERING LAB

(PART-A - ½ LAB)

Course Objectives: To make the student learn about:

1	The DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
2	Various test conditions of single phase transformers.

Syllabus:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne‟s Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
2. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
3. Brake Test on 3-Phase Induction Motor (Determination of Performance Characteristics)
4. Regulation of Alternator by Synchronous Impedance Methods.
5. Speed Control of D.C.Shunt Motor by
   a) Armature Voltage Control B) Field Flux Control Method
6. Brake Test on D.C Shunt Motor

Course Outcomes	
At the end of this course the student will be able to	
CO1	Learn about DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines.
CO2	Various test conditions of single phase transformers.

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	1.5	0.75

BASIC ELECTRONICS ENGINEERING LAB

(PART-B - ½ LAB)

(Common to ME & CHEM)

COURSE OBJECTIVES	
The students will be able to	
1	Understand the characteristics of PN junction diode and zener diode.
2	Understand the characteristics of BJT in CE and CB configurations
3	Learn the frequency response of CE Amplifier
4	Exposed to linear and digital integrated circuits

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Full Wave Rectifier with & without filter
4. Wave Shaping Circuits (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting Amplifiers using Op Amps
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs
9. Verification of Truth Tables of RS, JK, T & D flip flops using respective ICs

LAB REQUIREMENTS:

Cathode Ray Oscilloscopes (30MHz)

Signal Generator /Function Generators (3 MHz)

Dual Regulated Power Supplies (0 – 30V)

IC Trainer Kit

Bread Boards

Electronic Components

COURSE OUTCOMES	
At the end of this course the student will be able to,	
CO1	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
CO2	Analyze the application of diode as rectifiers, clippers and clampers.
CO3	Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits.
CO4	Learn the basics of linear integrated circuits and understand characteristics of operational amplifier.
CO5	Learn about available digital ICs and verify truth tables of logic gates and flip flops.

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

COMMUNICATIVE ENGLISH LABORATORY-1

COURSE OBJECTIVES	
1	Students will be exposed to a variety of self instructional, learner friendly modes of language learning
2	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.
3	Students will learn better pronunciation through stress, intonation and rhythm
4	Students will be trained to use language effectively to face interviews, group discussions, public speaking
5	Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Unit 1

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

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. JAM
2. Small talks on general topics
3. Debates

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. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

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. Asking for Information and Giving Directions
2. Information Transfer
3. Non-verbal Communication – Dumb Charade

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. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

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

- Young India Films
- Walden Infotech
- Orell

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO2	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
CO4	Evaluate and exhibit acceptable etiquette essential in social and professional settings
CO5	Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English

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

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	3	1.5

ENGINEERING PHYSICS LAB

Subject Code	Title of the Lab	L	T	P	C
	ENGINEERING PHYSICS LABORATORY	0	0	3	1.5

COURSE OBJECTIVES	
1	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2	To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.
3	To train engineering students on basis of measurements and the instruments
4	To equip the students with practical knowledge in electronic and optics experiments

LIST OF EXPERIMENTS

Any TEN of the following experiments has to be performed during the SEMESTER

1. Laser: Determination of wavelength using diffraction grating.
2. Laser: Determination of Particle size.
3. Determination of spring constant of springs using Coupled Oscillator
4. Determination of ultrasonic velocity in liquid (Acoustic grating)
5. Determination of dielectric constant and Curie temperature of a ferroelectric material.
6. B-H curve
7. Stewart-Gee‟s Method
8. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
9. Determination of numerical aperture of an optical fiber.
10. Determination of thickness of thin object by wedge method.
11. Determination of radius of curvature of lens by Newton‟s rings.
12. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
13. Determination of dispersive power of the prism

14. Sonometer: Verification of the three laws of stretched strings
15. Meldes experiment: Determination of the frequency of tuning fork

Note: Out of 10 experiments, two experiments will be performed using virtual laboratory.

Data Books Required: Nil

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.
CO2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CO4	The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application.
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020

Course Structure for 2nd Year B.Tech

Semester – 3 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables, Transforms and PDE	BSC	2-1-0	3
2.		**Thermodynamics**	**PCC**	**2-1-0**	**3**
3.		**Manufacturing Process**	**PCC**	**2-1-0**	**3**
4.		Engineering Mechanics	PCC	2-1-0	3
5.		**Design thinking and product innovation**	**BSC/ESC**	**2-0-0**	**2**
6.		**Machine Drawing**	**PCC**	**1-0-4**	**3**
7.		**Computer Aided Drafting Lab**	**PCC**	**0-0-3**	**1.5**
8		**Manufacturing Process lab**	**PCC**	**0-0-3**	**1.5**
9		**Design thinking and product innovation Lab**	**PCC**	**0-0-3**	**1.5**
10.		Environmental Science	MC	2-1-0	0
				Total	**21.5**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

COMPLEX VARIABLES, TRANSFORMS & PARTIAL DIFFERENTIALEQUATIONS
(Common to MECHANICAL, CHEMICAL & CIVIL)

L	T	P	C
2	1	0	3

Course Objective:

- This course aims at providing the student to acquire the knowledge on the calculus of functionsof complex variables.
- The aim is to analyze the solutions of partial differential equations.

COURST OUTCOMES : After completion of the course a successful student is able to

CO 1: Acquire knowledge in

a. Fourier series.
b. Laplace transforms and their applications.
c. Find the derivatives of complex functions.
d. Solving Partial Differential equations
e. Heat transfer and wave motion.

CO 2: To Develop skills in analyzing the

a. Properties of Fourier series for a given function.
b. Understand the analyticity of complex functions and conformal mapping.
c. Apply Cauchy’s integral formula and Cauchy’s integral theorem to evaluate improper integrals along contours.
d. Engineering systems & processes involving wave forms and heat transfer.
e. Partial differential equations through different evaluation methods.

CO 3: To develop skills in designing mathematical models for

a. Understand the usage of Laplace transforms.
b. Apply Cauchy’s integral theorem.
c. Understand singularities of complex functions.
d. Problems involving heat transfer and wave forms.

CO 4: To develop analytical tools in solving the problems involving

a. Fourier series
b. Laplace transforms
c. Heat transfer and wave motion.
d. Evaluate the Fourier series expansion of periodic functions.

CO 5: Use relevant mathematical technique for evaluating

a. Evaluate improper integrals of complex functions using Residue theorem.
b. Laplace transforms
c. Solve applications of partial differential equations.

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	P O3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	1	-	-	-	1	-	-	2	1	-	-					
CO2	1	3	-	-	-	1	-	-	2	2	-	-					
CO3	1	3	2	-	-	1	-	-	2	2	-	-					
CO4	1	1	1	3	-	1	-	-	2	1	-	-					
CO5	1	1	1	1	-	1	-	-	2	1	-	-					

Correlation Levels: High - 3 Medium – 2 Low - 1

Unit-I: Complex Variable – Differentiation:
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation,Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) 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 Variable – Integration:

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula,Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof); power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, 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).

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 – Inversetransform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function– Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transformof Periodic function. Differentiation and integration of transform – solving Initial value problemsto ordinary differential equations with constant coefficients using Laplace transforms.

Unit Outcomes:

Students will be able to

- Understand the concept of Laplace transforms and find 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

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourierseries – functions having discontinuity-Fourier series of Even and odd functions – Fourier seriesin an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

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.
- Apply Fourier series to establish Identities among Euler coefficients.
- Find Fourier series of wave forms.

Unit-V: Partial Differential Equations & Applications

Formation of partial differential equations by elimination of arbitrary constants and arbitraryfunctions – Solution of first order PDEs by Lagrange's method- Solution of non linear PDEs(Standard forms)-Solution of second order PDEs by Method of separation of variables –

Solutions of one dimensional wave equation, one dimensional heat equation under initial andboundary conditions.

Unit Outcomes:

At the end of this unit, the students will be able to

- Form Partial Differential Equations.
- Solve Partial Differential Equations of first order.
- Understand the method of separation of variables.
- Solve applications of Partial Differential Equations.

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”, Mc Graw Hill publishers.
2. Alan Jeffrey, “Advanced Engineering Mathematics”, Elsevier.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

THERMODYNAMICS

L	T	P	C
2	1	0	3

Course Objectives	
1	Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
2	Explain relationships between properties of matter and basic laws of thermodynamics.
3	Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process
4	Introduce the concept of available energy for maximum work conversion
5	Familiarize steam properties to understand working of steam power plants.
6	Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines

UNIT I

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 - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process-limitations of first law of thermodynamics**.**

Unit outcomes

At the end of this Unit, the student will be able to

- Understand thermodynamic systems, properties and their importance in solving engineering problems.
- Make energy balance for closed systems and open systems.
- Explain the First Law of thermodynamics applied to flow and non-flow process.

UNIT II

Second Law of Thermodynamics: 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.

Unit outcomes

At the end of this Unit, the student will be able to

- Understand second law of thermodynamics and apply for heat engine, refrigerator and heat pump.
- Explain the efficiency of thermodynamic systems.
- Enumerate the causes of irreversibility in thermodynamic systems.

UNIT III

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.

Unit outcomes

At the end of this Unit, the student will be able to

- Apply the concept of entropy to estimate the performance of systems.
- Evaluate expressions for availability and irreversibility of flow and non-flow processes.

UNIT IV

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.

Unit outcomes

At the end of this Unit, the student will be able to

- Apply properties of steam to design steam systems.
- Examine steam systems using conservation equations.
- Evaluate the dryness fraction and performance of steam systems.

UNIT V

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

Unit outcomes

At the end of this Unit, the student will be able to

- Understand the Tds equations, specific heats, Joule-Thomson coefficient in standard form, change in internal energy, enthalpy and entropy.
- Explain the working principle and construction of various air standards cycles.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Explain the importance of thermodynamic properties related to conversion of heat energy into work
CO2	Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles
CO3	Understand the concepts of entropy, availability, irreversibility, steady flow and non-flow process
CO4	Utilize steam properties to design steam based components
CO5	Understand the thermodynamic relations and Compare the air standard cycles

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7th edition, Tata McGraw Hill, 2011.

References

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2th edition, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6th edition, Laxmi publications, 2010.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

MANUFACTURING PROCESS

L	T	P	C
2	1	0	3

Course Objectives	
1	To know the working principle of different metal casting processes and gating system.
2	To understand the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes and principles of forging processes.
3	To study the classifications of welding processes, working of different types of welding processes and welding defects.
4	To study the classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.
5	To learn the Characteristics of Unconventional Machining Processes.

UNIT I

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.

Unit Outcomes:

At the end of this unit, the student will be able to

- Understand the steps involved in metal casting, pattern making.
- Apply the knowledge of designing gating systems, risers.
- Compare the working of various metal casting processes.
- Identify the various casting defects.

UNIT II

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; 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.

Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

Unit Outcomes:

At the end of this unit, the student will be able to

- Compare cold working and hot working processes.
- Explain the working of rolling mills and analyze the forces involved.
- Understand the working of various extrusion and forging processes.
- Understand the various operations of Sheet metal forming.

UNIT III

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. 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.

Unit Outcomes:

At the end of this unit, the student will be able to

- Classify the working of various welding processes.
- Compare V-I characteristics of different welding processes.
- Know the applications, advantages of various welding processes.
- Identify the defects in welding.

UNIT IV: Plastic Processing, Ceramics and Powder Metallurgy:

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, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

Unit Outcomes:

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts.
- Explain the steps in making ceramics parts.
- Explain the steps in manufacturing of powder metallurgy parts.
- Demonstrate the application of plastic, ceramics and power metallurgy.

UNIT V

Unconventional Machining Processes: Introduction-classification- Principles of Electrical discharge machining (EDM), Electro-chemical machining (ECM), Laser beam machining

(LBM), Plasma arc machining (PAM) and Electron beam machining, Abrasive jet machining (AJM), Water jet machining, Ultrasonic machining.

Unit Outcomes:

At the end of this unit, the student will be able to

- Classify the unconventional machining processes.
- Understand the principles of EDM, ECM, LBM, PAM ,AJM, Water jet and Ultrasonic machining process

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Demonstrate different metal casting processes and gating systems
CO2	Understand the hot and cold metal forming methods for rolling, extrusion and forging.
CO3	Know the application of various welding processes for different applications.
CO4	Outline the manufacturing methods of plastics, ceramics and powder metallurgy
CO5	Identify different unconventional processes and their applications

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

L	T	P	C
2	1	0	3

ENGINEERING MECHANICS
(Common to CIVIL & MECHANICAL)

OBJECTIVE: *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 Dr.R.K.Bansal, Lakshmi Publications.
(2) Engineering Mechanics by Shames & Rao – Pearson Education.
(3) Engineering Mechanics by Bhavakatti, New age pubilishers

REFERENCES:

(1) Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
(2) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.
(3) Engineering Mechanics by FedrinandL.Singer – Harper Collings Publishers.
(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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

L	T	P	C
2	0	0	2

DESIGN THINKING AND PRODUCT INNOVATION

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	
1	To bring awareness on innovative design and new product development.
2	To explain the basics of design thinking.
3	To familiarize the role of reverse engineering in product development.
4	To train how to identify the needs of society and convert into demand.
5	To introduce product planning and product development process

UNIT I
Design Thinking Background: Design Thinking Definition – Fundamental Concept – Resources – Processes – In Practice – Application.

Unit Outcomes:
After completion of this Unit, the student will be able to
- Understand fundamental concepts of design thinking
- Understand the Resources and processes
- Familiar in application and practice

UNIT II
PROCESS OF DESIGN
Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step – Five Step - Twelve Step - Creativity and Innovation in Design Process – Basic Materials - Design limitation.
Unit Outcomes:
After completion of this Unit, the student will be able to

- Understand Product life cycle, Design Ethics and Process.
- Understand the Creativity and Innovation in Design Process, Basic Materials Design limitation.

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.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Apply systematic approach in design
- Explain the steps in the design process
- Develop strategies for new product development

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, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand reverse engineering methods in product development
- Use new materials to improve the product
- Apply electronic controls to improve the product acceptability
- Summarize the safety and environmental factors in new product design

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.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Identify the needs for new product development in agriculture

- Develop simple electrical gadgets
- Explain the principles in design electrical vehicles and drones

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand fundamental concepts of design thinking, Resources and Applications.
CO2	Understand the Creativity and Innovation in Design Process and limitations
CO3	Apply systematic approach to innovative designs.
CO4	Identify Reverse engineering and importance of ergonomics in product development.
CO5	Identify new materials and manufacturing methods in design of agriculture machines and electrical vehicles

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
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.

Reference Books:

1. Design Thinking understanding How designs think & work, Nigal Cross, Berg Oxford-Newyork.
2. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007
3. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

MACHINE DRAWING

L	T	P	C
1	0	4	3

To impart knowledge on

Course Objectives	
1	Representing any matter/object with the help of picture & dimensioning
2	Working drawings of Machine Elements
3	Orthographic drawing of different machine parts
4	Developing assembly drawings

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

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) Riveted joints for plates, flanged& protected flanged joint.
d) Shaft coupling, spigot and socket pipe joint.
e) Journal and foot step bearings.

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

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand drafting fundamentals and standards.
CO2	Interpret drawings and extract required information
CO3	Create part drawings and sectional views of machine components.
CO4	Develop assembly drawings from part drawings for engine parts.
CO5	Develop assembly drawings from part drawings for machine parts and valves

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

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

COMPUTER AIDED DRAFTING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:	
1	To develop skill to use software to create 2D and 3D models.

List of Exercises:

Using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modelling – Coordinate systems (Absolute, Relative, Polar, etc.).
2. Creation of simple figures like polygon and general multi-line figures.
3. Drawing of a Title Block with necessary text and projection symbol.
4. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
5. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
6. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects.
11. Obtaining 2-D multi-view drawings from 3-D model.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Ability to use the software packages for drafting and modelling
CO2	Ability to create 2D and 3D models of simple objects.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

2nd Year B.Tech. - Semester – 3

MANUFACTURING PROCESS LAB

L	T	P	C
0	0	3	1.5

Course Objectives	
1	Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes.

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/ nonferrous 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	
CO1	Fabricate different types of components using various manufacturing techniques
CO2	Adapt unconventional manufacturing methods.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2^{nd}Year B.Tech. - Semester – 3

L	T	P	C
0	0	3	1.5

DESIGN THINKING AND PRODUCT INNOVATION LAB

Course Objectives	
1	To develop products/models by 3D printing
2	To design measuring devices for temperature, pressure, humidity, water level, smart lighting.
3	To design pneumatic and hydraulic circuits

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 (Two Exercises).
2. To design a device for measurement of Temperature/ pressure.
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/ safety issues in Auto mobiles.
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	
CO1	To develop 3D models using 3D printing
CO2	To design the system with measuring devices
CO3	To design hydraulic / pneumatic circuits

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 3

L	T	P	C
2	1	0	0

ENVIRONMENTAL SCIENCE
(Common to All Branches)

OBJECTIVE: *To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.*

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : 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: 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)

BIODIVERSITY AND ITS CONSERVATION : Introduction 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-sports 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, 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

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. – 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 – V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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.

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, and birds – river, hill slopes, etc..

TEXT BOOKS :

(1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palaniswamy – Pearson education
(3) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES :

(1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.

(3) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Pubilishing House
(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
Course Structure for 2nd Year B.Tech

Semester – 4 (Theory - 6, Lab –2)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**Thermal Engineering**	**PCC**	**2-1-0**	**3**
2.		**Kinematics of Machinery**	**PCC**	**2-1-0**	**3**
3.		Mechanics of Materials	PCC	2-1-0	3
4.		Fluid Mechanics& Hydraulic Machinery	PCC	2-1-0	3
5.		Numerical Methods &Probability Theory	BSC/ESC	2-1-0	3
6.		**Machine Tools**	**PCC**	**2-1-0**	**3**
7.		Universal Human Values	HSMC	2-0-0	2
8.		Mechanics of Materials Lab	PCC	0-0-3	1.5
9.		Fluid Mechanics& Hydraulic Machinery Lab	PCC	0-0-3	1.5
10.		**Biology for Engineers**	**MC**	**2-1-0**	**0**
				Total	**23**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

THERMAL ENGINEERING

L	T	P	C
2	1	0	3

To impart knowledge on

Course Objectives	
1	Rankine cycle and efficiency enhancement methods
2	Steam Generators, Compressors, Nozzles, and Turbines
3	Various Gas Power cycles and Concept of Jet Propulsion

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.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Illustrate the power generation through Rankine cycle.
- Understand efficiency enhancement methods of Reheating and regeneration.

UNIT -II

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

Air Compressors - Reciprocating Compressor, Single Stage multistage compressor, problems related to Reciprocating Compressor, Axial, Centrifugal, Rotary & Screen Compressor.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Understand the working principles of different high pressure and low pressure boilers.
- Understand the working principles of different Air Compressors.

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.

Condensers: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Distinguish the ideal flow and actual flow through nozzle.
- Know the importance of maximum discharge through nozzle.
- Entail the concept of Critical pressure ratio in calculations.
- Understand the effect of meta stable flow/ super saturation flow through nozzle.
- Understand the Concept of condensers

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.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Distinguish the working of impulse and reaction turbines.
- Construct the velocity triangle and combined velocity triangle.

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, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

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.

Unit Outcomes:

After completion of this Unit, the student will be able to

- Familiar with the basic components of a gas turbine power plant.
- Illustrate the power generation using Joule Cycle.
- Know the methods to increase the specific power output and efficiency of the cycle.
- Know the working of various propulsive devices.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Able to Understand the Rankine cycle and efficiency enhancement methods.
CO2	Able to Understand the working of boilers and air compressors.
CO3	Able to Explain the flow through steam nozzles.
CO4	Able to Determine the efficiency of the impulse and reaction turbine using velocity triangles.
CO5	Able to Analyze gas turbines cycles and compare the operational aspects of jet engines.

Text Books:

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

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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2^{nd} Year B.Tech. - Semester – 4

KINEMATICS OF MACHINERY

L	T	P	C
2	1	0	3

Course Objectives:
The objectives of this course are to

Course Objectives	
1	Introduce various basic mechanisms and applications
2	Explain different exact and approximate straight line motion mechanisms.
3	Explain the concept of instantaneous center
4	Familiarize the concept of velocity and acceleration of different points on a link
5	Describe cams and followers and their motions.
6	Introduce the gears, gear trends and their applications

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 Outcomes:
At the end of this unit the student will be able to

- Contrast the difference between machine and structure
- Identify the different types of kinematic pairs and kinematic chains
- Identify the inversion of four bar mechanism

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, Ackermann‟s steering gear. Hooke‟s Joint (Universal coupling) – Single and double Hooke‟s joint — applications – Simple problems.

Unit Outcomes:
At the end of this unit the student will be able to

- Identify the difference between exact and approximate mechanism

- Explain the working principles of different mechanisms
- Understand the functions of steering gear mechanisms
- Understand the difference between Davi"s and Ackerman"s steering gear mechanism

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, and determination of Coriolis component of acceleration. Klein"s 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 centers in-line theorem – Locating instantaneous centers for simple mechanisms and determination of angular velocity of points and links.
Unit Outcomes:
At the end of this unit the student will be able to
- Draw the velocity and accelerations for different configurations.
- Find the velocity and accelerations of different points on and away from different links
- Understand the concept of instantaneous centres
- Find the velocity of different points on the links and angular velocities of different links using instantaneous centres method.

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, Simple problems.
Unit Outcomes:
At the end of this unit the student will be able to
- Understand the phenomenon of interference
- Find the relative merits and demerits tooth profiles
- Understand principle of operation of different gear trains for different purpose
- Find velocity ratio and torques for different gear traind.

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.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the cam terminology
- Draw the cam profile for different types of follower motion
- Find the velocity and acceleration of the follower for different types of follower motion

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	An understanding of concepts of different of mechanism with lower pairs and higher pairs.
CO2	Gain the knowledge of different types of straight line motion mechanism and steering gear mechanism
CO3	Obtain an in depth knowledge of finding displacement velocity and acceleration of different points on different mechanisms using different methods (relative velocity, instantaneous methods).
CO4	Acquire the knowledge on different gear profiles and calculating the different parameters of gears
CO5	Gain the knowledge in designing of gear trains for the required purpose. Design and analyze different cam profile for different types of followers

TEXT BOOKS:

1. S.S. Rattan, "Theory of Machines", Tata McGraw Hill Publishers.
2. J.E. Shiegley "Theory of Machines", McGraw Hill .

REFERENCES :

1. R.S. Khurmi& J.K. Gupta "Theory of Machines", S. Chand Pub.
2. R.K.Bansal and J S Brar, "Theory of Machines", Laxmi Publications.
3. Thomas Bevan, "Theory of Machines", CBS.
4. J.S. Rao and R.V. Dukkipati, Mechanism and Machine Theory, New Age
5. R.L Norton. "Kinematics and dynamics of machinery" ,Tata McGraw Hill Publishers

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

MECHANICS OF MATERIALS

Course Objectives:

- 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 – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers for simple loading cases.

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.

Course Outcomes:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

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) Mechanics of Materials by Swaroop Adarash, New Age Publications

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 S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2ndYear B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Objectives:

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

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

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.

Course Outcomes:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. Standard book house
2. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.
3. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &Sons
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

NUMERICAL METHODS, PROBABILITY AND STATISTICS

(Common to CIVIL, MECHANIACAL& CHEMICAL)

Course Objective:

This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO 1 : Acquire knowledge in basic concepts such as

a. Numbertheory.
b. Congruences and itsproperties.
c. Divisibilitytests.
d. Finitefields.
e. Cryptology.

CO 2 Develop skills in analyzing the

a. Representation of integers and its application in computerscience.
b. Linearcongruences.
c. Pseudoprimes
d. Factorization and factorbases.
e. Key management incryptography.

CO 3 Develop skills in designing mathematical models for

a. Problems on primenumbers.
b. Linearcongruences
c. The sum and number of divisors of a giveninteger.
d. Finding factorization of the giveninteger.
e. Different encryptionmechanisms.

CO 4 Develop analytical skills in solving the problems involving

a. CGD, factorization of integer, linear Diophantineequations.
b. System of linearcongruences
c. Storage and hashfunctions.

d. Quadratic residues.
e. Various public keycryptography algorithms.

CO 5 Use relevant mathematical technique for evaluating

a. Factorization ofintegers.
b. Solution for the given system of linearcongruences.
c. Cipher text using different named algorithms such as RSA, Public –key cryptography, discrete logarithm, knapsack ciphersetc.

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	P O3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	P S O 2	P S O 3	P S O 4	P S O 5
CO1	3	1	-	-	-	1	-	-	2	1	-	-					
CO2	1	3	-	-	-	1	-	-	2	2	-	-					
CO3	1	3	2	-	-	1	-	-	2	2	-	-					
CO4	1	1	1	3	-	1	-	-	2	1	-	-					
CO5	1	1	1	1	-	1	-	-	2	1	-	-					

Correlation Levels: High - 3 Medium – 2 Low - 1

Unit-I: Solution of Algebraic & Transcendental Equations:
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson methodSystem of Algebraic equations: Gauss Jordan method-Gauss Siedal method.
Unit Outcomes:
Students will be able to
- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

Unit-II: Interpolation
Finite differences-Newton‟s forward and backward interpolation formulae – Lagrange‟sformulae. Gauss forward and backward formula, Stirling‟s formula, Bessel‟s formula.
Unit Outcomes:
Students will be able to
- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton‟s forward and backward formulae.
- Derive interpolating polynomial using Lagrange‟s formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

Unit-III: Numerical Integration & Solution of Initial value problems to Ordinary differential equations

Numerical Integration: Trapezoidal rule – Simpson‟s 1/3 Rule – Simpson‟s 3/8 RuleNumerical solution of Ordinary Differential equations: Solution by Taylor‟s series-Picard‟sMethod of successive Approximations-Modified Euler‟s Method-Runge-Kutta Methods.

Unit Outcomes:

Students will be able to

- Solve integral equations using Simson‟s 1/3 and Simson‟s 3/8 rule.
- Solve integral equations using Trapezoidal rule.
- Solve initial value problems to ordinary differential equations using Taylor‟s method.
- Solve initial value problems to ordinary differential equations using Euler‟s method and Runge Kutta methods.

Unit-IV: Probability theory:

Probability, probability axioms, addition law and multiplicative law of probability, conditionalprobability, Baye‟s theorem, random variables (discrete and continuous), probability densityfunctions, properties, mathematical expectation.

Unit Outcomes:

Students will be able to

- Understand the concept of Probability.
- Solve problems on probability using addition law and multiplication law.
- Understand Random variables and probability mass and density functions.
- Understand statistical constants of random variables.

Unit-V: Random variables & Distributions:

Probability distribution - Binomial, Poisson approximation to the binomial distribution andnormal distribution-their properties-Uniform distribution-exponential distribution

Unit Outcomes:

Students will be able to

- Understand Probability distribution function.
- Solve problems on Binomial distribution.
- Solve problems on Poisson distribution.
- Solve problems on Normal distribution.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Ronald E. Walpole "Probability and Statistics for Engineers and Scientists", ,PNIE.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

L	T	P	C
2	1	0	3

MACHINE TOOLS

Course Objectives:

Course Objectives	
1	To understand the tool materials, tool geometry and theory of metal cutting
2	To make student familiar with various operations on lathe and automatic lathe machines
3	To make the students familiar with the drilling, boring, shaping, slotting and planning operations
4	To make the students familiar with different types milling and grinding operations.
5	To know the use of jigs and fixtures for different machine operations

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, coolants, machinability – economics of machining, cutting Tool materials and cutting fluids –types and characteristics .

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation.
- Understand 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 and tool layout.

Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic concepts and operations on lathe machines.
- Familiar with various accessories used in lathe machines.
- Understand the different constructions of lathes 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.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the basic principles and operation of drilling, boring, Shaping, Slotting and planning machines.
- Familiar with machining time calculations, tool holding devices and parts of the drilling, boring, Shaping, Slotting and planning machines.

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 – comparison of grinding, lapping and honing, machining time calculations.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the principle of milling, grinding, lapping , honing and broaching operations.
- Familiar with parts 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 Unit built machine tools – multispindle heads. Power units-principal of working types of UBMTS, characterization and applications.

Unit Outcomes:

At the end of this unit the student will be able to

- Understand the design of jigs and fixtures and uses
- Understand the classification of jigs and fixtures, principle of location and clamping
- Familiar with examples of jigs and fixtures.

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Understand the cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting
CO2	Identify basic parts and operations of lathe, turret and capstan lathes and Automatic lathes
CO3	Understand the principles of parts and operation on machine tools like drilling, boring, shaper, slotting planer
CO4	Know the different types of milling, grinding machines and finishing operation and its application
CO5	Design jigs and fixtures, locating and clamping devices to produce a component.

Text Books:

1. Workshop Technology – Vol II, B.S.Raghu Vamshi, Dhanpat Rai & Co, 10th edition, 2013
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition

Reference Books:

1. Manufacturing Technology-Kalpakzian- Pearson
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st 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, Wiley Edn,2013
8. Machine Technology Machine tools and operations by Halmi A Yousuf &Harson, CRC Press Taylor and Francies .

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

UNIVERSAL HUMAN VALUES

(Common to all)

L	T	P	C
2	0	0	2

Introduction:

This course discusses the role of human values in one"s family. It very briefly touches issues related to their role in society and nature, which need to be discussed at length in one more semester for which the foundation course name as"H-102 Universal Human Values 2 : "Understanding Harmony" is designed. This may be covered in their III or IV Semester of their B.Tech study.

In the Induction Programme, students would get an initial exposure to human valuesthroughUniversalHumanValues–I.Thisexposureistobeaugmentedby this compulsory full semester foundationcourse.

Course Objective:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society andnature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
- Strengthening ofself-reflection.
- Development of commitment and courage toact.

COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Unit 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; „Natural Acceptance" and Experiential Validation- as the process for self-exploration

- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2:

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient „I" and the material „Body"
- Understanding the needs of Self („I") and „Body" - happiness and physical facility
- Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of „I" and harmony in „I"
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam andHealth.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one"s own life. Differentiate between prosperity and accumulation. Discuss programme for ensuring health Vs dealing with disease

Unit 3:

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‟ lives.

Unit 4:

Understanding Harmony in Nature and Existence - Whole existence as Coexistence

- Understanding harmony in Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation innature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasivespace
- Holistic perception of harmony at all levels ofexistence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit 5:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of humanvalues
- Definitiveness of Ethical HumanConduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic UniversalOrder
- Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems c. Ability to identify and develop appropriate technologies and management patterns for above productionsystems.
- Case studies of typical holistic technologies, management models and productionsystems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions andorganizations
- Sum up.

Text Book

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, “Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. A.N.Tripathi, “HumanValues”, NewAgeIntl.Publishers,NewDelhi,2004.
3. The Story of Stuff(Book).
4. MohandasKaramchandGandhi “TheStoryofMyExperimentswithTruth”
5. E. F. Schumacher. “Small is Beautiful”
6. SlowisBeautiful–CecileAndrews
7. J C Kumarappa “Economy of Permanence”
8. PanditSunderlal“Bharat Mein Angreji Raj”
9. Dharampal, “Rediscovering India”
10. Mohandas K.Gandhi, “Hind Swaraj or Indian Home Rule”
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

OUTCOME OF THECOURSE:

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life. At least a beginning would be made in thisdirection.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

II Year B.Tech. M.E. II-Sem

MECHANICS OF MATERIALS LAB

L	T	P	C
0	0	3	1.5

Course Objectives: The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures.

LIST OF EXERCISES:

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test.
5. Hardness test.
6. Shear test

Course Outcomes:

- Ability to perform different destructive testing.
- Ability to characteristic materials.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

II Year B.Tech. M.E. II-Sem

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

- The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

LIST OF EXERCISES:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

Course Outcomes:

- Ability to use the measurement equipments for flow measurement.
- Ability to do performance trust on different fluid machinery.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
2nd Year B.Tech. - Semester – 4

BIOLOGY FOR ENGINEERS

L	T	P	C
2	1	0	0

Course Objectives:

Course Objectives	
1	To provide basic understanding about life and life Process. Animal and plant systems
2	To understand bio molecules, their structures, functions and Applications
3	Brief introduction about human physiology and bioengineering
4	To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
5	Applications of biological Principles applied in our daily life using different technologies
6	Brief introduction to the production of transgenic microbes, Plants and animals.

Unit I: Introduction to Basic Biology
Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes.Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief
introduction to five kingdoms of classification.
Unit Outcomes:
After completing this unit, the student will be able to
- Summarize the basis of life.
- Understand the difference between lower organisms (prokaryotes) from higher organisms(eukaryotes).
- Understand how organisms are classified.

Unit II: Introduction to Biomolecules
Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and theirtypes. Enzymes, Enzyme application in Industry. Large scale production of enzymes byFermentation.
Unit Outcomes:
After completing this unit, the student will be able to
- Understand what are bio molecules? Their role in living cells, their structure, function and how they are produced.
- Interpret the relationship between the structure and function of nucleic acids.
- Summarize the applications of enzymes in industry.
- Understand what is fermentation and its applications of fermentation in industry.

Unit III: Human Physiology
Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic andanaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what nutrients are
- Understand the mechanism and process of important human functions

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription andTranslation. DNA technology. Introduction to gene cloning.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand and explain about gene structure and replication in prokaryotes andEukaryotes
- How genetic material is replicated and also understands how RNA and proteins aresynthesized.
- Understand about recombinant DNA technology and its application in differentfields.
- Explain what is cloning.

Unit V: Application of Biology

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins,Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basicsof Production of Transgenic plants and animals.

Unit Outcomes:

After completing this unit, the student will be able to Understand.

- How biology is applied for production of useful products for mankind.
- What are biosensors, biochips etc.
- Understand transgenic plants and animals and their production

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
CO2	Explain about biomolecules, their structure and function and their role in the living organisms. How biomol ecules are useful in Industry.
CO3	Briefly about human physiology
CO4	Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms
CO5	Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals

Text books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications -
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A Global Approach”, Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011

3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology –- 2014.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

III.B.Tech I Semester (R19)

Semester – 5 (Theory - 6, Lab –3)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Heat Transfer	PCC	2-1-0	3
2.		Dynamics of Machinery	PCC	2-1-0	3
3.		Operation Research	PCC	2-1-0	3
4.		**(Professional Elective-I)** 1. Power Plant Engineering 2. Alternative Fuels for IC Engines 3. Material handling Equipments	PEC-I	2-1-0	3
5.		**(Open Elective-I)** **1.** Optimization Techniques	OEC-I	2-1-0	3
		2. Energy Management		2-1-0	
		3. Rapid Prototyping		2-1-0	
		4. Python Programming		2-0-2	
6.		Design of Machine Members-I	PCC	2-0-0	2
7.		Thermal Engg. Lab	PCC	0-0-3	1.5
8.		Exploratory Data Analysis Lab	HSMC	0-0-3	1.5
9.		Machine Tools Lab	PCC	0-0-2	1
10.		Socially Relevant Project	PR	0-0-1	0.5
11.		Research Methodology	MC	3-0-0	0
				Total	**21.5**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

HEAT TRANSFER

Course Objectives

- 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.
- To understand the phenomenon of boiling and condensation to familiarize the mass transfer process

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 – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation.

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.

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.

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: Film wise and Drop wise 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.

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.

Course Outcomes

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

- Apply the concepts of different modes of heat transfer.
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes.
- Analyze free and forced convection phenomena in external and internal flows

- Design a heat exchanger for a given application.
- Design of thermal shields using the concepts of black body and non-black body radiation

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

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, Kondandaraman, 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.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

DYNAMICS OF MACHINERY

Course Objectives:

- To introduce to the basic concepts of friction and to analyze its effects on different applications.
- To understand the principles of gyroscopic effects and to analyze its effect on different applications.
- To impart knowledge on the principles in mechanisms used for governing of machines
- To analyze the machines on unbalanced forces and to determine their effects on them.
- To impart the knowledge on modeling and analysis of vibration behavior of different systems.

UNIT I

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

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.

UNIT II

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

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.

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.

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 inline and radial engines for primary and secondary balancing.

UNIT V

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

Course Outcomes:

At the end of the course student will be able to

- Apply the principles of friction on applications such as brakes and clutches.
- To apply the gyroscopic effect to stabilize aeroplanes, ships, two and four wheeled vehicles etc.
- To analyze different forces acting on governors and estimate the equilibrium speed of the engine.
- To estimate the magnitude of the unbalanced force in the system and determine the suitable balancing force/mass.
- To find the critical parameters of vibration of the system.

TEXT BOOKS:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.

2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

REFERENCES:

1. Theory of machines, thomas bevan, pearson, 3rd edition,2012.

2. The theory of machines, j.e. shiegley, mcgraw hill .

3. Theory of machines and mechanisms of shigley et.al. Oxford international student edition.

4. Theory of machines by r.s khurm, s.chand publications

NOTE: *End Exam should be conducted in Drawing Hall*

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

OPERATIONS RESEARCH

Course Objectives:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.
- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
- Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
- Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.
- Mathematical models for analysis of real problems in Operations Research.

UNIT- I

Introduction to OR and Linear Programming-, 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;

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 -Travelling Salesman problem.

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.

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 Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time.

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.

Course Outcomes:

CO1 Be able to understand the application of OR and frame a LP Problem with solution – graphical and through solver add in excel (software).
CO2 Be able to build and solve Transportation and Assignment problems using appropriate method.
CO3 Be able to design and solve simple models of CPM and queuing to improve decision making and develop critical thinking and objective analysis of decision problems.
CO4 Be able to solve simple problems of replacement and implement practical cases of decision making under different business environments .
CO5 Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

Text Books:

1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.

2. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Geralld J. Lieberman, TMH, 9th edition,2011.

References:

1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.

2. Operations Research, Wagner, PHI Publications , 2nd edition.

3. Operation Research, J.K.Sharma, MacMilan, 5th edition, 2013.

4. Linear Programming, Susy Phillippose, PHI

5. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.

6. Operations Research: Methods & Problems , Maurice Saseini, Arhur Yaspan& Lawrence

Friedman

7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

Power Plant Engineering (Professional Elective-I)

Course Objectives:

1. Apply knowledge of mechanical engineering related to power generation systems.
2. Control and economics in different type of power plants for their operation and maintenance.
3. To introduce students to different aspects of power plant engineering.
4. To familiarize the students to the working of power plants based on different fuels.
5. To expose the students to the principles of safety and environmental issues.

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.

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, 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.

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.

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.

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.

Course Outcomes:

1. Analyze the efficiency and output of modern Rankin cycle steam power plants with superheat, reheat, regeneration, and irreversibilities.
2. Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.
3. Explain the major types of steam, hydro, nuclear, tidal power plants and
4. Estimate power generation potential.
5. Scope of employability in various power plants

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. Power plant Engineering, Ramalingam, Scietech Publishers
2. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.
3. A Text Book of Power Plant Engineering, Rajput , Laxmi Publications, 4th edition, 2012.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III B.Tech I- SEMESTER

L	T	P	C
2	1	0	3

ALTERNATIVE FUELS FOR I.C. ENGINES
(Professional Elective-I)

Course Objectives

1 To expose potential alternate fuels and their characteristics

2 To use appropriate synthetic fuels and fuel additives for better combustion characteristics

3 To utilise alcohol fuels effectively for lower emissions

4 To elaborate on the utilisation of Bio-Diesel and its types as a suitable fuel in CI engines

5 To utilise different gaseous fuels and predict their performance and combustion characteristics

UNIT-I

Introduction: solid fuels, gases fuels, liquid fuels, chemical structure of petroleum, petroleum refining process, important requisite qualities of engine fuels, SAE rating of fuels.

UNIT-II

FUELS: Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, Producer gas, Bio gas and Vegetable oils - Use in I.C.Engines-Merits and Demerits of various fuels.

UNIT-III

ALCOHOL FUELS: Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle -Reformed alcohols.
Alcohols in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines - Surface ignition engines - Ignition accelerators - Manufacture of alcohol fuels.

UNIT-IV

GASEOUS FUELS: Hydrogen - Properties - Use in C.I Engines - Use in S.I Engines - Storage methods - Safety precautions -Production methods.
Production of Producer gas and bio gas - Raw materials - Gasification - Properties - Cleaning up the gas -Use in S.I. and fuel engines, LPG & Natural gas - Properties - Use in S.I. and C.I. Engines.

UNIT-V
VEGETABLE OILS: Properties - Esterification - Performance in Engines.
FUEL QUALITY: Fuel quality standards for Automotive Engines - Lead free gasolines, low and ultra -low sulphur diesels, LPG, CNG, and Biodiesels.

Course Outcomes

CO1 Categorize, interpret and understand the essential properties of fuels for IC engines

CO2 Identify the need for alternate fuels and characterize prospective alternate fuels

CO3 evaluate the storage and dispensing facility requirements

CO4 Analyze the implement limitations with regard to performance, emission and materials compatibility

CO5 Develop strategies for control of emissions as per the legislation standards

TEXT BOOKS:

1. Internal combustion engines by V . Ganesan, Tata McGraw Hill book cop. 2007
2. Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications,1997.

REFERENCES:

1. Osamu Hirao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and sons, 1988.
2. Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

MATERIAL HANDLING EQUIPMENTS (Professional Elective-I)

Course Objectives:

1. To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.

2. To sensitize the students on the materials management functions – Planning, Purchase,Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing.

3. To realize the importance of materials both in product and service.
4. planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

5. It also aims to explore the layout planning by computer applications following different algorithms.

UNIT-I

Overview of Material Handling: Principles of Material Handling, Principal groups of Material Handling equipment – General Characteristics and application of Material Handling Equipment, Modern trends in material handling.

UNIT-II

Lifting Equipments: Hoist- Components of Hoist – Load Handling attachments hooks, grabs and clamps – Grabbing attachments for bulk material – Wire ropes and chains.

UNIT-III

Lifting tackle pulleys for gain of force and speed: Tension in drop parts – Drums, Shears and sprockets – Arresting gear and brakes – Block brakes, Band brakes, thrust brakes – Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms – Slewing Mechanisms – Elevators and lifts.

UNIT-IV

CONVEYORS: Types - description -applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors

UNIT-V

ELEVATORS: Bucket elevators: Loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes :

1. The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.
2. The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.
3. The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system
4. The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.
5. The students will be able to design of fork lift trucks.

REFERENCES

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

OPTIMIZATION TECHNIQUES (Open Elective-I)

L	T	P	C
2	1	0	3

Course Objectives:

• To introduce various optimization techniques i.e classical, linear programming,

• Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

• Electrical and electronic engineering circuits design problems in real world situations.

• To explain the concept of Dynamic programming and its applications to project

• Learn the knowledge to formulate optimization problems

UNIT - I

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.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : 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,

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Course Outcomes:

After completion of this course, the student will be able to explain the need of optimization of engineering systems

- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm,
- transportation problem apply unconstrained optimization and constrained non-linear programming and
- dynamic programming Formulate optimization problems.

TEXT BOOKS:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

ENERGY MANAGEMENT (Open Elective-I)

Course Objectives:

To impart knowledge on

1. To understand importance of Energy Management.
2. To Carry out Energy Audit.
3. Methods to reduce consumption of energy and save cost.
4. Significance of project management and energy trade prices.
5. To improve energy efficiency of overall system.

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest-Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

Energy Management Programs: Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT – IV

ENERGY AUDITING: Definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

Course Outcomes:

Ability to

- Apply the principles energy management for conservation.
- Describe the energy rate structures.
- Examine the economic evaluation of energy conservation solutions.
- Carry out Energy Audit of the Residence / Institute/ Organization.
- Compare energy scenario of India and World.

Text Books:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

Reference Books:

1. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
2. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
3. The role of Energy Manager, E.E.O., U.K.
4. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
5. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

Rapid Prototyping (Open Elective-I)

Course Objectives:

Impart knowledge on

- Product development using rapid prototyping processes
- Rapid prototyping processes
- Rapid prototyping is a group of methods used to rapidly manufacture a scale model of a physical part or assembly using three-dimensional computer aided design.
- Construction of the part or assembly is usually done using 3D printing technology.
- Rapid prototyping techniques are often referred to solid free.

UNIT-I

Introduction: Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Application.

Selective Laser Sintering: Type of machine, Principle of operation, Process parameters, Data preparation for SLS, Applications.

UNIT-II

Fusion Deposition Modelling: Principle, Process parameter,Path generation, Application

Solid Ground Curing: Principle of operation, Machine details, Applications.

UNIT-III

Laminated Object Manufacturing: Principle Of Operation, LOM materials.
Process details, application.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, Object Quadra systems.

UNIT-IV

LASER ENGINEERING NET SHAPING (LENS)

Rapid Tooling: Indirect Rapid tooling -Silicon rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

UNIT-V

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

Allied Processes: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification-data transfer to solid models.

Course Outcomes:
Ability to

- Select and employ appropriate rapid prototype methods for product development.
- Develop prototypes of products.
- Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications.
- Identify The process photopolymers, photo polymerization, layering technology, laser and laser scanning.
- Applying of measurement and scaling technique for prototype manufacturing.

TEXT BOOKS:

1. Rapid Prototyping and Tooling by Hari Prasad & K.S. Badhrinarayan/ Page Turners
2. Paul F. Jacobs- "**Stereo lithography and other RP & M Technologies**", SME, NY 1996.
3. Flham D.T & Dinjoy S.S - "**Rapid Manufacturing**" Verlog London 2001.
4. Lament wood, "**Rapid automated",** Indus press New York

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	0	2	3

Python Programming (Open Elective-I)

Subject Code	Title of the Subject	L	T	P	C
19A30501	Introduction to Application Development with Python	2	0	2	3

COURSE OBJECTIVES	
1	Study the computer basics , software engineering and network basics , HTML
2	Learn Java features to create applications & perform event handling .
3	Learn the Database and interconnection with java.

COURSE OUTCOMES	
CO1	Ability to know basics of computer and software engineering
CO2	Ability to write Efficient programs of HTML
CO3	Create Tables with the databases and retrieving by using queries.
CO4	Able to design java application and dynamic behavior of classes.
CO5	Design and develop the object oriented programs using pure functions, operator overloading, and Inheritance, set, lists, tuples and dictionary concepts in python.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3		2		1		2	1			3		
CO2	3	3		2							2			3	
CO3	2	3	1			1			3			1			1
CO4	3		2		3					3	3			3	
CO5	3									3				2	

UNIT-1

Introduction to Computer Basics: Computer, Hardware, CPU, Monitor, Keyboard/mouse, Memory, -RAM, Storage, Software, OS, Application, Saving a file, Files and Folders.

Basics of Network: Home and Office Networks,Networking Types and Structures, Wired vs Wireless Networks,Networking Topologies,Networking Topology- Physical vs Logical, Peer to Peer, Client Server, Network Size.

Networking Levels and Layers and Protocols: Network Addressing, Classes of IPv4, Public and Private IP Addresses, What is a Protocol? What is a Protocol Suite?

Protocol Stacks, Networking and Internet Service: IP protocol, DHCP (Dynamic Host configuration Protocol), DNS (domain Name Service), General Networking Physical Component.

Software Engineering Fundamentals : Software Requirement, Problem Recognition, Evaluation and Synthesis, Modeling, Specification, Review, Objectives of Software Design, Software Design Concepts, Different levels of Software Design, Software Design Process, Architectural Design, Structured Programming, Functional Programming, Programming style, Software Documentation, Software Implementation Challenges , Software Validation, Software Verification, Manual Vs Automated Testing, Testing Approaches, Testing Levels, Testing Documentation, Testing vs. Quality Control, Quality Assurance and Audit

Software Engineering Fundamentals & OOP: Overview of Software Maintenance Need for Maintenance, Categories of Software Maintenance.

Overview of Configuration management and version control : What is Software Configuration Management?, Why do we need Configuration management?, Tasks in SCM process, Configuration Identification, Baseline, Change Control, Configuration Status Accounting, Configuration Audits and Reviews, Participant of SCM process, Software Configuration Management Plan, Software Configuration Management Tools.

Agile Basics:

What is Agile?, What are Agile Methodologies?, What is the Agile Manifesto?, What is Agile project management?, Agile Scrum methodology.

OOP :

Object Oriented Concepts Problems in Functional Programming, What Is ObjectOriented Programming? , Objects and Classes Declaration of Class, Declaring Objects, State of an Object, Behaviour of an Object Principles in ObjectOriented technology Abstraction, Encapsulation

OOP & HTML, CSS and JavaScript:

Principles in Object-Oriented technology, Inheritance, Polymorphism

HTML, CSS and JavaScript

Introduction to Web Technology

World Wide Web, IoT, Web Programming, Web Framework, HTML, CSS and JavaScript

Introduction to HTML5: HTML5 Elements, Semantic Elements HTML Overview, HTML Versions, Semantic Web, Semantic Elements in HTML5, <header>, <nav>, <section>, <article>, <aside>, <footer>

Table, List, Working with Links, Image Handling

Define an HTML Table, <table>, <tr>, <td>, <th>, <caption>, Unordered List, Ordered List, Description List, <ul>, <ol>, <li>, <dl>, <dt>, <dd>, Hyperlinks, The target Attribute, Absolute URLs vs. Relative URLs, Use an Image as a Link, Link to an Email Address, <a>, href Attribute, <img>, The src Attribute, The alt Attribute, Image Size - Width and Height, Image as a Link

Form-Input Elements, HTML5 Form elements

The <form> Element, The <input> Element, Text Fields, The <label> Element, Radio Buttons, Checkboxes, The Submit Button

1. List the basic concepts of computer fundamentals(L1)
2. Identify and apply the basic concepts of OOP, HTML, CSS and JavaScript.(L3)

UNIT-II

HTML, CSS and JavaScript:

HTML5 Attributes, Video & Audio, iframes

Standard Attributes, align, background, bgcolor, class, height, hidden, id, style, tabindex, valign, width, Embedding Video, Embedding Audio, Handling Media Events, HTML <iframe> Tag

Introduction to CSS3, CSS Syntax, CSS Styling

What is CSS, Why use CSS, Inline Style, CSS Style Tags, Linking to CSS, Style Override Precedence

Text and Fonts properties, CSS Selectors, Different color schemes

Text Color and Background Color, CSS Text Alignment, Text Direction, Vertical Alignment, Generic Font Families, The CSS font-family Property, Font Style, Font Size

CSS Borders, CSS Margins, CSS Backgrounds

CSS Border Style, The border-style property, Border Width, Border Color, Border Sides, CSS Rounded Borders, margin-top, margin-right, margin-bottom, margin-left, CSS background-color, Opacity / Transparency, CSS background-image, CSS background-repeat

JavaScript basics

Introduction to Javascript, Execution of Javascript, Scripts in head and body of HTML, Internal and External Javascript, Javascript Variables, Comments

Functions in Javascript

JavaScript Function Syntax, Built in methods in Javascript, Function Invocation, Function Return, Why Functions?, The () Operator Invokes the Function, Functions Used as Variable Values, Local Variables

Javascript validation

Client-side form validation, Different types of client-side validation, Using built-in form validation, Validating forms using JavaScript, Validating forms without a built-in API

Events, Javascript event handling

Introduction to JavaScript events, Event flow, Event bubbling, Event capturing, Event object, addEventListener(), preventDefault(), stopPropagation()

JavaScript Strings

String Methods and Properties, String Length, Extracting String Parts, The substring() Method, Replacing String Content, Converting Upper and Lower Case, The concat() Method

JavaScript Dates

JavaScript Date Output, Creating Date Objects, new Date(),new Date(year, month, ...), new Date(dateString), Date Methods, Displaying Dates

Array in Javascript

What is an Array, Creating an Array, Accessing Array Elements, Array Properties and Methods, Looping Array Elements

Document Object Model (Window, Frame, Navigator Objects)

What is Document Object Model (DOM), Node Types, The nodeName and nodeValue properties, Node and Element, Node Relationships

Working with Document Object (Its Properties and methods, Cookie handling)

Selecting Elements, Traversing Elements, Manipulating Elements

RDBMS Concepts and SQL Using Oracle:

Introduction to RDBMS Concepts

What is a Relational Database, The relational model, Benefits of relational database management system, ACID properties and RDBMS ,Introduction to SQL History of SQL, SQL Standards, How SQL Works Creating and Managing Tables , Guidelines for Managing Tables, Creating Tables, Altering Tables, Dropping Tables, Data Manipulation: INSERT, UPDATE, DELETE

1. Analyze and apply the different HTML features to design the web applications(L4)
2. Create the different forms and check for data accuracy using Javascript and RDBMS. (L5)

UNIT-III

RDBMS Concepts and SQL Using Oracle:
Basic SQL SELECT Statements
SELECT, FROM Clause, Comparison Operators, WHERE Clause, ORDER BY, AND, OR, DISTINCT, IN, IS NULL, IS NOT NULL, LIKE, REGEXP_LIKE, NOT, ALIASES
Scalar & Aggregate Functions
String Functions, Numeric Functions, Date Functions, Conversion Functions, NULL-related Functions, AVG, COUNT, MAX, MIN, LISTAGG, SUM
Joins & Subqueries
Oracle INNER JOIN, Oracle LEFT JOIN, Oracle RIGHT JOIN,
Introduction to the Oracle Subquery: Advantages of Oracle Subqueries, Oracle Subquery in the SELECT clause, Oracle Subquery in the FROM clause, Oracle Subquery with comparison operators, Oracle Subquery with IN and NOT IN operators, Oracle correlated Subquery, Oracle correlated Subquery in the WHERE clause, Oracle correlated Subquery in the SELECT clause,
Oracle correlated Subquery with the EXISTS operator
Views & Index
What is a VIEW in Oracle, Create VIEW, Update VIEW, DROP VIEW, What is an Index in Oracle, Create an Index, Create a Function-Based Index, Rename an Index, Drop an Index
RDBMS Concepts and SQL & Introduction to Java:
Sequence, Synonym
About Sequences, Creating Sequences, Altering Sequences, Using Sequences, Dropping Sequences
About Synonyms, Creating Synonyms, Using Synonyms in DML Statements, Dropping Synonyms
Data Control Language Statements , GRANT, REVOKE

1. Create the SQL statements that edit existing data. (L5)
2. Explain and Design the SQL statements that create database objects.(L6)

UNIT-IV:
Introduction to Python : Type Conversion, I/O and import, Operators, Namespace, Modules in Python, Python DateTime.

Classes and Objects: What Are Classes and Objects in Python? Advantages of Using Classes in Python, Defining a Class in Python, Creating an Object in Python, The self, The_init_() function in Python, Python Inheritance and its Types.

Strings: Creating a String in Python, Accessing Python String Characters, Deleting/Updating from a String, Escape Sequencing in Python, Formatting of Strings, Python Operators for Strings, Builtin Python String Methods

1. Solve the problems by applying modularity principle(L3)
2. Design programs for manipulating strings (L6)

UNIT-IV:

Lists: Python Lists, Accessing Values in Lists, Updating Lists, Delete List Elements, Basic List Operations, Indexing, Slicing, and Matrixes, Built-in List Functions & Methods

Sets: Set commands, Create a set in Python, Iteration Over Sets, Add member(s) in Python set, Remove item(s) from Python set, Intersection of sets, Union of sets, set difference in Python, Clear sets.

Tuples: What is Tuple? Accessing Values in Tuples, Updating Tuples, Delete Tuple Elements, Basic Tuples Operations, Indexing, Slicing, and Matrixes, Built-in Tuple Functions.

Dictionary: What is Dictionary? Accessing Values in Dictionary, Updating Dictionary, Properties of Dictionary Keys, Built-in Dictionary Functions & Methods.

1. Analyze and Apply modifications to PYTHON programs that solve real-world problems. (L4)
2. Use data structure dictionaries (L3)
3. Organize data in the form of sets, tuples and dictionary (L6)

Text books:

Reference Books:

1. Introduction to Application Development with Python, Learning Reference Guide
2. Think Python How to Think Like a Computer Scientist 2nd Edition, Version 2.4.0, Allen Downey Green Tea Press
3. LEARNING TO PROGRAM WITH PYTHON Richard L. Halterman.
4. https://www.tutorialspoint.com/basics_of_computers/bas ics_of_computers_introduction.htm
5. https://courses.lumenlearning.com/santaanainformationsystems/chapter/networking-introduction
6. https://www.javatpoint.com/network-addressing
7. https://whatis.techtarget.com/definition/Internet-Protocolsuite-IP-suite
8. https://docs.microsoft.com/en-us/windowsserver/networking/technologies/dhcp/dhcp-top
9. https://www.guru99.com/c-sharp-inheritance-polymorphism.html
10. https://www.tutorialspoint.com/html5/html5_attributes.htm
11. https://www.geeksforgeeks.org/introduction-to-javascript/
12. https://www.javascripttutorial.net/javascript-dom
13. https://www.techonthenet.com/oracle/synonyms.php
14. https://www.programiz.com/python-programming/input-outputimport

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
2	0	0	2

DESIGN OF MACHINE MEMBERS-I

Course Objectives:

- To introduce the basic principles of mechanical design and their applications
- Enable students to attain the basic knowledge required to understand select machine elements
- To apply principles of machine component to satisfy functional and strength requirements.
- To analyze the cotter joints and shafts.
- To apply the design concepts to mechanical components

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 – Tensional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

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.

UNIT – III

Design of Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

Design Of 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.

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.

UNIT-V

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

Course Outcomes:
Able to

- Analyse stresses acting on components and determine the size based on theories of failure.
- Decide specifications as per standards given in design data and select standard components to improve interchangeability.
- inculcate an ability to design cotter joints and shafts
- Design machine components for a given load condition using design data hand books.
- to design keys and couplings.

Text Books:

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
2. Machine Design,Schaum's series,TMH Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
2. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, NewDelhi.
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 McGraw Hill Publishers
7. Machine Design by Groover – CBS Publications.

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

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	1.5

THERMAL ENGINEERING LAB

Course Objective

1. To impart practical exposure of various thermal engineering systems
2. To study the concepts, applications of the thermal engineering laboratory
3. To demonstrate and conduct experiments, interpret and analyze results of IC Engine testing.
4. To develop an idea of fuel properties and their variation with temperature.
5. To determine kinematic viscosity and calorific value of fuels.

1. Valve / Port Timing Diagrams of an I.C. Engines

2. Performance Test on a 4 -Stroke Diesel Engines

3. Performance Test on 2-Stroke Petrol engine

4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine

5. Retardation and motoring test on 4- stroke engine

6. Heat Balance of an I.C. Engine.

7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.

8. Performance Test on Variable Compression Ratio Engines, economical speed test.

9. Performance Test on Reciprocating Air – Compressor Unit

10. Study of Boilers

11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

Course Outcomes

CO1 Evaluating the Air/Fuel Ratio and Volumetric efficiency of an I.C.Engines & Performance of Air - Compressors

CO2 Appreciate the Mechanism of ports /Valves functioning in 2-stroke petrol /Diesel engine and to understand IC Engine Assembly

CO3 Evaluating the performance characteristics of single cylinder petrol engine at different loads and single cylinder diesel engine at different loads and draw the heat balance sheet

CO4 Understand the method of finding the indicated power of individual cylinders of an engine by using morse test

C05 Understand the working and various components of Boilers

JNTUACEA **R-19**

2019-2020

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	1.5

EXPLORATORY DATA ANALYSIS LAB

Course Objectives:

- Focuses on analyzing and summarizing the main characteristics of data sets including visual methods.
- Explores techniques for formulating hypothesis about data for testing and for new data collection and experiments

List of lab assignments:

1. The basics of analytic graphics and the base plotting system in R.
2. Advanced graphing systems available in R: the Lattice system and the ggplot2 system
3. Clustering and dimension reduction techniques to make graphical displays of very high dimensional data
4. A complete EDA Analysis using R
5. Plotting and Coloring in R

Course Outcomes:

Upon completion of this course, learners will be able to:

- Use the R programming language with relative facility
- Command the use of the basic Plotting Systems used in R
- Analyze Data Sets using the Principles of Exploratory Data Analysis
- Explain the Visual Information contained in the R-generated Graphs
- Explain and present the Findings in the Data Sets, after the Analysis is complete

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L	T	P	C
0	0	2	1

MACHINE TOOLS LAB

Course Objectives::

1. Demonstration of construction & operations of general purpose machines
2. Know the working principles of different instruments.
3. Familiarize different machine tools used in production floor.
4. Impart hands on experience on lathe, drilling, shaping, milling, slotting, grinding and tool and cutter grinding machines.

List of Experiments:

1. Job on Step turning and
2. 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 Planing
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.
10. Study of Injection Moulding Machine.

Course Outcomes:

- Perform step, taper turning, knurling and threading.
- Produce stepped surface using shaper and keyway using milling machine
- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations.
- Ability to manufacture tools using cutter grinder.

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L	T	P	C
0	0	1	0.5

SOCIALLY RELEVANT PROJECT

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

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L	T	P	C
3	0	0	0

RESEARCH METHODOLGY

Subject Code	Title of the Subject	L	T	P	C
	Research Methodology	3	0	0	0

COURSE OBJECTIVES : The objective of this course is

1	To understand the basic concepts of research and research problem
2	To make the students learn about various types of data collection and sampling design
3	To enable them to know the method of statistical evaluation
4	To make the students understand various testing tools in research
5	To make the student learn how to write a research report
6	To create awareness on ethical issues n research

Syllabus

UNIT I Introduction to Research

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:- After completion of this unit student will

- Understand the concept of research and its process
- Explain various types of research
- Know the steps involved in research design
- Understand the different research approaches

UNIT IISampling 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 Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the concept of sampling and sampling design
- Explain various techniques in measurement and scaling
- Learn various methods of data collection
- Design survey questionnaires for different kinds of research

- Analyze the questionnaires

UNIT III Correlation and Regression Analysis

Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

LEARNING OUTCOMES:-After completion of this unit student will

- Know the association of two variables
- Understand the importance of correlation and regression
- Compare and contrast correlation and regression
- Learn various types of correlation
- Apply the knowledge of C&R Analysis to get the results

UNIT IV Statistical Inference

Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

LEARNING OUTCOMES:-After completion of this unit student will

- Know the statistical inference
- Understand the hypothesis testing procedure
- Compare and contrast Parametric and Non-parametric Tests
- Understand the use of chi-square test in investigating the distribution of categorical variables
- Analyze the significance of variance and covariance

UNIT VReport 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:-After completion of this unit student will

- Learn about report writing
- Understand how to write research paper
- Explain various techniques of interpretation
- Understand the importance of professional ethics in research
- Design a scientific paper to present in the conferences/seminars
-

Text books:

1. Research Methodology:Methods and Techniques – C.R.Kothari, 2nd Edition, New Age International Publishers.
2. Research Methodology: A Step by Step Guide for Beginners- Ranjit Kumar, Sage Publications

REFERENCES:

1. Research Methodology and Statistical Tools – P.Narayana Reddy and G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.
2. Business Research Methods–Donald R. Cooper & Pamela S Schindler, 9/e,
3. S C Gupta, Fundamentals of Statistics,7th Edition Himalaya Publications

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the basic concepts and its methodologies
CO2	Understand the concept of sampling, research design etc.
CO3	Demonstrate the knowledge of research processes
CO4	Analyze the importance of research articles in their academic discipline
CO5	Select appropriatetesting toolsused in research
CO6	Design a research paper without any ethical issues

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

III.B.Tech II Semester (R19)

Semester – 6 (Theory - 6, Lab –2)					
S.No	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Modern Manufacturing Methods	PCC	2-1-0	3
2.		Design of Machine Members-II	PCC	2-1-0	3
3.		English Language Skills	HSMC	3-0-0	3
4.		**(Professional Elective-II)** 1. Automobile Engineering 2. Turbo Machinery 3. Productions and Operations Management	PEC-II	2-1-0	3
5.		**(Open Elective-II)** 1. Solar Energy Systems 2. Introduction to Electric and Hybrid Vehicles 3. Industrial Engineering	OEC-II	2-1-0	3
6.		**Humanities Elective-I** 1. Managerial Economics and Financial Analysis 2. Entrepreneurship and Incubation 3. Business Ethics and corporate governance	HEC-I	2-1-0	3
7.		Heat Transfer Lab	PCC	0-0-3	1.5
8.		English Language Skills lab	HSMC	0-0-3	1.5
9.		Socially Relevant Project	PR	0-0-1	0.5
10.		Constitution of India	MC	3-0-0	0
Total					**21.5**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

MODERN MANUFACTURING METHODS

Course Objectives:

- To learn the importance and basics of unconventional machining.
- To understand the rapid prototyping processes.
- To have the knowledge of different micro machining methods
- To understand the working principles of various Non-traditional machining methods.
- To learn about Non-traditional forming processes.

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.

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.

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.

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 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.

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.

Course Outcomes:

At the end of this course the student should be able to understand

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

1. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.
2. Advanced machining processes, VK Jain, Allied publishers.

REFERENCES:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian, Pearson
3. Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

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DESIGN OF MACHINE MEMBERS– II

Course Objectives:

- To impart knowledge and skills in applying elementary design principles, basic design procedures and use of design data for the design of mechanical elements.
- To provide knowledge about the concepts, procedures and the data, to design and analyse machine elements in power transmission systems.
- To impart competency to specify, select and design the mechanical components for transmission systems.
- To Design mechanical machine components

UNIT -I

Design Of Curved Beams: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

Design Of Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT- II

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.

Design Of Power Screws: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT- III

Design Of Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT -IV

Design Of Spur & Helical Gears: Spur gears- Helical gears – 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.

UNIT- V

Design of IC Engine Parts: Pistons– Construction, Design of piston. Cylinder, Cylinder block, Connecting Rod, Crank shafts- Centre cranks.

Course Outcomes:
Student will be able to

- Identify the working principles of mechanical components employed in mechanical transmission systems.
- Apply suitable theories and basic engineering principles and procedures to design the transmission elements.
- Select appropriate engineering design data from standard data books for the design of mechanical transmission components.
- Design the transmission systems components for given conditions using Design data hand book.
- Design the engine parts

Text Books:

1. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9th edition, 2010.

2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

References:

1. Machine Design, Schaum"s series, TMH Publishers, New Delhi, 1st edition, 2011

2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013.

3. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi

4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.

5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.

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ENGLISH LANGUAGE SKILLS

Subject Code	Title of the Subject	L	T	P	C
	English Language Skills	3	0	0	3

Course Description:

English Language Skills aims to enable the engineering students to meet the demands of the modern job market through thorough training in LSRW skills, presentation skills, interview skills, academic writing etc. Students of our region have knowledge of their respective subjects, but the surveys make it clear that they are lagging behind in expressing themselves effectively in a professional setting. So this course will enable them to hone these skills and excel in their respective fields.

COURSE OBJECTIVES	
1	To develop awareness in students of the relevance and importance of technical communication and presentation skills.
2	To prepare the students for placements
3	To sensitize the students to the appropriate use of non-verbal communication
4	To train students to use language appropriately for presentations and interviews
5	To enhance the documentation skills of the students with emphasis on formal and informal writing

COURSE OUTCOMES	
CO1	To recall and memorize the basic concepts of effective communication
CO2	To understand the various components of effective communication.
CO3	To apply writing skills in order to meet the demands of work place environment.
CO4	To analyze verbal and non-verbal interpretations in multicultural context.
CO5	To evaluate different aspects of verbal and linguistic competence to become effective presenters.
CO6	To design and develop an effective written documents in technical domain.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										
CO2				✓								
CO3		✓										
CO4							✓					
CO5		✓										
CO6												

SYLLABUS

UNIT 1: LSRW SKILLS

Introduction to LSRW Skills – Definition – Importance of LSRW Skills - Advantages and Disadvantages of Oral and Written Skills – Advantages and disadvantages of Written & Speaking skills - Barriers to effective communication

OUTCOMES
To recall and memorize the basic concepts of LSRW skills
To understand the various components of oral and written skills
To apply English language skills to avoid barriers to effective communication

UNIT II: VERBAL & NON-VERBAL SKILLS

Informal and Formal Conversation - Non-verbal Skills–Kinesics, Proxemics, Chronemics, Haptics, Oculesics ,Paralinguistic features – Body language for interviews

To understand the basic components of non-verbal communication.
To apply the knowledge of the difference between informal and formal conversation in order to meet the demands of work place environment.
To analyze non-verbal interpretations in multicultural context.

UNIT III: ACADEMIC WRITING SKILLS

Writing Skills–Art of condensation- summarizing and paraphrasing - Abstract Writing, Synopsis Writing – Formal Letter Writing - Report Writing

To understand the basic components of written communication.
To apply knowledge of different formats of written communication needed in

work place environment.
To analyze the structure of letters, reports etc.

UNIT IV: CREATIVE WRITING SKILLS

Film Review Writing – Creative Writing- Short Story Writing – Speeches for academic settings – Writing Skits – Script for Short Films/Web Series

To apply writing skills in creative writing to meet the demands of documentation in professional life
To analyze different figures of speech in creative writing
To evaluate different aspects creative and academic writing to become effective at written communication

UNIT V: PROFESSIONAL SPEAKING SKILLS

Job Interviews –Types of Job Interviews – Characteristics of a job interview - Interview Preparation Techniques –How to overcome Stage fright
Group Discussions(GD): Importance of Group Discussion- Characteristics of a GD - GD as a tool for selection – GD Strategies – Do's & Don't of GD - GD Vs Debates

To analyze the different aspects of interviews and group discussions
To evaluate the group dynamics to excel in group discussions
To design and develop strategies to answer effectively in interviews

Text Books:

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma,3rd Edition, O U Press 2015

References:

1.Communication Skills by Pushpalatha& Sanjay Kumar, Oxford Univsesity Press

2.Books on **TOEFL/GRE/GMAT/CAT/IELTS** by Barron's/DELTA/Cambridge University Press.2012.

3. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.

4. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

5. Successful Presentations by John Hughes & Andrew Mallett, Oxford.

6. Winning at Interviews by Edgar Thorpe and Showick Thorpe, Pearson

7. Winning Resumes and Successful Interviews by Munish Bhargava, Mc Graw Hill

WEB LINKS

1. **https://blog.allaboutlearningpress.com/listening-comprehension/**
2. **https://www.englishclub.com/**
3. **https://www.helpguide.org/articles/relationships-communication/nonverbal-communication.htm**
4. **https://www.slideshare.net/poojavrs/lsrw-109040479**
5. https://www.slideshare.net/nandapalit/non-verbal-verbal-communication
6. https://www.slideshare.net/madeehasaeed96/writing-skills-71430610
7. https://www.slideshare.net/rhinautan/creative-writing-76208225
8. https://www.slideshare.net/vikkerkar/interview-skills-presentation
9. https://www.slideshare.net/ritikadhameja/group-discussion-46255658

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AUTOMOBILE ENGINEERING (Professional Elective-II)

Course Objectives

The student will be made to learn:

1. The anatomy of the automobile in general
2. The location and importance of each part
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels
4. Suspension, frame, springs and other connections
5. Emissions, ignition, controls, electrical systems and ventilation

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.

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

UNIT- III

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.

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.

UNIT- V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control–Modern Techniques in automobiles – 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, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

Course Outcomes

CO1: Identify the different parts of the automobile

CO2: Explain the working of various parts like engine, transmission, clutch, Gear box & Propeller Shaft

CO3: Describe how the steering system operates.

CO4: Describe how the suspension and the Braking system operate.

CO5: Understand the environmental implications of automobile emissions & develop a strong base for understanding future developments in the automobile industry

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers

2. Automobile Engineering BY Joseph Hidner

Reference Books:

1. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.

3. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.

4. Automotive engines , Newton, Steeds & Garret.

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TURBO MACHINERY (Professional Elective-II)

Course Objectives :

1. Learning the fundamentals of turbo machines and their applications in the thermodynamic analysis.
2. Study of functioning of steam nozzles and steam turbines and their thermodynamic analysis.
3. Understanding the concepts of gas dynamics with respect to thermodynamics and learning about the functioning of centrifugal compressors.
4. Study of functioning and performance analysis of axial flow compressors.
5. Learning the concepts of axial flow gas turbines and thermodynamic analysis of axial flow gas turbines.

Unit – I:

Fundamentals of Turbo machines: Classification, Applications Thermodynamic analysis; Isentropic flow, Energy transfer; Efficiencies; static and Stagnation conditions; continuity equation; Euler's flow through variable cross sectional area; unsteady flow in turbo machines.

Unit –II:

Steam Nozzles: Effect of back – pressure on the analysis; Design of nozzles.

Steam Turbines of C & C –D nozzles : Impulse Turbines: work done and velocity triangles; Efficiencies; Constant Reaction Blading; Design of blade passages, angles and height; Secondary flow; leakage losses; Thermodynamic analysis of steam turbines.

Unit – III:

Gas Dynamics: Fundamentals thermodynamic concepts; Isentropic conditions; Mach number and Area – Velocity relation; Dynamic pressure; normal shock relations for perfect gas; supersonic flow, oblique shock waves ; normal shock recovery ; detached shocks ; Aerofoil theory.

Centrifugal Compressor: Types; Velocity triangles and efficiencies; Blade passage design; Diffuser and pressure recovery; slip factor; stanitz and stodolas formulae; Effect of inlet mach number; Prewirl; performance.

Unit – IV:

Axial Flow Compressors: Flow analysis, work and velocity triangles ; Efficiencies; Thermodynamic analysis; stage pressure rise ; Degree of reaction ; stage loading ; general design, effect of velocity incidence ; performance.

Cascade Analysis: Geometry and Terminology; Blade forces, Efficiency; losses; free and forced vortex blades.

Unit – V:

Axial Flow Gas Turbines: Work done; velocity triangles and efficiencies; thermodynamic flow analysis; degree of reaction; Zweifels relation; Design cascade analysis – Soderberg – Hawthrone – ainley-correlations; secondary flow; Free-vortex blades; Blade angles for variable degree of reaction; Actuator disc theory; stresses in blades; Blade assembling; materials and cooling of blades; performance; Matching of compressor and turbine; off-design performance.

Course Outcomes :

1. Analysis of Euler's flow through variable cross sectional area and unsteady flow in turbo machines.
2. Designing of steam nozzles and steam turbines and obtaining the thermodynamic performance of steam turbines.
3. Obtaining the relations of gas dynamics in gas flow and analyzing the performance of centrifugal compressor thermodynamically.
4. Analyzing the performance of axial flow compressor thermodynamically and obtaining the cascade analysis.
5. Calculating the efficiencies of axial flow gas turbines and analyzing their performance thermodynamically.

REFERENCES:

1) Fundamentals of Turbo machines – Shephard
2) Practise on Turbomachines – G. Gopalakrishnan & D. Prithviraj, SciTech Publishers, Chennai.
3) Theory and practice of steam turbines – Kearton
4) Gas Turbines – Theory and practice – Zucrow
5) Elements of Gas Dynamics – Liepman and Roshkow
6) Elements of Gas Dynamics – Yahya
7) Turbines, Pumps, Compressors – Yahya
8) Axial Flow Compressors – Horlock.
9) Gas Turbines- Cohen, Roger & Sarvanamuttu

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PRODUCTION & OPERATIONS MANAGEMENT
(Professional Elective-II)

Course Objectives:

The objectives of the course are as follows:

1. Identify the three functions of production planning and control operations.
2. Able to understand forecasting methods.
3. Describe the factors effect the location and different types of layouts.
4. Summarize different Aggregate planning Strategies and functions of Inventories .
5. Able to understand the scheduling policies and elements of TQM.

UNIT – I

Functions of production planning & controls operations & productivity, productivity measurement, goods and services, Design of goods and services: selection, generating new products, product development, issues in product design.

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.

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, computerised layout: ALDEP, CRAFT, CORELAP.

UNIT – IV

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects. 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.

UNIT – V

Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.
MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).
Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control.

Course Outcomes:

Upon completing this course, students should be able to:

1. Understand the functions of production planning and control operations.
2. Able to apply forecasting methods.
3. Understand the factors effect the location and different types of layouts.
4. Analyze different Aggregate planning Strategies and Inventory control methods .
5. Develop the scheduling policies and elements of TQM.

TEXT BOOKS:

1. Modern Production / Operations Management by Baffa & Rakesh Sarin, Wiley, 1987
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation Management by Adam & Ebert- PHI Pub.,

REFERENCES:

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.

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SOLAR ENERGY SYSTEMS (Open Elective-II)

Course objectives

1. Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.
2. Study of various solar energy technologies with different types of concentrating collectors.
3. Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.
4. Understanding the basics of economics involves in the solar system.
5. Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I

SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces.

Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS:

Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V
THERMAL POWER:
The power concepts- design aspects, thermo-chemical reactor.
SOLAR POND AND SOLAR STILLS:
Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :
1. Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.
2. Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.
3. Developing solar cells in the field of nano technology.
4. Calculating the cash flow and costs involves in the solar energy systems.
5. Designing and developing of thermo chemical reactor with respect to thermal power.

Reference Books:

1. Solar Energy Thermal Process Diffice and Beckman
2. Solar Heating and Cooling by Kreith and Kreider
3. Solar Energy Utilization by G.D.Rai
4. Solar Energy Utilization by G.D.Rai , Khanna Publishers.
5. Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,
6. Applied Solar Energy by Meinel and Meinel
7. Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
8. Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

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INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES
(Open Elective-II)

Course Objectives

1. To understand the need of electric vehicles and hybrid vehicles
2. To understand the energy sources of electric vehicles and its types
3. To understand about basics of motors and controller
4. To analyze and design the various components of electric with environment corner
5. To understand the type of hybrid vehicles and considerations

UNIT I NEED FOR ALTERNATIVE SYSTEM
Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles

UNIT II ENERGY SOURCES : BATTERIES AND FUEL CELLS
Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid-Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling. Different type of energy storage – Solar, wind, compressed fluid.
Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III PROPULSION MOTORS AND CONTROLLERS
Characteristic of permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

UNIT IV VEHICLE DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES
Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice-Wing Mirror, Aerials and Luggage racks

UNIT V HYBRID VEHICLES
Types of Hybrid- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages.
Power split device – Energy Management System - Design consideration - Economy of hybrid vehicles

Course Outcomes

1. Explain the need of electric vehicles and hybrid vehicles instead of IC engines
2. discuss different energy storage technologies, used for hybrid and electric vehicles and their control
3. develop the electric propulsion unit and its control for application of electric vehicles
4. UNDERSTAND OF electric vehicle drive systems
5. understand of hybrid vehicle drive systems

TEXT BOOKS:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
3. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005

REFERENCES:

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005

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INDUSTRIAL ENGINEERING (Open Elective-II)

Course Objectives:

1. Understand the Levels, Functions, importance of Management and Organizational Structures.

2. Design Plant Location and Plant Layout Selection Criteria of Material Handling Equipment.

3. To impart knowledge on work study, Method study, work Measurement techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools.

4. To impart knowledge on the material management, inventory Models Stores Management andStores Records

5. Understand the working principle of Human Resource Management& marketing management.

UNIT- I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.

Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and 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 – Matrix Approach Plant Layout: Definition, Objectives, Organization, Types of Production, Types of Plant Layout – Various Data Analyzing Forms – Travel Chart, Optimization of Layout-Load Distance Model & CRAFT-Materials Handling Function-Objectives - Types-Selection Criteria of Material Handling Equipment.

UNIT- III

Work Study – Definition, Objectives, Method Study – Definition, Objectives, Steps Involved – Various Types of Associated Charts – Differences between Micromotion and Memomotion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations, Differences with Time Study – Applications.

UNIT- IV

Material Management – Objectives, Inventory – functions, types, associated cost, inventory classification techniques- ABC Analysis; Inventory Models- Deterministic models- EOQ Model –Models with one Price Break and Multiple Price Breaks- shortages are not allowed – Stochastic Models – Demand may be Discrete Variable or Continuous Variable – Instantaneous Production. Instantaneous Demand and Continuous Demand and No Set-up Cost Stores Management and Stores Records- Purchase Management, Duties of Purchase Manager, Associated forms

UNIT -V

Human Resource Management-Functions of HRM, Job Evaluation, Merit Rating- Difference with Job Evaluation, Different Methods of Merit Ratings, Wage Incentives, Different Types of Incentive Schemes Inspection & Quality Control: Differences between Inspection & Quality Control. Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards- Importance and Evaluation Procedure Marketing Management- Introduction, Marketing vs Selling, Market Segmentation.

Course Outcomes:

- Ability to apply various work study techniques towards productivity improvement apply industrial engineering concepts in real life environment
- Improve product design through quality engineering and reliability tools method
- Design organization structure and implement management principles in real time business environment.
- Design layouts for different types of industries, manufacturing, process and service sectors.
- Elaborate productivity and profitability by implementing work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004

2. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

References:

1. Industrial Engineering and production management, MartindTelsang S.Chand.

2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.

3. Work Study by ILO(International Labour Organization)

4. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005

5. Production and Operations management, PanneerSelvam, PHI,2004.

6. Statistical Quality Control by EL Grantt, McGrawhil

7. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	0	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To inculcate the basic knowledge of micro economics and financial accounting
2	To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
3	To know the various types of Market Structures & pricing methods and its strategies
4	To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5	To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

SYLLABUS

UNIT-I:Managerial Economics

Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand - DemandElasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

State the Nature of Managerial Economics and its importance
- Understand the concept of demand andits determinants
- Analyze the Elasticity and degree of elasticity
- EvaluateDemand forecasting methods
- Design the process of demand estimation for different types of demand

UNIT-II: Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Shortrun and longrun Production Function- Isoquants andIsocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) -

Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Define the production function, Input-Output relationship and different cost concepts
- Apply the least-cost combination of inputs
- Analyze the behavior of various cost concepts
- Evaluate BEA for real time business decisions
- Develop profit appropriation for different levels of business activity

UNIT-III: Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the structure of markets, features of different markets and forms of business organizations
- Apply the price output relationship in different markets
- Analyze the optimum output levels to maximize profit in different markets
- Evaluate price-output relationship to optimize cost,revenue and profit

UNIT- IV:Capital Budgeting

Introduction – Nature, meaning, significance, functions and advantages. Typesof Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals,Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the concept of capital budgeting and its importance in business
- Contrast and compare different investment appraisal methods
- Analyze the process of selection of investment alternatives using different appraisal methods
- Evaluate methods of capital budgeting for investment decision making and for maximizing returns
- Design different investment appraisals and make wise investments

UNIT-V: Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis -***

Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Discuss the concept,convention and significance of accounting
- Apply the fundamental knowledge of accounting while posting the journal entries
- Analyze the process and preparation of final accounts and financial ratios
- Evaluate the financial performance of an enterprise by using financial statements

Text Books:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

References:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Data Books Required:

Present Value Factors table

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the concepts related to Managerial Economics, financial accounting and management.
CO2	Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
CO3	Apply the concepts of production, cost and revenues for effective business decisions
CO4	Analyze how to invest their capital and maximize returns
CO5	Evaluate the capital budgeting techniques
CO6	Develop theaccounting statements and evaluate the financial performance of business entity.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

ENTREPRENEURSHIP AND INCUBATION

(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	ENTREPRENEURSHIP& INCUBATION	2	1	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To make the student understand about Entrepreneurship
2	To enable the student in knowing various sources of generating new ideas in setting up ofnew enterprise
3	To facilitate the student in knowing various sources of finance in starting up of a business
4	To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5	To encourage the student in creating and designing business plans

Syllabus

UNIT-I: Entrepreneurship

Introduction-Nature, meaning, significance, functions and advantages. concept, characteristics-knowledge and skills requirement - process - Factors supporting entrepreneurship - Differences between Entrepreneur and Intrapreneur - entrepreneurial mindset and personality - Recent trends.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyzerecent trends in Entrepreneurship across the globe
- Develop a creative mind set and personality in starting a business.

UNIT-II: Women Entrepreneurship

Introduction – Nature, meaning, significance, functions and advantages. Growth of women entrepreneurship in India. - Issues & Challenges - Entrepreneurial motivations.Entrepreneurship

Development and Government. Role, of Central and State Government - incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Analyze the role of export-oriented units
- Evaluate the tax concessions available for Women entrepreneurs

.

UNIT-III:Product Development
Introduction – Nature, meaning, significance, functions and advantages. Startup Initiatives - Generating business/ Service idea – Sources and methods –Identifying opportunities - Feasibility study - Market feasibility, technical/operational feasibility, Financial feasibility. Developing business plan, Preparing project report, Presenting business plan to investors.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plansin project preparation and prepare project reports

UNIT-IV:Startups
Introduction – Nature, meaning, significance, functions and advantages. Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence theType/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Design their own business incubation/incubators as viable-business unit.

UNIT-V: Finance
Introduction – Nature, meaning, significance, functions and advantages. Sources - Long term and Short term - Institutional Finance – Commercial Banks, SFC's and NBFC's in India, Role in

small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions supporting entrepreneurship development.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the various sources of finance in Starting the new venture
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluatethe need and importance of MSMEs in the growth of country

TEXT BOOKS

1. D F Kuratko and T V Rao, **Entrepreneurship** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit :login.cengage.com)
2 .Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

REFERENCES

1. Vasant Desai,Small Scale Industries and Entrepreneurship, Himalaya Publishing 2012.
2. Rajeev Roy Entrepreneurship, 2nd Edition, Oxford, 2012.
3.B.JanakiramandM.Rizwana Entrepreneurship Development: Text & Cases, Excel Books, 2011.
4.Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

E-RESOURCES

1. Entrepreneurship-Through-the-Lens-of-enture Capital

2.http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship

3.http://nptel.ac.in/courses/122106032/Pdf/7_4.pd

4.http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Concepts related to the Entrepreneurship and Incubators
CO2	Understand the concept of Entrepreneurship and challenges in the world of competition.
CO3	Apply the Knowledge in generating ideas for New Ventures.
CO4	Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
CO5	Evaluate the role of central government and state government in promoting Entrepreneurship.
CO6	Create and design business plan structure through incubations.

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DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

BUSINESS ETHICS AND CORPORATE GOVERNANCE

(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
	BUSINESS ETHICS AND CORPORATE GOVERNANCE	2	1	0	3

COURSE OBJECTIVES : The objectives of this course are	
1	To make the student understand the principles of business ethics
2	To enable them in knowing the ethics in management
3	To facilitate the student's role in corporate culture
4	To impart knowledge about the fair-trade practices
5	To encourage the student in creating knowingabout the corporate governance

Syllabus

UNIT-I:ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior - Value systems - Business Ethics,Types, Characteristics, Factors, Contradictions and Ethical Practices inManagement- Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze the corporate social responsibility of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction Ethics in production, finance, ,Human Resource Managementand,Marketing,Management - Technology Ethics and Professional ethics - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of Marketing Ethics
- Compare and contrasttechnical ethics and professional ethics
- Develop ethical values

UNIT-III: CORPORATE CULTURE

Introduction, Meaning,definition,Nature, Scope, Functions,andsignificance– Cross cultural issues in Ethics - - Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Define UniversalismUtilitarianism, Distributive
- Understand the corporate culture in business
- Analyze Ethical Value System Ethical Values in different Cultures

UNIT- IV:LEGAL FRAME WORK

Law and Ethics, Agencies enforcing Ethical Business Behavior, Legal Impact– Environmental Protection, Fair Trade Practices,legal Compliances, Safeguarding Health and wellbeing of Customers.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair-trade practices
- Make use of Environmental Protection andFair-Trade Practices

UNIT -V : CORPORATE GOVERNANCE

Introduction, meaning – scope Nature - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility. of BODs composition, Cadbury Committee - various committees - reports - Benefits and Limitations.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand corporate governance code

- Analyze role ofauditors, board of directors and shareholders in corporate governance
- Implementing corporate socialresponsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH

2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH.

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy : Business Ethics and Corporate Governance, HPH

2. H.R.Machiraju: Corporate Governance

3. K. Venkataramana, Corporate Governance, SHBP.

4. N.M.Khandelwal : Indian Ethos and Values for Managers

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Ethics and Types of Ethics.
CO2	Understand business ethics and ethical practices in management
CO3	Understand the role of ethics in management
CO4	Apply the knowledge in cross cultural ethics
CO5	Analyze law and ethics
CO6	Evaluate corporate governance

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III Year B.Tech.M.E. II Semester

L	T	P	C
0	0	3	1.5

HEAT TRANSFER LAB

Course Objectives:

Students undergoing this course would

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

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
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

NOTE*: Heat transfer data books are permitted in the examinations*

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

Course Outcomes

Upon the successful completion of course, students will be able to

- Differentiate different modes of heat transfer
- Identify parameters for measurement for calculating heat transfer.
- Determine effectiveness of heat exchanger.
- Design new equipment related to heat transfer.
- Apply principles of heat transfer in wide application in industries.

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III Year B.Tech.M.E. II Semester

L	T	P	C
0	0	3	1.5

ENGLISH LANGUAGE SKILLS LAB

Subject Code	Title of the Lab	L	T	P	C
	English Language Skills Lab	-	-	3	1.5

Course Description:

English Language Skills Lab aims to enable the engineering students to meet the demands of the modern job market through group activities, individual presentations, mock interviews and group discussions. Students of our region have knowledge of their respective subjects, but the surveys make it clear that they are lagging behind in expressing themselves effectively in a professional setting. So, this course will enable them to hone these skills and excel in their respective fields.

COURSE OBJECTIVES	
1	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.
2	Further, they would be required to communicate their ideas relevantly and coherently in writing.
3	To prepare all the students for their placements.
4	To initiate them into greater use of the computer in resume preparation, report writing, format making etc.
5	To train them to use language effectively to face interviews, group discussions, public speaking.

COURSE OUTCOMES	
CO1	To recall and memorize tips to communicate effectively
CO2	To understand various listening components that includes listening comprehension of gist and detailed information.
CO3	To apply extensive and intensive reading methods for specific reading and voracious reading of vast material.
CO4	To analyze differentdescriptive and technical writing material.
CO5	To evaluate and develop, academic research paper with appropriate citations,

	quotations, and references when needed.
CO6	To develop communicative competency and make the students job ready

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3							✓					
CO4											✓	
CO5								✓				
CO6												

UNIT-I: COMMUNICATIVE COMPETENCY

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary for competitive purpose

OUTCOMES
To recall and memorize the basic concepts of reading and listening skills
To understand the various components to build up vocabulary
To apply English language skills to avoid barriers to effective reading and listening

UNIT-II: TECHNICAL WRITING

1. Email Writing
2. CV/Resume Writing
3. Mini Project Writing

To understand the basic components of writing Emails
To apply the knowledge of writing eye catching resumes
To analyze different ways of writing a mini project

UNIT-III: ORAL PRESENTATION SKILLS

1. Self-Introduction – Introducing Others – Welcome Speech – Vote of Thanks
2. Oral Presentation-Individual/Impromptu Speeches/ JAM
3. Stage Dynamics– Barriers to Effective Presentation

To understand the basic components of speeches
To apply knowledge of different forms of presentation.
To analyze stage dynamics for effective presentation

UNIT-IV: TECHNICAL**PRESENTATION SKILLS**

1. Information Transfer
2. PPT Presentation
3. Poster Presentation

To apply knowledge of different types of pictograms to transfer the information
To analyze the techniques of preparing PPTs
To evaluate different skills in poster presentation

UNIT-V: PROFESSIONAL SKILLS

1. Group discussions-II
2. Interview skills
3. Answering Strategies

To analyze the different aspects of interviews and group discussions
To evaluate the group dynamics to excel in group discussions
To design and develop strategies to answer effectively in interviews

MINIMUM REQUIREMENT FOR ELCS LAB:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 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:

1. Orell: Language Lab Software
2. Clarity Pronunciation Power – Part I (Sky Pronunciation)
3. Clarity Pronunciation Power – part II
4. LES(Learn English Select) by British council
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
7. Cambridge Advanced Learners' English Dictionary with CD.

The software consisting of the prescribed topics elaborated above should be procured and used.

REFERENCE BOOKS

1. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
2. **TOEFL &GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
3. **Train2success.com**

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009.
3. Books on **TOEFL/GRE/GMAT/CAT/IELTS** by Barron's/DELTA/Cambridge University Press.2012.
4. **Handbook for Technical Writing** by David A McMurrey& Joanne Buckely CENGAGE Learning 2008.
5. **English for Technical Communication for Engineering Students, AyshaVishwamohan, Tata Mc Graw-Hill 2009.**
6. **Word Power Made Handy,** Shalini Verma, S Chand Publications, 2011.
7. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011.

WEB LINKS

1. https://www.slideshare.net/ruschellecossid/reading-comprehension-56872438

2. https://www.slideshare.net/FiveEEE/listening-comprehension-40031081

3. https://www.slideshare.net/shrutisalunkhe2/english-for-competitive-exams

4. https://www.slideshare.net/nidhipandey16/email-writing-52942112

5. https://www.slideshare.net/aamirmuhammadaamir77/resume-writing-ppt

6. https://www.powershow.com/view/1d8cf2-OWFhN/Mini_Project_Report_Writing_Workshop_powerpoint_ppt_presentation

7. https://www.slideshare.net/8788902/oral-presentations-28994496

8. https://www.slideshare.net/nandapalit/presentation-skills-33500438

9. https://www.slideshare.net/ritikadhameja/group-discussion-46255658

10. https://www.slideshare.net/vikkerkar/interview-skills-presentation

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
0	0	1	0.5

SOCIALLY RELEVANT PROJECT

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

III Year B.Tech.M.E. II Semester

L	T	P	C
3	0	0	0

CONSTITUTION OF INDIA

Subject Code	Title of the Subject	L	T	P	C
	CONSTITUTION OF INDIA	3	0	0	0

COURSE OBJECTIVES : The objective of this course is	
1	To Enable the student to understand the importance of constitution
2	To understand the structure of executive, legislature and judiciary
3	To understand philosophy of fundamental rights and duties
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-state relation in financial and administrative control

Syllabus

UNIT-IIntroduction 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:-After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History and features of Indian constitution
- Learn about Preamble, Fundamental Rights and Duties
-

UNIT-IIUnion Government and its Administration

Structure of the Indian Union- Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat–LokSabha-RajyaSabha - The Supreme Court and High Court - Powers and Functions

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-IIIState Government and its Administration

Structure of the State Govt. -Governor - Role and Position -CM and Council of Ministers - State Secretariat-Organization Structure and Functions

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between structure and functions of state secretariat

UNIT-IV **Local Administration**

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation PanchayatiRaj - Functions– PRI– ZillaParishath - Elected officials and their roles – CEO, ,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration's role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Learn about the role ofZillaParishath block level organization

UNIT-V Election Commission

Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

LEARNING OUTCOMES:-After completion of this unit student will

- Know the role of Election Commission
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze the role of state election commission
- Evaluate various commissions vizSC/ST/OBC and women

TEXT BOOKS

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

2. SubashKashyap, Indian Constitution, National Book Trust

REFERENCES:

1. J.A. Siwach, Dynamics of Indian Government & Politics,

2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

3. .J.C. Johari, Indian Government andPolitics, Hans India

4. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,

Prentice – Hall of India Pvt. Ltd.. New Delhi

E-RESOURCES:

1.nptel.ac.in/courses/109104074/8
2.nptel.ac.in/courses/109104045/
3.nptel.ac.in/courses/101104065/
4.www.hss.iitb.ac.in/en/lecture-details
5.www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	State the historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the governmentie., executive, legislative and judiciary.
CO3	Demonstrate the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government
CO5	Appraise the knowledge in strengthening of the constitutional institutions like CAG,Election Commission and UPSC for sustaining democracy.
CO6	Develop themselves as responsible citizens and pave way to build a democratic country.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

IV.B.Tech I Sem (R19)

Semester –7 (Theory - 5, Labs -2 &Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Introduction to CAD/CAM	PCC	2-1-0	3
2.		Metrology & Measurements	PCC	2-1-0	3
3.		**(Professional Elective-III)** 1. Refrigeration & Air-Conditioning 2. Mechanics of Composite Materials 3. Automotive Transmission Systems	PEC-III	2-1-0	3
4.		**(Open Elective-III)** 1. Wind Energy Systems 2. Special Types of Vehicles 3. Industrial Automation and Control Systems	OEC-III	2-1-0	3
5.		**Humanities Elective-II** 1. Organizational Behavior 2. Management Science 3. Business Environment	HEC-II	2-1-0	3
6.		CAD/CAM Lab	PCC	0-0-3	1.5
7.		Metrology &Measurements Lab	PCC	0-0-3	1.5
8.		Seminar	PCC	0-0-1	0.5
9.		Project*	PR	------	1.5
10.		Industrial Training/Skill Development/Research Project*	PR	------	2
				Total	**22**

*** Marks shall be awarded in 7th semester, but started at end of 6th semester and complete before beginning of 7th semester.**

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L	T	P	C
2	1	0	3

INTRODUCTION TO CAD / CAM

	Course Objectives:
1.	To impart the students to CAD/CAM and CIM and the basics of computer graphics.
2.	To impart knowledge on geometric modeling.
3.	To impart fundamental knowledge on NC and concepts of part programming.
4	To introduce the philosophy of group technology, basics of Flexible Manufacturing Systems and computer aided quality control.
5	To impart the concepts of Computer Aided Process Planning, Computer Integrated Process Planning and introduce the trends in manufacturing.

UNIT –I

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

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

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.

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.

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.

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.

	Course Outcomes: Ability to
CO1	To implement the concepts of CAD/CAM and CIM in industry.
CO2	Use CAD software for solid modeling.
CO3	To implement suitable NC part programming concepts.
CO4	Implement appropriate suitable production systems and computer aided quality control.
CO5	Utilize suitable computer aided process planning and computer integrated production planning for a customized manufacturing system.

Text Books:

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

References:

1. Automated Production Systems and CIM by P.Groover Pearson Education, Limited.
2. CAD/CAM/CIM (Revised second edition)- P. Radhakrishnan, S. Subramanyan, V. Raju- New Age International Edition
3. CAD/CAM- Theory and practice- Irahim Zeid- Tata Mcgraw Hill publications.

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2	1	0	3

Metrology & Measurements

Course Objectives:

- To introduce the science of measurement and measuring machines commonly used.
- To impart knowledge about limits, fits and tolerances, geometric dimensioning aspects.
- To introduce the methods of acceptance test for conventional machine tools.
- To familiarize students with the concepts of Laser metrology and surface roughness.
- Measurement techniques for measuring process parameters in industry and in research

UNIT- I

Limits, Fits and Tolerances: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – inter-changeability 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.

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.

UNIT -III

Surface Roughness Measurement: 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 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.

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.

UNIT-V

Measurement 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.

Course Outcomes:

- Students will be able to work in metrology divisions in industries.
- Students will be able to understand the advanced metrology systems.
- Choose measuring instruments suitable for specific application.
- Design and fabricate a system for measuring simple parameters.
- Apply the knowledge in during the measurement process.

Text Books:

(1) Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE
(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.

References:

(1) Engineering Metrology, Mahajan, Dhanpat Rai, 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, Mc GrawHill, 2013.
(5) Instrumentation, measurement &analysis ,B.C.Nakra & K K Choudhary, TMH, 6th edition, 2011.

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L	T	P	C
2	1	0	3

REFRIGERATION AND AIR CONDITIONING
(Professional Elective –III)

Course Objectives:

To impart knowledge on

- Working principle of refrigeration and air-conditioning cycle.
- Fundamentals of psychrometry.
- Applications of refrigeration and air-conditioning.
- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.

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 - Refrigeration Needs of Air Crafts.

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

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT- III

Vapour Absorption Refrigeration (VAR) System – Description and Working of NH3 – 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.

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.

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.

Course Outcomes:
Ability to

- Understand various refrigeration systems.
- Demonstrate the working of refrigeration equipments.
- Understand various psychrometric processes.
- Design the space cooling load.
- Explain the air-conditioning equipment.

Text Books:

1. Refrigeration and Air Conditioning, CP Arora, TMH, 15th edition, 2013.

2. A Course in Refrigeration and Air conditioning, S.C Arora & Domkundwar, Dhanpatrai

References:

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

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L	T	P	C
2	1	0	3

MECHANICS OF COMPOSITE MATERIALS
(Professional Elective –III)

Course Objectives:

1. Able to define of Basic Matrix materials ,understand the Mechanical properties of composites
2. Able to know the manufacturing of PMCs ,RTM,MMCs ,SMCs andCMCs.

3.Undestand Lamina constitutive Quations

4.Analysis of Lamina strength and Laminated flat plates.

5.Study Thermal Anaysis.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites.

UNIT II MANUFACTURING OF COMPOSITES

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state,vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation-interfaces

UNIT III INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke‟s Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill‟s Criterion for Anisotropic materials. Tsai-Hill‟s Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT V THERMAL ANALYSIS

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke‟s Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E‟s. C.T.E‟s for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

Course Outcomes

1. Able to Understand the Basic Matrix materials ,understand the Mechanical properties of composites
2. Able to Process the manufacturing of PMCs ,RTM,MMCs ,SMCs andCMCs.
3. Determine Strain Displacement relations and the Lamina Stresses
4. Able to Analyze of Lamina strength and Laminated flat plates.
5. Able to analyze Thermal Anaysis modifications of Hookes Law.

REFERENCES

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994,
Second Edition - CRC press in progress.
2. Hyer, M.W., “Stress Analysis of Fiber – Reinforced Composite Materials”, McGraw-Hill, 1998
3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”,
Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber –”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.
8. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)
9. Chung, Deborah D.L., “Composite Materials: Science and Applications”, Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

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DEPARTMENT OF MECHANICALENGINEERING

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2	1	0	3

AUTOMOTIVE TRANSMISSION SYSTEMS
(Professional Elective –III)

Course bjectives:

- To know about the various Automation in Manufacturing
- Able to understand the Material handling and identification.
- Able to understand about the PLC
- Able to understand DDS,SCADA and DCS

UNIT I

Clutches Principle, Functions, General requirements, Torque capacity, Types of clutches, Cone clutch, Single-plate clutch, Diaphragm spring clutch, Multi-plate clutch, Centrifugal clutch, Electromagnetic clutch, Lining materials, Over-running clutch, Clutch control systems.

UNIT II

Drive Lines Propeller shaft-universal joints, hooks and constant velocity U.J., Drive line arrangements -Hotchkiss drive and torque tube drive, Rear wheel drive, front wheel drive and four-wheel drive layouts and its advantages and limitations.

UNIT III

Wheels and Tyres Basic requirements of wheels and tyres, Types of road wheels, Construction of wheel assembly, wheel balancing, Tyre construction, material, types, tubeless, cross ply radial type, tyre sizes and designation, Aspect ratio, tyre trade pattern, tyre valve, Tyre inflation pressure, safety precautions in tyres, Tyre rotation and matching, Types of Tyre wear and their causes, Selection of tyres under different applications, tyre retreating hot and cold, factors affecting tyre performance.

UNIT IV

Automatic Transmission Principle of semi-automatic and automatic transmission, Hydromantic transmission, Fully automatic transmission, Semi-automatic transmission, Hydraulic control system, Continuous variable transmission (CVT) – operating principle, basic layout and operation, Advantages and disadvantages.

UNIT V

Vehicle Chassis Introduction To chassis, chassis operating condition, chassis frame, vehicle components location. Manufacturing processes for chassis, causes of chassis failure.

Course outcomes:

- The students will understand the Level of automation
- The students will understand the FMS planning and implementation
- The students will be able to design block diagrams of PLC.
- The students will able to design of alarm and interlock systems

Text Books:

1. Dr. Kripal Singh, Automobile Engineering-Vol. 1, 13th Edition, Standard PublishersDistributors
2. N. K. Giri, Automotive Mechanics, Khanna Publishers, Delhi, Eighth Edition

Reference Book:

1. Newton, Steed andGarrot, Motor Vehicles, 13th Edition, Butterworth London
2. A. W. Judge, Modern Transmission, Chapman and Hall Std., 1989
3. Chek Chart, Automatic Transmission, A Harper and Raw Publications
4. J. G.Giles, Steering, Suspension and Tyres, – Lliffe Book Ltd., London
5. W. Steed, Mechanics of Road Vehicles, Lliffe Book Ltd
6. Heisler, Vehicle and Engine Technology, Second Edition, SAE International Publication

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2	1	0	3

WIND ENERGY SYSTEMS
(Open Elective –III)

Course objectives:

- To impart knowledge on the following Topics
- Recognize current and possible future role of renewable energy sources.
- Adequate inputs on a variety of issues in harnesing renewable Energy.
- Awarenes about renewable Energy Sources and technologies.

UNIT-I

Historical developments, latest developments, state of art of wind energy technology, turbine rating, cost of energy, wind power plant economics, installation and operation costs, decommissioning, Indian scenario and worldwide developments, present status and future trends

UNIT-II

Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography.

UNIT-III

Design of wind turbine blade; effect of stall and blade pitch on coefficient of power vs tip speed ratio and cut-out wind speeds, blade materials, design characteristics, multiple stream tube theory, vortex wake structure; tip losses; rotational sampling, wind turbine design programs, aerodynamic loads, tower shadow, wind shear, blade coning, gyroscopic, transient and extreme loads.

UNIT-IV

Pitch control, yaw control, Electrical and Mechanical aerodynamic braking, teeter mechanism. Wind turbine dynamics with DC and AC generators: induction and synchronous generators, variable speed operation, effect of wind turbulence. Power electronics Converter and Inverter interfaces for wind energy utilization system for isolated and grid connected system.

UNIT-V

Wind farm electrical design, Planning of wind farms, special application for developing countries, maintenance and operation, wind farm management, site selection. Environmental assessment; noise, visual impact etc. Instrumentation, data loggers, remote monitoring and control.

Course outcomes:

- The students will understand the Historical developments
- The students will understand the Nature of atmosphere is winds
- The students will be able to design wind warm electrical
- The students will be able to design wind turbine blade.

REFERENCES:

1. Paul Gipe, Wind Energy Comes of Age, John Wiley & Sons Inc.
2. Ahmed: Wind Energy Theory and Practice, PHI, Eastern Economy Edition, 2012
3. L.L. Freris, Wind Energy Conversion System, Printice Hall.
4. Tony Burton et al, Wind energy Hand Book, John Wiley & Sons Inc.
5. Directory, Indian Wind Power 2004, CECL, Bhopal.

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2	1	0	3

SPECIAL TYPES OF VEHICLES

(Open Elective –III)

Course Objectives:-

1.The course is designed to give knowledge of various special purpose vehicles.

2.To develop existing systems and their applications in the present context.

3. To understand the main components of tractor.

4. To identify man-lift chassis, scissor lift trucks.

UNIT –I

EARTH MOVING EQUIPMENTS Construction layout, capacity, specification and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrappers, motor graders, skid steer loaders ,excavator, hydraulic shovels, bucket conveyors , surface miners – high wall Miners. Selection criteria for prime mover.

UNIT- II

CONSTRUCTIONAL EQUIPMENTS Construction layout, capacity, specification and applications of cranes – types , Articulated Trucks ,concrete ready mixer ,trenchers , Asphalt Pavers , road reclaimers , General description, specification and functions of smooth wheeled rollers, pneumatic tired rollers, , sheep"s foot rollers, vibrating compactors , draglines, drillers ,bore well machine

UNIT-III

FARM EQUIPMEMTS Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment –- Top lifting harvesters. General description, working, specification and functions of paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.

UNIT IV

INDUSTRIAL VEHICLE General description, specification, capacity and working of fork lifts - attachment, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, fire fighting vehicle, reclaimers, Street sweepers.

UNIT V

MILITARY AND COMBAT VEHICLES Special features and constructional details of Main Battle tank, gun carriers, truck-mounted missile launchers, transport vehicles, armored vehicle-launched bridge, amphibious bridging vehicle, and communication vehicles.

Course Outcomes:-

Students will be able to

CO1:- Study the Special type of vehicles based on the need and purpose.

CO2:- Study about the Constructional Equipments of different Special type vehicles

CO3:- Understand and describe the working principles of Different vehicles used in Farm sector.

CO4:- Learn about the working principles of Industrial Purpose Vehicles.

CO5:- study the Special features and constructional details of Military and Combat Vehicles.

TEXT BOOKS:

1. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.

REFERENCES:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Jerry Scutts, “Advanced Military Vehicle Modelling” , Osprey Publishing, 1999
3. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
4. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
6. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
7. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

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2	1	0	3

INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS
(Open Elective –III)

Course Objectives

1. To introduce the importance of automation techniques manufacturing and process industries.
2. To impart the role of PLC in industry automation.
3. To expose to various control techniques employed in process automation.
4. To develop automation system for manufacturing and process industries.

UNIT-I

Course Content Automation in Manufacturing Industries Introduction- Automation in production system, Principles and strategies of automation, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage, Automated flow lines with storage buffers.

UNIT-II

Material handling and identification technologies -Overview of material handling systems, Types of material handling equipment, Design of the system, Conveyor system, Automated guided vehicle system, Automated storage systems, Interfacing handling and storage with manufacturing, Overview of Automatic Identification Methods.

UNIT-III

Automated Manufacturing Systems-Components, Classification and overview of manufacturing systems, Cellular manufacturing, Flexible manufacturing system(FMS), FMS and its planning and implementation, Automated assembly system – design and types of automated assembly systems, Analysis of multi station and single station assembly machine.

UNIT-IV

Introduction to computer based industrial automation- Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. SCADA for process industries includes understanding of RTUs, Pumping stations, Evacuation processes, Mass Flow Meters and other flow meters, Leak-flow studies of pipelines, Transport Automation

UNIT-V

Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of

PLCs, Integrating Process safety PLC and DCS, Application of international standards in process safety control.

Course outcomes:

- The students will understand the constructional, working principle of various types of manual and automotive transmission of an automobile.
- The students will understand the constructional

Text Books

1. M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5 th Edition, Pearson Education, 2009.
2. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2003.
3. Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011.
4. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016.

Reference Books

1. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013.
2. Lukas M.P, " Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986.
3. N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009.
4. https://nptel.ac.in/syllabus/108108098/.

Course Outcomes On completion of this course, the students will be able to

1. familiar with various automation technologies in manufacturing and process industries.
2. understand various automation tools and methods in manufacturing industry.
3. implement various control and automation method in process industries.
4. familiar with various communication technologies in manufacturing and process industries.

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2	1	0	3

ORGANIZATIONAL BEHAVIOUR
(Humanities Elective –II)

Subject Code	Title of the Subject	L	T	P	C
	ORGANIZATIONAL BEHAVIOUR	2	1	0	3

COURSE OBJECTIVES:	
1	**Toenablestudent's comprehension of organizational behavior**
2	**To offer knowledge to students onself-motivation, leadership and management**
3	**To facilitate them to become powerful leaders**
4	**To Impart knowledge about group dynamics**
5	**To make them understand the importance of change and development**

Syllabus

Unit-I: Introduction

, Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behavior –Attitude -Perception - Learning – Personality.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of OrganizationalBehavior
- Contrast and compare Individual& Group Behavior andattitude
- Evaluate personality types

Unit-II: Motivation and Leading

Theories of Motivation- Maslow‟sHierarchy of Needs - Hertzberg‟s Two Factor Theory - Vroom‟s theoryof expectancy - McClelland‟s theory of needs–Mc Gregor‟s theory X and theory Y– Adam‟s equity theory – Locke‟s goal setting theory– Alderfer‟sERG theory - Leadership–research,theories, traits - LeadersVs Managers.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of Motivation
- Analyze theTheories of motivation
- Explain how employees are motivated according to Maslow‟s Needs Hierarchy

Unit-III: Organizational Culture

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of goodLeader - Conflict Management -Evaluating Leader- Women and Corporate leadership.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of Leadership
- Contrast and compare Trait theoryand Managerial Grid
- Distinguish the difference between Transactional and Transformational Leadership
- Evaluate the qualities of good leaders

Unit-IV:Group Dynamics

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of groupbehavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

LEARNING OUTCOMES: -After completion of this unit student will

- Understand theconcept of Group Dynamics
- Contrast and compare Group behavior and group development
- Evaluate how to resolve conflicts in the organization

Unit-V:Organizational Change and Development

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization"s change and development

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the importance of organizational change and development
- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

TEXT BOOKS:

1. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Rao,OrganisationalBehaviour,HimalyaPublishing House 2017

References

- McShane, Organizational Behaviour, TMH 2009
- Nelson,OrganisationalBehaviour, Thomson, 2009.
- Robbins, P.Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson 2009.
- Aswathappa,OrganisationalBehaviour,Himalaya, 2009

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Organizational Behavior, its nature and scope.
CO2	Understand the nature and concept of Organizational behavior
CO3	Apply theories of motivation to analyze the performance problems
CO4	Analyze the different theories of leadership
CO5	Evaluate group dynamics
CO6	Develop as powerful leader

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

Management Science
(Humanities Elective–II)

Subject Code	Title of the Subject	L	T	P	C
	MANAGEMENT SCIENCE	2	1	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2	To make the students understand the role of management in Production
3	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training &Development, job evaluation and Merit rating concepts
4	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in management

Syllabus

UNIT-I:INTRODUCTION TO MANAGEMENT

Management-Concept and meaning-Nature-Functions-Management as a Science and Art and both. Schools of Management Thought-Taylor‟s Scientific Theory-Henry Fayol‟s principles-Elton Mayo‟s Human relations-Systems Theory- **Organizational Designs**-Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.

LEARNING OUTCOMES: At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Analyze the organization chart & structure for an enterprise.
- Apply the concepts & principles of management in real life industry.
- Evaluate and interpret the theories and the modern organization theory.

UNIT-II:OPERATIONSMANAGEMENT

Principles and Types of Plant Layout-Methods of Production (Job, batch and Mass Production), Work Study- Statistical Quality Control- Deming „s contribution to Quality. **Materials Management -** Objectives- Inventory-Functions - Types, Inventory Techniques-EOQ-ABC Analysis-Purchase Procedure and Stores Management- **Marketing Management -**Concept- Meaning - Nature-Functions of Marketing - Marketing Mix- Channels of Distribution -Advertisement and Sales Promotion- Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Analyze Marketing Mix Strategies for an enterprise
- Evaluate Materials departments &Determine EOQ
- Create and design advertising and sales promotion

UNIT-III:HUMAN RESOURCES MANAGEMENT (HRM)

HRM- Evolution of HRM - Definition and Meaning – Nature-Managerial and Operative functions--Job Analysis -Human Resource Planning (HRP)–Process of Recruitment&Selection - Training and Development-Performance Appraisal-Methods of Performance Appraisal – Placement-Employee Induction-Wage and Salary Administration.

LEARNING OUTCOMES: At the end if the Unit, the learners will

- Understand the concepts of HRM in Recruitment, Selection, Training & Development
- Apply Managerial and operative Functions
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

UNIT-IV:STRATEGIC& PROJECT MANAGEMENT

Strategy Definition& Meaning-Vision - Mission- Goals- Corporate Planning Process- Environmental Scanning-Steps in Strategy Formulation and Implementation-SWOT Analysis
Project Management- 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 the Unit, the learners will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques
- Creative in completing the projects within given time

UNIT -V: Contemporary Issues In Management

The concept of Management Information System (MIS)- Materials Requirement Planning (MRP)- Customer Relations Management (CRM)- Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management (SCM)- Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking -Balanced Score Card-Knowledge Management.

LEARNING OUTCOMES At the end if the Unit, the learners will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in modern
- Analyze CRM,MRP,TQM
- Evaluate Six Sigma concept and SCM

Text Books:

1. A.R Aryasri, Management Science, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.

References:

1. Koontz &Weihrich, Essentials of Management, 6/e, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, ManagementPrinciples and Guidelines,Biztantra.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. Samuel C.Certo, Modern Management, 9/e, PHI, 2005

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Management, and its Functions
CO2	Understand the concepts & principles of management and designs of organization in a practical world
CO3	Apply the knowledge of Work-study principles & Quality Control techniques in industry
CO4	Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
CO5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO6	Create Modern technology in management science.

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
2	1	0	3

BUSINESS ENVIRONMENT
(Humanities Elective –II)

Subject Code	Title of the Subject	L	T	P	C
	Business Environment	2	1	0	3

Course Objectives	
1	To make the student understand about the business environment
2	To enable them in knowing the importance of fiscal and monitory policy
3	To facilitate them in understanding the export policy of the country
4	To Impart knowledge about the functioning and role of WTO
5	To Encourage the student in knowing the structure of stock markets

Syllabus

Unit-I:Overview of Business Environment

Introduction – meaning Nature,Scope,significance, functions and advantages. Types- Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis& Characteristics of business.

Learning Outcomes: -After completion of this unit student will
- Understand the concept of Business environment
- Classify various types of business environment
- Evaluate the environmental analysis in business
- Discuss the Characteristics of Business.

Unit-II:Fiscal Policy

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Public debt - Development activities financed by publicexpenditure - Evaluation of recent fiscal policy of GOI. 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: -After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Identify the functions of RBI and its role
- Analyze the Monitory policy in India
- Know the recent trends and the role of Finance Commission in the development of our country
- Differentiate between Fiscal and Monitory Policy

Unit-III:India's Trade Policy

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral TradeAgreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes: -After completion of this unit student will

- Understand the role ofIndian international trade
- Understand and explain the need for Export and EXIM Policies
- Analyze causes for Disequilibrium and correction measure
- Differentiate between Bilateral and Multilateral Trade Agreements

UNIT-IV:World Trade Organization

Introduction – Nature, meaning, significance, functions and advantages. Organization and Structure - Role andfunctions 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: -After completion of this unit student will

- Understand the role of WTO in trade
- AnalyzeAgreements on trade by WTO
- Understand the Dispute Settlement Mechanism
- Compare and contrast the Dumping and Anti-dumping Measures.

Unit-V:Money Markets And Capital Markets

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - StockExchanges - Investor protection and role of SEBI.

Learning Outcomes: -After completion of this unit student will

- Understand the components of Indian financial system
- Know the structure of Money markets and Capital markets
- Analyze the Stock Markets
- Apply the knowledge in future investments
- Understand the role of SEBI in investor protection.

TEXT BOOKS:

1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of 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 the course, students will be able to	
CO1	Define Business Environment and its Importance.
CO2	Understand various types of business environment.
CO3	Apply the knowledge of Money markets in future investment
CO4	Analyze India"s Trade Policy
CO5	Evaluate fiscal and monitory policy
CO6	Develop a personal synthesis and approach for identifying business opportunities

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	1.5

CAD / CAM LAB

Course Objectives:
To impart the knowledge on the
1. Usage of computer in Design and Manufacturing.
2. Conceptualization of objects in three dimensions and producing orthographic views.
3. Visualization of assembly of various machine parts.
4. CNC part programming of simple profiles.
5. Ability to work with inter-disciplinary groups in professional, industry and research organizations.

List of Experiments:

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances. Study of script, DXE AND IGES FILES. Surface modelling.
2. **Part Modeling:**
   a) Generation of various 3D Models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.
   b) Generation of various 3-D models of simple machine parts by feature based /Boolean based modelling.
3. **Assembly Modeling:** Assembly modelling of Simple components.
4. **Computer Aided Analysis:**
   a) Structural Analysis (At least two exercises)
   b) Thermal Analysis (At least two exercises)
5. **CAM:**
   a) Study of various post processors used in NC Machines.
   b) Development of NC code for free form and sculptured surfaces using CAM packages.
   c) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages.

Through Any Four Software Packages from the following:

Use of Auto CAD, Iron CAD, Edge CAM, Micro Station, CATIA, Pro-E, I-DEAS, Gibbs CAM, Master CAM, Ansys etc,.

Course Outcomes:
Ability to
1. Develop 3D models by representation techniques.
2. Modeling of parts and assemble them to create a functional assembly.
3. Utilize Computer Aided Analysis tools to solve real time engineering problems.
4. Use CAM software to generate NC code.
5. Implement CNC part Programme for manufacturing various profiles.

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IV Year B.Tech.M.E. I Semester

L	T	P	C
0	0	3	1.5

METROLOGY & MEASUREMENTS LAB

Course Objectives:

To impart knowledge on

- Working principles of linear and angular measuring instruments
- Measurement of linear and angular dimensions of a typical work piece specimen using the measuring instruments
- Methods of form measurements.
- Hands on experience with various measuring instruments to utilize in industries.

Section A

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Calibration of strain guage for temperature measurement
5. Calibration of thermocouple for temperature measurement
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed
8. Calibration of resistance temperature detector for temperature measurement

Section B

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

Course outcomes:
Ability to

- Carry out- measurements with linear and angular measuring instruments.
- Measure linear and angular dimensions of a typical work piece specimen using the measuring instruments.
- Demonstrate and use different length measuring instruments like vernier calipers and micrometers.
- Explain different angle measuring instrument like universal bevel protractor, sine bar Formulate some unknown quantity or parameter of engineering interest.
- Evaluate the surface quality of a given specimen which is important in all kind of manufacturing.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Mechanical Engineering) 2019-2020
COURSE STRUCTURE

IV.B.Tech II Semester (R19)

Semester –8 (Theory - 2, Project–1)					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**(Professional Elective-IV)** 1. Total Quality Management 2. Mechanical Vibrations 3. Robotics and Applications in Manufacturing	**PEC-IV**	**2-1-0**	**3**
2.		**(Open Elective-IV)** 1. Finite Element Methods 2. Energy Conservation and Management 3. Introduction to Mechatronics	**OEC-IV**	**2-1-0**	**3**
3.		Project	PR	0-0-7	7
				Total	**13**

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IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

TOTAL QUALITY MANAGEMENT
(Professional Elective-IV)

Course Objectives:

1.To understanding of Basic concepts of Total Quality Management and Outline the Dimensions Barriers regarding with Quality.
2. Illustrate the TQM principles.
3. Demonstrate Tools utilization for Quality improvement.
4. Explain the various types of Techniques are used to measure Quality.
5. Study various Quality Systems and Auditing on implementation of TQM.

UNIT- I

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT- II

TQM PRINCIPLES

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT -III

TQM TOOLS AND TECHNIQUES I

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT -IV

TQM TOOLS AND TECHNIQUES II

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT- V

QUALITY SYSTEMS

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing -QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

Course Outcomes:

1. To define Quality and Dimensions of product ,service.
   Outline the Dimensions Barrietsregarding with Quality.
2. Able to apply the TQM principles.
3. The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
4. Able to develop the Quality function and improve performance measures..
5. Develop different Quality Systems and Auditing on implementation of TQM.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th
2. Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,
4. 2006.
5. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall
6. (India) Pvt. Ltd., 2006.

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

MECHANICAL VIBRATIONS
(Professional Elective-IV)

Course Objectives: To impart knowledge on

1.	Understanding the behaviour of single degree freedom systems in damped and undamped condition.
2.	Formulating mathematical model for forced vibration problems
3.	Formulating mathematical model for two degree freedom vibration problems
4.	Formulating mathematical model for multi degree forced vibration problems
5.	Analysing the vibrations of continuous systems and critical speed problems

UNIT I

Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

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.

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.

UNIT III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

UNIT IV

Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

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.

Course outcomes: At the end of the course the student will be

CO1	Familiar with the basics of free vibration problems in single degree with and without damping
CO2	Able to understand the concepts of forced vibrations problems and their measurements
CO3	Able to formulate equations for 2 DOF and evaluate the modes of vibration
CO4	Able to frame and solve the equations of multi degree problems using various numerical analysis methods
CO1	Able to analyse the continuous systems and critical speeds shafts

Text Books:

1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.

2. Vibration of Mechanical System, 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,

4. Mechanical Vibrations, Singresu S. Rao, Pearson Education, New Delhi.

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

ROBOTICS AND APPLICATIONS IN MANUFACTURING
(Professional Elective-IV)

Course objectives:
- To know about the various Manufacturing systems in industries
- Able to understand the assembly line balancing
- Able to understand functional line diagrams and degree of freedom
- Able to understand Manipulator kinematics

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.

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.

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.

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.

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.

Course outcomes:

- The students will understand the Basics elements of an automated system
- The students will understand Automated flow line and assembly of balancing
- The students will be able to understand about the robot configurations.
- The students will able to design the homogenous transformations

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.

2. Industrial Robotics - M.P. Groover, TMH.

Reference Books:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.

2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd.

1983 London.

3. Robotic Engineering , Richard D. Klafter, Prentice Hall

4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006

5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

FINITE ELEMENT METHODS

(Open Elective-IV)

	Course Objectives:
1.	To introduce the concepts of Mathematical Modeling of Engineering Problems.
2.	To understand the FEM concepts of structural components
3	To apply FEM concepts for higher order complex elements
4	To analyze the problems of solid mechanics
5	To design the heat transfer equipments and fluid mechanics systems

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.

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.

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.

UNIT IV

Finite Element Application In Solid Mechanics: Problem modelling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso-parametric, sub-parametric and super-parametric 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.

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 function

formulation.

Course Outcomes : After the completion of the course, the student will be	
CO1	Familiar with the concepts, principles and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems.
CO2	Able to evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations
CO3	Able to write polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and isoparametric elements.
CO4	Familiar with triangular and quadrilateral elements and solve problems on numerical integration Gaussian Quadrature and Axisymmetric elements.
CO5	Able to solve problems on steady state heat flow and fluid flow problems in ID & 2D

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, New Delhi.

6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

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DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

ENERGY CONSERVATION AND MANAGEMENT
(Open Elective-IV)

Course Objectives:

* To understanding of technical and commercial aspects of energy conservation and energy auditing.
* To inculcate knowledge and skills about assessing the energy efficiency of an entity
* To impart knowledge in the domain of energy conservation
* To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative business models
* To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding energy conservation and energy auditing.

UNIT - I
THERMODYNAMICS
Availability, energy and Anergy-Exergy, energy, entropy relationship- Degradation of energy – exergy analysis- exergy conservation- combustion, thermal efficiency, thermal losses; thermal balance sheets.
HEAT EXCHANGER THEORY:
Types Of heat exchangers - overall heat transfer coefficient – fouling factor - Design of heat Exchangers, L.M.T.D. and N.T.U. methods.

UNIT - II
ENERGY CONSERVATION:
Rules for efficient energy conservation – technologies for energy conservation – outline of waste heat and material reclamation, load management.
ENERGY AUDITING:
A definition- Level of responsibility- Control of Energy- Uses of Energy - Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- General energy audit- Detailed energy audit.

UNIT - III
THERMAL INSULATION & REFRACTORIES:
Heat loss through un insulated and insulated surfaces; effect of insulation on current carrying wires – economic thickness of insulation – critical radius of insulation – properties of thermal insulators – classification of insulation materials – classification of refractories – properties of refractories – Criteria for good refractory material – application of insulating & refractory materials.

UNIT - IV

WASTE HEAT RECOVERY SYSTEMS:

Guideline to identify waste heat – feasibility study of waste heat – shell and tube heat exchangers – Thermal wheel – heat pipe heat exchanger – Heat pump – waste heat boilers – Incinerators.

UNIT - V

HEAT RECOVERY SYSTEMS:

Liquid to liquid heat exchangers – regenerators, recuperaters, rotating regenerators – selection of materials for heat exchangers, U- tube heat exchanger, fluidized bed heat exchanger – economizer.

Course Outcomes:

On completion of this course, the students will be able to

CO1. Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing

CO2. Ability to analyze the viability of energy conservation projects

CO3. Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing

CO4. Strategic and policy recommendations on energy conservation and energy auditing.

CO5. Ability to develop for waste heat recovery Systems.

References :

1. The role of Energy Manager, E.E.O., U.K.
2. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
3. Conduction Heat Transfer- -Schneder Addition Wieslthy
4. Conduction of Heat in Solids -Carslaw & Jaeger.
5. Fundamentals of heat and mass transfer -R.C. Sachdev New Age International Publishers
6. Heat Transfer By R.K. Rajput/ laxmi publication

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

IV Year B.Tech.M.E. II Semester

L	T	P	C
2	1	0	3

INTRODUCTION TO MECHATRONICS
(Open Elective-IV)

Course objectives:

To introduce the basics of mechatronics systems.
To undersatand the microprocessors and microcontrollers technology and related applications.
To impart knowledge in Study of the architectural details and programming of 16 bit 8085 microprocessor.
To understand the system modeling and analysis in time domain.
To develop architecture and programming of 8051 processor.

UNIT-I

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.

UNIT-II
8085 MICROPROCESSOR AND 8051 MICROCONTROLLER

Introduction – Architecture of 8085– Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.

UNIT-III
PROGRAMMABLE PERIPHERAL INTERFACE

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface

UNIT- IV
PROGRAMMABLE LOGIC CONTROLLER

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT-V

ACTUATORS AND MECHATRONIC SYSTEM DESIGN

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

Course Outcomes : At the end of the course students will be able to
Students can able to understand the concepts,need and importance of mechatronics.
They can able to know the concepts of 8085 microprocessor, 8051 microcontroller
They can able to understand the Programmable peripheral Interface
Students can able to know the structure, programming and selection of PLC
They can able to know the working principle and design concepts of actuators, mechatronic system.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008 2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

=== B.Tech (Mechanical Engineering) (R20) 2020 Admitted Batch Course Structure

Induction Program – 3 weeks

I- Year B.Tech.

Semester-1(Theory-4,Lab -5)					
S.No	CourseNo	CourseName	Category	L-T-P	Credits
1.	20A15101	Linear Algebra and Calculus Common to All branches of Engineering	BS	3-0-0	3
2.	20A15301	Engineering Chemistry Common to CE, MECH, CHEM	BS	3-0-0	3
3.	20A10506	C-Programming & Data Structures Common to CE, MECH, CHEM	ES	3-0-0	3
4.	20A10804	Materials Science & Engineering	ES	3-0-0	3
5	20A10303	EngineeringWorkshop Common to CE, MECH, CHEM	LC	0-0-3	1.5
6	20A10508	IT Workshop Common to CE, MECH, CHEM	LC	0-0-3	1.5
7.	20A10805	Materials Science & Engineering Lab	ES	0-0-3	1.5
8.	20A15302	Engineering Chemistry Lab Common to CE, MECH, CHEM	ES	0-0-3	1.5
9.	20A10507	C-Programming & Data Structures Lab Common to CE, MECH, CHEM	ES	0-0-3	1.5
				Total	19.5

Semester–2(Theory–5,Lab –4, MC-1)					
S.No	CourseNo	CourseName	Category	L-T-P	Credits
1.	20A15102	**Differential Equations and Vector Calculus** Common to all branches of Engineering except CSE	BS	3-0-0	3
2.	20A15203	Engineering Physics Common to CE, MECH, CHEM	BS	3-0-0	3
3.	20A15501	CommunicativeEnglish Common to CE, MECH,	HS	3-0-0	3
4.	20A12401	Basic Electrical & Electronic Engineering Common to MECH, CSE & CHEM	ES	3-0-0	3
5.	20A10301	Engineering Drawing Common to CE, MECH, CHEM	LC	1-0-2	2
6.	20A10302	Engineering Graphics Lab Common to CE, MECH, CHEM	LC	0-0-2	1
7.	20A15502	CommunicativeEnglish Lab Common to CE, MECH,	HS	0-0-3	1.5
8.	20A15204	EngineeringPhysics Lab Common to CE, MECH, CHEM	BS	0-0-3	1.5
9.	20A12402	Basic Electrical & Electronic Engineering Common to MECH, CSE & CHEM	ES	0-0-3	1.5
10	20A19101	Universal Human Values Common to CE, MECH, CHEM	MC	3-0-0	0
*FOR 2020 Admitted Batch only				Total	19.5

JNTUA COLLEGE OF ENGINEERING (Autonomous) ANANTHAPURAMU
DEPARTMENT MECHANICAL ENGINEERING
COURSE STRUCTURE – R20 REGULATIONS II-
B.Tech Course Structure- 2020 Admitted Batch

II-B.Tech Semester-I							
S.No	**Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
1	20A35102	Complex variables, and Transforms Techniques Common to EEE, MECH, ECE	**BS**	**3**	**0**	**0**	**3**
2	20A30108	Theory-2 Fluid Mechanics& Hydraulic Machines	**PC/ES**	**3**	**0**	**0**	**3**
3	20A30301	Theory-3 Manufacturing Processes	**PC/ES**	**3**	**0**	**0**	**3**
4	20A30302	Theory-4 Thermodynamics	**PC/ES**	**3**	**0**	**0**	**3**
5	20A30303	Theory-5 Mechanics of Materials	**PC/ES**	**3**	**0**	**0**	**3**
6	20A30109	Laboratory-1 Fluid Mechanics& Hydraulic Machines lab	**PC/ES**	**0**	**0**	**3**	**1.5**
7	20A30304	Laboratory-2 Manufacturing Processes Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
8	20A30305	Laboratory-3 Mechanics of Materials Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
9	20A30306	**Skill oriented Course-I** Essential for NX Designer	**SC**	**1**	**0**	**2**	**2**
10	20A10803	**Mandatory non-credit Course- II Common to CE,Mech, CHEM** Environmental Science	**MC**	**3**	**0**	**0**	**0**
					Total		**21.5**

JNTUA COLLEGE OF ENGINEERING (Autonomous) ANANTHAPURAMU
DEPARTMENT MECHANICAL ENGINEERING
COURSE STRUCTURE – R20 REGULATIONS II-
B.Tech Course Structure- 2020 Admitted Batch

II-B.Tech Semester-II							
S. No	**Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
1	20A45101	Numerical Methods &Probability Theory Common to EEE, MECH	**BS**	**3**	**0**	**0**	**3**
2	20A40301	Theory-2 Applied Thermodynamics	**PC/ES**	**3**	**0**	**0**	**3**
3	20A40302	Theory-3 Kinematics of Machinery	**PC/ES**	**3**	**0**	**0**	**3**
4	20A40303	Theory-4 Manufacturing Technology	**PC/ES**	**3**	**0**	**0**	**3**
5	0 20A49101 a	**Humanities Elective-I Common to Civil, Mech, chemical** 1.Managerial Economics & Financial Analysis	**HS**	**3**	**0**	**0**	**3**
	20A49101 b	Entrepreneurship and incubation					
	20A49101 c	Business Ethics and Corporate Governance					
6	20A40304	Laboratory-1 Applied Thermodynamics Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
7	20A40305	Laboratory-2 Manufacturing Technology Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
8	20A40306	Laboratory-3 Computer Aided Machine Drawing	**PC/ES**	**0**	**0**	**3**	**1.5**
9	20A40307	Skill oriented Course-II Application Development with Python	**SC**	**1**	**0**	**2**	**2**
10	20A49102	Mandatory non-credit Course-III Common to All Branches Design Thinking for Innovation	**MC**	**2**	**0**	**0**	**0**
11	20A49901	NSS/NCC/NSO Activities	**-**	**0**	**0**	**2**	**0**
						Total	**21.5**

Community Service Internship/Project (Mandatory) for 6 weeks during Summer vacation

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
Department of Mechanical Engineering
Course Structure III -I B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester–V						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50301	Theory – 1 Design of Machine Members	3	0	0	3
2.	20A50302	Theory – 2 Metrology and Measurements	3	0	0	3
3.	20A50303	Theory – 3 Dynamics of Machinery	2	0	1	3
4.	20A50304a 20A50304b 20A50304c	**Professional Elective Course – I** 1. Power Plant Engineering 2. Tool Design 3. Automation and robotics	3	0	0	3
5.	20A50305	**Open Elective Course – I** **Common to All Branches** **Optimization Techniquies** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A50306	Lab-1 Metrology and Measurements	0	0	3	1.5
7.	20A50307	Lab-2 Dynamics Laboratory	0	0	3	1.5
8.	20A50308	**Skill oriented course - III** Computer Aided Modeling	1	0	2	2
9.	20A50309	Evaluation of Community Service Project				1.5
10.	20A59101	**Mandatory Non-credit Course** Indian Constitution (CIV, ME, CHEM)	2	0	0	0
Total						**21.5**

Note:

A student is 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 Minor from V Semester onwards.

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.

A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

Department of Mechanical Engineering

Course Structure III -II B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester–VI						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60301	Theory – 1 CAD/CAM	3	0	0	3
2.	20A60302	Theory – 2 Finite Elements Methods	3	0	0	3
3.	20A60303	Theory – 3 Heat Transfer	3	0	0	3
4.	 20A60304a 20A60304b 20A60304c	**Professional Elective Course– II** 1. Production and Operation Management 2. Non-Destructive Testing 3. Total Quality management	3	0	0	3
5.	20A60305	**Open Elective Course – II** **Common to all Branches** **Solar Energy Systems** (Each department offer one course including Mathematics, Physics, Chemistry andHSS)	3	0	0	3
6.	20A60306	Lab-1 Computer Aided design Laboratory	0	0	3	1.5
7.	20A60307	Lab-2 Computer Aided Manufacturing	0	0	3	1.5
8.	20A60308	Lab-3HeatTransferLaboratory	0	0	3	1.5
9.	 20A65502	**Skill oriented course - IV** Soft Skills (CIV, ME, Chemical)	1	0	2	2
10.	20A69901	**Mandatory Non-credit Course** Intellectual Property Rights & Patents (CIV, ME, CHEM)	2	0	0	0
Total						**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Department of Mechanical Engineering

Course Structure IV -I B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester-VII						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	 20A70301a 20A70301b 20A70301c	**Professional Elective Course– III** 1. Refrigeration & Air Conditioning 2. Operation Research 3. Design for Manufacturing	3	0	0	3
2.	 20A70302a 20A70302b 20A70302c	**Professional Elective Course– IV** 1. Automobile Engineering 2. Mechanical Vibrations 3. Modern Manufacturing Methods	3	0	0	3
3.	 20A70303a 20A70303b 20A70303c	**Professional Elective Course– V (MOOC)** 1.Heat exchangers, Fundamentals and design analysis 2. Mechatronics 3.Theory of Composite Materials	3	0	0	3
4.	 20A75401a 20A75401b 20A75401c	**Humanities Elective** **Common to All Branches** 1. Management Science 2. Business Environment 3. Organizational Behavior	3	0	0	3
5.	20A70304	**Open Elective Course – III** **Common to All Branches** **Modern Manufacturing Methods** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A70305	**Open Elective Course – IV** **Material Handling Equipment** **Common to All Branches** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
7.	20A70306	**Skill oriented course – V** INDUSTRIALAUTOMATION	1	0	2	2
8.	20A70307	Evaluation of Industry Internship				3
Total						**23**

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

Department of Mechanical Engineering

Course Structure IV -II B.TECH. – < ME> R20- 2020 Admitted Batch

Semester-VIII							
S.No.	**Course Code**	**Course Name**	**Category**	**L**	T	**P**	**Credits**
1.	20A80301	Full Internship & Project work	PR				12
						Total	**12**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Common to All Branches

		Open Elective Course – I*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50105	Experimental Stress Analysis	3	0	0	3
2.	20A50205	Electric Vehicle Engineering	3	0	0	3
3.	20A50305	Optimization Techniques	3	0	0	3
4.	20A50405	Basics of Electronics and Communication	3	0	0	3
5.	20A50505	Introduction to Java Programming	3	0	0	3
6.	20A50805	Energy Conversion and Storage Devices	3	0	0	3
7.	20A55101	Optimization Methods (Mathematics)	3	0	0	3
8.	20A55201	Material Characterization Techniques(Physics)	3	0	0	3
9.	20A55401	E-Business (H & SS)	3	0	0	3
10.	20A55301	Chemistry Of Energy Materials (Chemistry)	3	0	0	3

***It is mandatory that the candidate should select any subject other than parent branch subject.**

		Open Elective Course – II				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60105	Disaster Management(CIVIL)	3	0	0	3
2.	20A60205	Renewable Energy Systems(EEE)	3	0	0	3
3.	20A60305	Solar Energy Systems(MECH)	3	0	0	3
4.	20A60405	Basics of Integrated Circuits Applications(ECE)	3	0	0	3
5.	20A60505	Introduction to Linux Programming (CSE) (CSE)	3	0	0	3
6.	20A60805	Green Technology(CHEM)	3	0	0	3
7.	20A65101	Mathematical Modelling & Simulation (Common for CIVIL,MECH &CHEM)(Mathemtics)	3	0	0	3
8.	20A65102	Wavelet transforms and its Applications (Common for EEE&ECE) (Mathemtics)	3	0	0	3
9.	20A65103	Statistical Methods for Data Science CSE (Data Science) (Mathemtics)	3	0	0	3
10.	20A65201	Physics Of Electronic Materials And Devices (Physics)	3	0	0	3
11.	20A65501	Academic Writing and Public Speaking(H & SS)	3	0	0	3
12.	20A65301	Chemistry Of Polymers And Its Applications (Chemistry)	3	0	0	3

***It is mandatory that the candidate should select any subject other than parent branch subject.**

Common to All Branches

		Open Elective Course – III*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70103	Building Technology for Engineers (CIVIL)	3	0	0	3
2.	20A70204	Battery Management Systems (EEE)	3	0	0	3
3.	20A70304	Modern Manufacturing Methods (MECH)	3	0	0	3
4.	20A70404	Digital Electronics (ECE)	3	0	0	3
5.	20A70504	Cyber Security (CSE)	3	0	0	3
6.	20A70804	Industrial Pollution Control Engineering (CHEM)	3	0	0	3
7.	20A75101	Numerical Methods for Engineers	3	0	0	3
8.	20A75201	SMART MATERIALS AND DEVICES (Physics)	**3**	**0**	**0**	**3**
9.	20A75501	Employability Skills (H&SS)	**3**	**0**	**0**	**3**
10.	20A75301	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (Chemistry)	**3**	**0**	**0**	**3**

***It is mandatory that the candidate should select any subject other than parent branch subject.**

		Open Elective Course – IV*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70104	Environmental Impact and Assessment (CIVIL)	3	0	0	3
2.	20A70205	IOT Applications in Electrical Engineering (EEE)	3	0	0	3
3.	20A70305	Material Handling Equipment (MECH)	3	0	0	3
4.	20A70405	Principles of Digital Signal Processing (ECE)	3	0	0	3
5.	20A70505	Introduction to DBMS (CSE)	3	0	0	3
6.	20A70805	Solid Waste management (CHEM)	3	0	0	3
7.	20A75102	Number theory and its Applications (Mathemtics)	3	0	0	3
8.	20A75202	Sensors and Actuators For Engineering Applications (Physics)	**3**	**0**	**0**	**3**
9.	20A79102	English Literary Spectrum (H & Ss)	**3**	**0**	**0**	**3**
10.	20A75302	Chemistry Of Nanomaterials And Applications (Chemistry)	**3**	**0**	**0**	**3**

***It is mandatory that the candidate should select any subject other than parent branch subject.**

HONOURS DEGREE IN MECHANICAL ENGINEERING
INTERNAL COMBUSTION ENGINE (R20)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1	20A03H11	Internal combustion Engine Design	3	1	4
2	20A03H12	Engine Auxiliary Systems	3	1	4
3	20A03H13	Alternative fuels for I.C.Engines	3	1	4
4	20A03H14	Engine pollution and control	3	1	4
5	20A03H15	MOOC I**: Hybrid and Electric vehicles			2
6	20A03H16	MOOC II**: Automotive safety			2

**** Based on the availability of courses offered by NPTEL SWAYAM with a minimum of 12 weeks duration.**

ANANTAPUR COURSES OFFERED FOR MINOR DEGREE IN THE STREAM OF MECHANICAL ENGINEERING -3D PRINTING (Offered to other Engineering Branches R20)
3D PRINTING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M11	Material Science for engineering	3	1	0	4
2	20A03M12	Computer Aided Machine Drawing	3	1	0	4
3	20A03M13	3D Printing Materials	3	1	0	4
4	20A03M14	Applications of 3D Printing	3	1	0	4
5	20A03M15a	MOOC I**: Metal Additive Manufacturing https://onlinecourses.nptel.ac.in/noc22_me130/preview				2
6	20A03M16a	MOOC II**: Introduction to Composites https://nptel.ac.in/courses/112104168				2

**** Based on the availability of courses offered by NPTEL SWAYAM with a minimum of 12 weeks duration.**

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem	**L**	**P**	**T**	**C**
	3	**0**	**1**	**3**

Linear Algebra & Calculus

Common to All Branches of Engineering

Course Objectives:

This course will illuminate the students in the concepts of calculus and linear algebra.
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.

Bridge Course: Limits, continuity, Types of matrices

Unit 1: Matrices **10 hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigenvalues and Eigenvectors and their properties, Properties of Eigen values and Eigen vectors on special matrices, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

Learning Outcomes:

At the end of this unit, the student will be able to

solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors (L3).
identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

Unit 2: Mean Value Theorems **6hrs**

Rolle"s Theorem, Lagrange"s mean value theorem, Cauchy"s mean value theorem, Taylor"s and Maclaurin theorems with remainders (without proof), related problems.

Learning Outcomes:

At the end of this unit, the student will be able to
Translate the given function as series of Taylor"s and Maclaurin"s with remainders (L3)
analyze the behaviour of functions by using mean value theorems (L3)

Unit 3: Multivariable calculus **10 hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

Unit 4: Multiple Integrals **10hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

Unit 5: Beta and Gamma functions **6 hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

Text Books:

B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.

Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn

Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press

Peter O‟neil, Advanced Engineering Mathematics, Cengage Learning.

R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education

B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education

H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)

Utilize mean value theorems to real life problems (L3)

familiarize with functions of several variables which is useful in optimization (L3)

Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)

Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
2	1	0	3

(Common to CE, MECH, CHEM)

Subject Code	Title of the Subject	L	T	P	C
19A53101	**Engineering Chemistry**	2	1	-	3

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

COURSE OUTCOMES	
CO1	**list** the differences between temporary and permanent hardness of water, **explain**the principles of reverse osmosis and electrodialysis. **compare**quality ofdrinking 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 –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – 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 fuel cells

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, 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

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol

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.

UNIT-4 Advanced Engineering Materials **(8 hrs)**

(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:

Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi

Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Common to CE, ME, , CHEM

C-Programming & Data Structures 20A10506

Course Objectives:

To illustrate the basic concepts of C programming language.
To discuss the concepts of Functions, Arrays, Pointers and Structures.
To familiarize with Stack, Queue and Linked lists data structures.
To explain the concepts of non-linear data structures like graphs and trees.
To learn different types of searching and sorting techniques.

Unit-1

Introduction to C Language - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

At the end of the Unit, students should be able to:

Use C basic concepts to write simple C programs. (L3)
Use iterative statements for writing the C programs (L3)
Use arrays to process multiple homogeneous data. (L3)
Test and execute the programs and correct syntax and logical errors. (L4)
Translate algorithms into programs. (L4)
Implement conditional branching, iteration and recursion. (L2)

Unit – 2

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

At the end of the Unit, students should be able to:

Writing structured programs using C Functions. (L5)
Writing C programs using various storage classes to control variable access. (L5)
Apply String handling functions and pointers. (L3)
Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

Unit-3

Data Structures, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

At the end of the Unit, students should be able to:

Describe the operations of Stack. (L2)
Explain the different notations of arithmetic expression. (L5)
Develop various operations on Queues. (L6)

Unit – 4

Linked Lists – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

At the end of the Unit, students should be able to:

Analyze various operations on singly linked list. (L4)
Interpret operations of doubly linked lists. (L2)
Apply various operations on Circular linked lists. (L6)

Unit-5

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

At the end of the Unit, students should be able to:

Develop the representation of Tress. (L3)
Identify the various Binary tree traversals. (L3)
Illustrate different Graph traversals like BFS and DFS. (L2)
Design the different sorting techniques (L6)
Apply programming to solve searching and sorting problems. (L3)

Text Books:

The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes:

Analyse the basicconcepts of C Programming language. (L4)
Design applications in C, using functions, arrays, pointers and structures. (L6)
Apply the concepts of Stacks and Queues in solving the problems. (L3)
Explore various operations on Linked lists. (L5)
Demonstrate various tree traversals and graph traversal techniques. (L2)
Design searching and sorting methods (L3)

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I-Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Material Science & Engineering 20A10804

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

UNIT I

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-Phase diagrams: 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

- Understand 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)
- Know the concept of metallography in studying the microstructures of metals and alloys. (L2)

UNIT II

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels-stainless steels and tool steels.

Cast irons: Microstructure, 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 III

Heat Treatment of Steels: Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe_3C alloys and microstructure development. Continuous 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 iron - iron carbide phase diagram. (L2)
Know the influence of heat treatment in modification of properties of steels. (L2)
Develop a heat treatment cycle based on properties required. (L3)
Comprehend the principles of surface hardening methods. (L2)

UNIT IV

Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram

Learning Outcomes:

At the end of this unit the student will be able to

Understand 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: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand 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)
- Select steels and cast irons for a given application. (L3)
- Apply heat treatment to different applications. (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)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

Text Book(s)

V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997R.

References

Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
Balasubramaniam, Callister‟s Material Science and Engineering, 2/e, Wiley India, 2014.

L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson

Education, 2008.

4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

Engineering Workshop
(Common to CE, MECH, CHEM)

L	T	P	C
0	0	3	1.5

Course Objective:	20A10303
1	To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

Half – Lap joint
Mortise and Tenon joint
Corner Dovetail joint or Bridle joint

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

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 tyre puncture and change of two wheeler tyre

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

Power tools:

Demonstration of a) Circular Saw b) Power Planer
c) Zig Saw d) Buffing Machine

After completion of t lab the student will be able to

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Apply wood working skills in real world applications. (L3)
CO2	Build different objects with metal sheets in real world applications. (L3)
CO3	Apply fitting operations in various applications. (L3)
CO4	Apply different types of basic electric circuit connections. (L3)
CO5	Understand the operation of power tools. (L2)

Note: In each section a minimum of three exercises are to be carried out.

(w.e.f 2020-21)

JNTUA College of Engineering (Autonomous) Ananthapuramu
Department of Computer Science and Engineering B.Tech (R20)

B.Tech I Year

IT Workshop 20A10508

(Common to CE, ME, CHEM)

L-T-P-C: 0-0-3-1.5

Note: Use open source tools for implementation of the following exercises.

Course Objectives:

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

Preparing your Computer

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

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

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, and 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

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, Image Manipulation tools.

Task 9: 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.

Task 10: 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

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling

Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

Introduction to Computers, Peter Norton, McGraw Hill

MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.

Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

Networking your computers and devices, Rusen, PHI

Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH

Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Course Outcomes:

Disassemble and Assemble a Personal Computer and prepare the computer ready to use.

Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.

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.

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I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Engineering Chemistry Lab
(Common to CE, MECH, CHEM)

Subject Code	Title of the Lab	L	T	P	C
19A15302	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

Determination of Hardness of a groundwater sample.
pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
Determination of cell constant and conductance of solutions
Potentiometry - determination of redox potentials and emfs
Determination of Strength of an acid in Pb-Acid battery
Preparation of a polymer
Determination of percentage of Iron in Cement sample by colorimetry
Estimation of Calcium in port land Cement
Adsorption of acetic acid by charcoal
Determination of percentage Moisture content in a coal sample

Determination of Viscosity of lubricating oil by Red Viscometer 1
Determination of Flash and Fire points of fuels
Determination of Calorific value of gases by Junker‟s gas Calorimeter

TEXT BOOKS:

Vogel‟s Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem **L T P C 0**
031.5

(Common to CE, MECH, CHEM)

20A10507

C-Programming & Data Structures Lab

Course Objectives:

To get familiar with the basic concepts of C programming.
To design programs using arrays, strings, pointers and structures.
To illustrate the use of Stacks and Queues
To apply different operations on linked lists.
To demonstrate Binary search tree traversal techniques.
To design searching and sorting techniques.

Week l

Write C programs that use both recursive and non-recursive functions

To find the factorial of a given integer.
To find the GCD (greatest common divisor) of two given integers.
To solve Towers of Hanoi problem.

Week 2

Write a C program to find both the largest and smallest number in a list of integers.
Write a C program that uses functions to perform the following:
Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

Write a C program that uses functions to perform the following operations:
To insert a sub-string in to a given main string from a given position.
To delete n characters from a given position in a given string.

Week 4

Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn„t contain T.

Write a C program to count the lines, words and characters in a given text.

Week 5

Write a C Program to perform various arithmetic operations on pointer variables.

Write a C Program to demonstrate the following parameter passing mechanisms:

i) call-by-value ii) call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

Reading a complex number
Writing a complex number
Addition of two complex numbers
Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

Arrays
Pointers

Week 8

Write C programs that implement Queue (its operations) using

Arrays
Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

Converting infix expression into postfix expression
Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

Creating a Binary Tree of integers

Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

Linear search
Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

Bubble sort
Selection sort
Insertion sort

Text Books:

Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

B.A. Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.

Richard F. Gilberg & Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

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radipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.

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.Balaguruswamy, “C and Data Structures”, 4th Edition, Tata Mc Graw Hill.

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.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

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.T.Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009.

Course Outcomes

ℜ ℜ ℜ ℜ
emonstrate basic concepts of C programming language. (L2)

ℜ ℜ ℜ ℜ
evelop C programs using functions, arrays, structures and pointers. (L6)

ℜ ℜ ℜ ℜ
llustrate the concepts Stacks and Queues. (L2)
ℜ ℜ ℜ ℜ
esign operations on Linked lists. (L6)
ℜ ℜ ℜ ℜ
pply various Binary tree traversal techniques. (L3)
ℜ ℜ ℜ ℜ
evelop searching and sorting methods. (L6)

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Material Science & Engineering Lab 20A10805

Course Objectives:

To understand the microstructure and hardness of engineering materials.
To explain grain boundaries and grain sizes of different engineering materials.

List of Experiments:

Metallography sample preparation
Microstructure of pure metals – Iron, copper and aluminum as per ASTM standards
Microstructure of low carbon steel, mild steel and high carbon microstructure of cast irons.

Microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.

Hardenability of steels by Jominy End Quench Test.
Microstructure of heat treated steels.
Hardness of various untreated and treated steels.
Microstructure of ceramics, polymeric materials.
Microstructure of super alloy and nano-materials.
Hardness of ceramics, super alloys, nano-materials and polymeric materials (one sample on each)

Course Outcomes:

The student is able to

Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (L4)
Visualize grains and grain boundaries. (L3)
Importance of hardening of steels. (L2)
Evaluate hardness of treated and untreated steels. (L4)
Differentiate hardness of super alloys, ceramics and polymeric materials.

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem	**L**	**P**	**T**	**C**
20A15102	**3**	**0**	**0**	**3**

Differential Equations and Vector Calculus

(Common to all branches of Engineering except CSE)

Course Objectives:

To enlighten the learners in the concept of differential equations and multivariable calculus.
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.

UNIT 1: Linear differential equations of higher order (Constant Coefficients) **10hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters.Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:

At the end of this unit, the student will be able to

identify the essential characteristics of linear differential equations with constant coefficients (L3)
solve the linear differential equations with constant coefficients by appropriate method (L3)
classify and interpret the solutions of linear differential equations (L3)
formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT 2:Partial Differential Equations **8hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange‟s method and non-linear PDEs (Standard Forms)

Learning Outcomes:

At the end of this unit, the student will be able to

apply a range of techniques to find solutions of standard PDEs (L3)
outline the basic properties of standard PDEs (L2)

UNIT 3: Applications of Partial Differential Equations **10 hrs**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

Learning Outcomes:

At the end of this unit, the student will be able to

calcify the PDE (L3)

learn the applications of PDEs(L2)

UNIT4: Vector differentiation **6hrs**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

apply del to Scalar and vector point functions (L3)

illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT 5: Vector integration **8hrs**

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) and applications of these theorems.

Learning Outcomes:

At the end of this unit, the student will be able to

find the work done in moving a particle along the path over a force field (L4)

evaluate the rates of fluid flow along and across curves (L4)

apply Green"s, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
Peter O"neil, Advanced Engineering Mathematics, Cengage Learning.
R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L6)

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem **L T P C**
2 1 0 3

Common to Civil, Mechanical, Chemical

Subject Code	Title of the Subject	L	T	P	C
20A15203	ENGINEERING PHYSICS	2	1		3

COURSE OBJECTIVES

- To make a bridge between the physics in school and engineering courses.
- To understand the concepts of mechanics and employ the applications of oscillations to engineering fields.
- To familiarize the basic ideas of acoustics and ultrasonics with their Engineering applications.
- 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.
- To evoke interest on applications of superposition effects like interference, diffraction and polarization in engineering.
- 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.

COURSE OUTCOMES

After studying this course, the student will be able to:

CO1	Understand the basics of mechanics and types of
CO2	Explain sound propagation in buildings, acoustic properties of typically used materials in buildings and the use of ultrasonics.
CO3	Apply the different realms of physics in both scientific and technological systems through the study of lasers and fiber optics.
CO4	Analyze different physical phenomena of optics like interference, diffraction and polarization.
CO5	Compare the properties of dielectric, magnetic and nano materials along with their engineering applications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Unit-I: Wave Optics
12hrs

Interference- Principle of superposition – Interference of light – Conditions for sustained interference – Interference in thin films (Reflection Geometry) – Colors in thin films – Newton‟s Rings- Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction – 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 – Nd-YAG laser – He-Ne 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

10hrs

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Orientation polarization (Qualitative), Electronic and Ionic – Lorentz internal field – Clausius-Mossotti equation – Dielectric breakdown – Dielectric 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:AcousticsandUltrasonics **10hrs**

Acoustics- Introduction – Requirements of acoustically good hall – 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 – Miller indices – Separation between successive (hkl) planes.

Characterization Techniques: X-Ray Diffraction**:** Bragg"s law – Bragg"s X-ray diffractometer – Crystal structure determination by Powder 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:

Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018).
Engineering Physics – K. Thyagarajan, McGraw Hill Publishers (2018).
Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
Engineering Physics by B.K. Pandey and S. Chaturvedi, Cengage Learning(2018)
Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press(2016)
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)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem | | **L** | **T** | **P** | **C**

	L	T	P	C
20A15501	2	0	0	2

Communicative English 1
Common to Civil, Mechanical

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.

Course Objectives

Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers

Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials

Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations

Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information

Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

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: Innovation: Muhammad Yunus

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:

Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

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

Course Outcomes

At the end of the course, the learners will be able to

Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English

Apply grammatical structures to formulate sentences and correct word forms

Analyze discourse markers to speak clearly on a specific topic in informal discussions

Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.

Create a coherent paragraph interpreting a figure/graph/chart/table

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem **L T P C 3003**

20A12401

Basic Electrical & Electronics Engineering

Part A: Basic Electrical Engineering
((Mechanical, CSE & Chemical)

I B.Tech – II Sem L T P 3 0 03

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 Power system generation, transmission and distribution

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, Resonance.
Learning Outcomes: Students should be able to
● recall Kirchoff laws
● analyze simple electric circuits with DC excitation
● apply network theorems to simple circuits
● analyze single phase AC circuits consisting of series RL - RC - RLC combinations

Unit 2 DC & AC Machines:
Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Torque equation – Analyze Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC tests on transformer - Principle and operation of 3-phase AC machines [Elementary treatment only]
Learning Outcomes: Students should be able to
● explain principle and operation of DC Generator & Motor.
● perform speed control of DC Motor
● explain operation of transformer and induction motor.
● explain construction & working of induction motor - DC motor
Unit 3 Basics of Power Systems:

1. 2. 3. 4.

Layout & operation of Hydro, Thermal, Nuclear Stations –Principle of operation of solar PV cell, characteristics of PV cell – Basic concept of wind power generation- Typical AC power supply scheme – Definition of short, medium and long transmission lines – Concepts of distribution system.

Learning Outcomes: Students should be able to

● understand working operation of various generating stations
● analyze the I-V characteristics solar PV cell

Text Books:

1. D. P. Kothari and I. J. Nagrath - “Basic Electrical Engineering” - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, “Principles of Power System” – S.Chand – 2018.

References:

1. L. S. Bobrow - “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.
3. C.L. Wadhwa – “Generation Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International Publications.

Course Outcomes: The students should be able to

● apply concepts of KVL/KCL in solving DC circuits
● understand and choose correct rating of a transformer for a specific application
● illustrate working principles of DC Motor
● identify type of electrical machine based on their operation
● understand the basics of power generation, transmission and distribution

JNTUA COLLEGE OF ENGINEERING (Autonomous):: ANANTHAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I –Year B.Tech.II -Semester **L T P C**
3 0 0 3

20A12401

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRONICS ENGINEERING
PART- B

COURSE OBJECTIVES	
The students will be able to	
	Understand principle and terminology of electronics.
	Analyse the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators.
	Understand the concept of Digital Logic
	Understand the Concept & Principles of Digital Logic

COURSE OUTCOMES	
At the end of this course the student will be able to	
CO1	Able to apply the knowledge of diodes, Zener diodes, BJT"s and FET"s for applications of different circuits.
CO2	Analyse the applications of operational amplifiers.
CO3	Solve problems of various digital logic gates and circuits.
CO4	Correlate the fundamental concepts to various Real life applications of today.

UNIT I

Diodes and Transistors: Semiconductor Diode, Zener Diode, Rectifier Circuits, Wave Shaping Circuits,Bipolar Junction Transistors(operating modes modes,Configurations and Charecteristics), Introduction to Transistor Biasing and Transistor as an amplifier, Introduction to Field-Effect Transistors (Configurations and characteristics).

UNIT II

Operational Amplifiers: Op-amp Equivalent Circuit, Ideal and practical Op-amp characteristics, Op-Amp Applications (Inverting amplifier, Non -inverting amplifier, Summing, scaling & averaging amplifiers, integrator, differentiator, Active filters, oscillators and comparators).

UNIT III

Digital Electronics: Number Systems and Codes, Logic Gates, Boolean Theorems, DeMogan"s Theorems, Algebraic Simplification, Karnaugh Map Method. Binary Addition, 2"s Complement System, Full Adder, BCD Adder. NAND and NOR gate Latches, S-R Flip-Flop, JK Flip-Flop, D Flip-Flop, Introduction to Shift registers and Counters

Text Books:

Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education

Ramakant A.Gayakwad, Op-Amps and Linear Integrated Circuits, Eastern Economy Edition

3.M.Morris Mano and Michael D.Ciletti, Digital Design, Pearson Education,4th Edition

References:

R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education.

Bell, D. A., Electronic Devices and Circuits, Oxford University Press

3.R.J. Tocci: Digital Systems; PHI, 6e, 2001.

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DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
1	0	2	2

20A10301

Engineering Drawing
(Common to CE, MECH, CHEM)

Course Objectives:

Bring awareness that Engineering Drawing is the Language of Engineers.
Familiarize how industry communicates technical information.
Teach the practices for accuracy and clarity in presenting the technical information.
Develop the engineering imagination essential for successful design.

Unit:I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance-Conventions in drawing-lettering - BIS conventions. a)Conic sections including the rectangular hyperbola- general method only,
Cycloid, epicycloids and hypocycloid c) Involutes

Learning Outcomes:

At the end of this unit the student will be able to

Lettering and dimensioning by freehand (L1)
Create geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
Create Conic sections and cycloidal curves.(L6)

Unit: II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or 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 Projection of the objectives in four quadrants (L2)
Project the points, lines and planes (L6)

Unit: III

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

Learning Outcomes:

At the end of this unit the student will be able to

1.Project the solids in both planes. (L6)

2. To draw the solids by auxiliary method. (L6)

Unit: IV

Sections of solids: 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

1.Project the sectional view of regular solids.(L6)

2. Understand how to draw the true shapes of the sections.(L2)

Unit:V

Development of surfaces: 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

Draw the development of surfaces of the solids.(L6)

Understand to develop the sectional parts of the solids.(L2)

Text Books:

K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.

N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

Dr K.Prahlada Rao, Dr. S. Krishnaiah, Prof.A.V.S. Prasad, Engineering Graphics, Amaravati publications.

Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009

Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000

Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009

K.C.John, Engineering Graphics, 2/e, PHI, 2013

Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

draw various curves applied in engineering. (L2)

show projections of solids and sections graphically. (L2)

draw the development of surfaces of solids. (L3)

Additional Sources

Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

20A10302

Engineering Graphics Lab
(Common to CE, MECH, CHEM)

Course Objectives:

Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
Instruct graphical representation of machine components.

Computer Aided Drafting:

Introduction to Geometric Modeling: 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.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Text Books:

K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:

T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
K.C.John, Engineering Graphics, 2/e, PHI, 2013
Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

Use computers as a drafting tool. (L2)
Draw isometric and orthographic drawings using CAD packages. (L3)

Additional Sources: 1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, red woods.edu.

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

COMMUNICATIVE ENGLISH LABORATORY-1
(Common to CE, MECH,)

20A15502

Course Objectives

students will be exposed to a variety of self instructional, learner friendly modes of language learning

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 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: Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills

CO2: 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.

CO4: Evaluate and exhibit acceptable etiquette essential in social and professional settings

CO5: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

Phonetics for listening comprehension of various accents

Reading comprehension

Describing objects/places/persons

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

JAM

Small talks on general topics

Debates

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

Situational dialogues – Greeting and Introduction

Summarizing and Note making

Vocabulary Building

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

Asking for Information and Giving Directions

Information Transfer

Non-verbal Communication – Dumb Charade

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

Oral Presentations
Précis Writing and Paraphrasing
Reading Comprehension and spotting errors

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

Young India Films
Walden Infotech
Orell

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

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem (20A15204) **L T P C**
0 0 3 1.5

(Common to CE, MECH, CHEM)

Subject Code	Title of the Lab	L	T	P	C
20A15204	**ENGINEERING PHYSICS LABORATORY**	0	0	3	1.5

COURSE OBJECTIVES	
	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
	To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.
	To train engineering students on basis of measurements and the instruments
	To equip the students with practical knowledge in electronic and optics experiments

COURSE OUTCOMES	
CO1	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.
CO2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CO4	The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application.
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.

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

Any TEN of the following experiments has to be performed during the SEMESTER

Laser: Determination of wavelength using diffraction grating.
Laser: Determination of Particle size.
Determination of spring constant of springs using Coupled Oscillator
Determination of ultrasonic velocity in liquid (Acoustic grating)
Determination of dielectric constant and Curie temperature of a ferroelectric material.
B-H curve
Stewart-Gee's Method
Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
Determination of numerical aperture of an optical fiber.
Determination of thickness of thin object by wedge method.
Determination of radius of curvature of lens by Newton"s rings.
Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
Determination of dispersive power of the prism
Sonometer: Verification of the three laws of stretched strings
Meldes experiment: Determination of the frequency of tuning fork

Note: Out of 10 experiments, two experiments will be performed using virtual laboratory.

Data Books Required: Nil

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem	L	T	P	C
	0	0	1.5	0.75

BASIC ELECTRICAL ENGINEERING LAB

20A12402

(PART-A - ½ LAB)

Common to Mechanical, CSE & Chemical
Part A: Electrical Engineering Lab

I B. Tech – II Sem. L T P
0 0 3

Course Objectives:
1. To verify Kirchoff's laws and Superposition theorem
2. To learn performance characteristics of DC Machines
3. To perform various tests on 1- Phase transformer
4. To study the I – V characteristics of solar PV cell

Note: From the following list experiments minimum six experiments are required to be conducted:

List of experiments: -
1. Verification of Kirchhoff laws
2. Verification of Superposition Theorem
3. Magnetization characteristics of a DC Shunt Generator
4. Speed control of DC Shunt Motor
5. OC & SC test of 1 – Phase Transformer
6. Load test on 1-Phase Transformer
7. I – V characteristics of solar PV cell
8. Brake test on DC Shunt Motor

Course Outcomes: The students should be able to
1. Understand Kirchoff's laws & Superposition theorem
2. Analyze the various characteristics on DC machines by conducting various tests
3. Analyze I – V characteristics of PV cell
4. Apply the knowledge to perform various tests on 1-phase transformer

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2020-21

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

I- Year B.Tech. II-Sem	**L**	**T**	**P**	**C**
	0	**0**	**1.5**	**0.75**

BASIC ELECTRONICS ENGINEERING LAB

20A12402

(PART-B - ½ LAB)

(Common to ME & CHEM)

COURSE OBJECTIVES	
The students will be able to	
	Understand the characteristics of PN junction diode and zener diode.
	Understand the characteristics of BJT in CE and CB configurations
	Learn the frequency response of CE Amplifier
	Exposed to linear and digital integrated circuits

COURSE OUTCOMES	
At the end of this course the student will be able to,	
CO1	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
CO2	Analyze the application of diode as rectifiers, clippers and clampers.
CO3	Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits.
CO4	Learn the basics of linear integrated circuits and understand characteristics of operational amplifier.
CO5	Learn about available digital ICs and verify truth tables of logic gates and flip flops.

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.

Zener diode characteristics and Zener as voltage Regulator

Full Wave Rectifier with & without filter

Wave Shaping Circuits (Clippers & Clampers)

Input & Output characteristics of Transistor in CB / CE configuration

Frequency response of CE amplifier.

Inverting and Non-inverting Amplifiers using Op Amps

Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs

Verification of Truth Tables of RS, JK, T & D flip flops using respective ICs

LAB REQUIREMENTS:

Cathode Ray Oscilloscopes (30MHz)

Signal Generator /Function Generators (3 MHz)

Dual Regulated Power Supplies (0 – 30V)

IC Trainer Kit

Bread Boards

Electronic Components

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU (Common to All Branches of Engineering)

20A19101 UNIVERSAL HUMAN VALUES
Common to CIVI, Mech, Chemical

I - Year B.Tech. II-Sem **L T P C**

3 00 0

1. Introduction:

This course discusses the role of human values in one‟s family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course names as"H-102 Universal Human Values 2 : "Understanding Harmony" is designed which may be covered in their III or IV Semester.

In the Induction Program, students would get an initial exposure to human values through Universal HumanValues–I.This exposure is to be augmented by this compulsory full semester foundation course.

2.Learning 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

COURSE TOPICS:

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Universal Human Values-I - Self-Exploration - content and process; „Natural Acceptance‟ and Experiential Validation - self-exploration - Continuous Happiness and Prosperity - Human Aspirations - current scenario - Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!

human being as a co-existence of the sentient „I" and the material„Body" - the needs - happiness and physical facility -the Body as an instrument of „I" - the characteristics and activities of „I" and harmony in „I" - the harmony of I with the Body

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

the harmony in the Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all- pervasive space - Holistic perception of harmony at all levels of existence.

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Humanistic Education - Competence in professional ethics: professional competence - people friendly and eco-friendly production systems - appropriate technologies and management patterns for above production systems. Individuals as socially and ecologically responsible engineers, technologists and managers

Prescribed Text Book

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

Teachers" Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

ReferenceBooks

.**JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999**
HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.

The Story of Stuff (Book).

Economy of Permanence - J C Kumarappa 8.

Bharat Mein Angreji Raj - PanditSunderlal 9.

Rediscovering India - byDharampal

Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi

India Wins Freedom - Maulana Abdul Kalam Azad 12.

Vivekananda - Romain Rolland(English)

This is OUTCOME OF THECOURSE:

By the end of the course,

CO1: Define terms like Natural Acceptance, Happiness and Prosperity

CO2: Understand awareness of oneself, and ones surroundings (family, society, nature)

CO3: Apply what they have learnt to their own self in different day-to-day settings in real life

CO4: Relate human values with human relationship and human society.

CO5: Justify the need for universal human values and harmonious existence

CO6: Develop as socially and ecologically responsible engineers

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING II Year B.Tech.M.E. I Semester

Course Code	Complex variables and Transforms Techniques		L	T	P	C
20A35102	B.Tech II Year (Common to ECE, EEE & MECH)		3	0	0	3
Pre-requisite	Functions,Differentiationsand Integration	Semester	III			

Course Objectives:
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.
Course Outcomes (CO): Student 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, Fourier Transforms and Z transforms.

evaluate the Fourier series expansion of periodic functions.

Understand the use of Fourier transforms and apply Z transforms to solve difference equations.

UNIT - I	**Complex Variable – Differentiation**:	8 Hrs

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate- construction of analytic function by Milne Thomson method-Conformal mappings- standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT - II	**Complex Variable – Integration**:	9 Hrs

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, 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).

UNIT - III	**Laplace Transforms**	9 Hrs
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 - IV	**Fourier series**	8 Hrs
Determination of Fourier coefficients (Euler’s) – 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-typical wave forms - Parseval’s formula- Complex form of Fourier series.		
UNIT - V	**Fourier transforms & Z Transforms:**	9 Hrs
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 . Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.		
Textbooks:		
Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India		
Reference Books:		
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.		
Online Learning Resources:		
nptel.ac.in/courses/111107056 onlinelibrary.wiley.com https://onlinecourses.nptel.ac.in/noc18ma12.		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Fluid Mechanics and Hydraulic Machines**		**L**	**T**	**P**	**C**
20A30108			**3**	**0**	**0**	**3**
Pre-requisite	**Physics, Chemistry**	**Semester**	**III**			

Course Objectives:

- To impart ability to solve engineering problems in fluid mechanics
- To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
- To enable the students measure quantities of fluid flowing in pipes, tanks and channels
- To Introduce concepts of uniform and non-uniform flows through open channel.
- To impart knowledge on design of turbines and pumps.

Course Outcomes (CO):

- Familiarize basic terms used in fluid mechanics
- Understand the principles of fluid statics, kinematics and dynamics
- Understand flow characteristics and classify the flows and estimate various losses in flow through channels
- Analyze characteristics for uniform and non-uniform flows in open channels.
- Design different types of turbines, centrifugal and multistage pumps.

UNIT - I Introduction to Fluid Statics

Distinction between a fluid and a solid - characteristics of fluids - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT - II Fluid kinematics and Dynamics

Classification of fluid flow - Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number

UNIT - III Analysis Of Pipe Flow

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series. Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody's diagram – Introduction to boundary layer theory.

UNIT - IV Flow in Open Channels

Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Computation of Uniform flow.Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity – Broad Crested Weir. Gradually Varied FlowDynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification - Elements and characteristics- Energy dissipation.

UNIT - V	Hydraulic Machines

Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory characteristic curves of hydraulic turbines - Cavitation - Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies – Introduction to Reciprocating Pump.

Textbooks:

P. M. Modi and S. M. Seth, “Hydraulics and Fluid Mechanics”, Standard Book House

K. Subrahmanya, “Theory and Applications of Fluid Mechanics”, Tata McGraw Hill

Reference Books:

R. K. Bansal, A text of “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications (P) Ltd., New Delhi.

K. Subramanya, Open channel Flow, Tata McGraw Hill.

N. Narayana Pillai, Principles of “Fluid Mechanics and Fluid Machines”, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.

C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, “Fluid Mechanics and Machinery”, Oxford University Press, 2010.

Banga& Sharma, “Hydraulic Machines”, Khanna Publishers.

Online Learning Resources:

https://www.coursera.org/courses?query=fluid%20mechanics

https://www.udemy.com/topic/fluid-mechanics/

https://onlinecourses.nptel.ac.in/noc21_ce31/preview

https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/

http://lms.msitonline.org/mod/folder/view.php?id=138

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	Manufacturing Processes		L	T	P	C
20A30301			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To introduce the students to working principle of different metal casting processes and gating system.
- To impart knowledge on plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- To teach principles of forging, tools and dies, working of forging processes.
- To develop fundamental understanding on classification of the welding processes, working of different types of welding processes and welding defects.
- To impart knowledge on manufacturing methods of plastics, ceramics and powder metallurgy.
- To introduce the basic concepts of Unconventional Machining Processes.

Course Outcomes (CO):

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)

UNIT - I	Casting Processes	8 Hrs

Introduction: Importance and selection of manufacturing processes.

Introduction to casting process, process steps; pattern 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.

UNIT - II	Metal Forming & Forging	8 Hrs

Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; 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.

Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

UNIT - III	Metal Joining Processes	8 Hrs

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. applications, advantages and disadvantages of the above processes, Plasma Arc welding, Laser Beam Welding, Electron Beam Welding and Friction Stir Welding. Heat affected zones in welding; Welding defects: causes and remedies. soldering and Brazing: Types and their applications.

UNIT - IV	Plastic Processing, Ceramics and Powder Metallurgy	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, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

UNIT - V	Additive Manufacturing Processes	10 Hrs
Introduction, Fused-deposition modeling, Stereolithography Multijet/Polyjet Modeling, Selective Laser Sintering, Electron-Beam Melting, Three-Dimensional Printing, Laminated-object Manufacturing, Laser-Engineered Net Shaping-Solid-ground Curing.		
Textbooks:		
Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018. Serope Kalpakjian and Steven R. Schmid , Manufacturing Engineering and Technology, 7/e, Pearson, 2018.		
Reference Books:		
Introduction to Physical Metallurgy by Sidney H.Avner Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.		
Online Learning Resources:		
https://www.digimat.in/nptel/courses/video/112107145/L01.html https://www.digimat.in/nptel/courses/video/112105126/L01.html		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	Thermodynamics		L	T	P	C
20A30302			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.

Course Outcomes (CO):

After completing the course, the student will be able to:

- Understand the importance of thermodynamic properties related to conversion of heat energy into work. (L1)
- 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)
- Analyze thermodynamic relations and air standard cycles. (L5)

UNIT - I	First law of Thermodynamics	10 Hrs

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 and Temperature measurement.

Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics**.**

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.

UNIT - III	Entropy, Availability and Irreversibility	8 Hrs

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems.
Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.
Maxwell relations, TdS equations difference in heat capacities, ratio of heat capacities.

UNIT - IV	Properties of Steam and use of Steam Tables	8 Hrs

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. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V	Air Standard Cycles	8 Hrs

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles, Comparison of Brayton and Otto Cycles.

Textbooks:
P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.
Reference Books:
J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015 R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010
Online Learning Resources:
https://nptel.ac.in/courses/112/105/112105266/ https://nptel.ac.in/courses/112/104/112104113/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Mechanics of Materials**		**L**	**T**	**P**	**C**
20A30303			**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- Understand the basics of stresses and strains
- Draw the shear force and bending moment drawings of various beams.
- Understand the Behaviour of members and Torsional forces
- Understand the Behaviour of cylinders
- Understand the stresses developing in curved beams.

Course Outcomes (CO):

- Evaluate stresses and strains
- To draw the SF and BM diagrams for various beams under different loading conditions
- Determine the resistance and deformation in machine members subjected to torsional loads and springs.
- Analyze and design thin, thick cylinders.
- Analysis of stresses in curved bars.

UNIT - I	Analysis of stress and strain

Types of external loads - self weight - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams working stress - elongation of bars of constant and varying sections - Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigenvalue problem.

UNIT - II	Bending moment and shear force

Different types of beams - shear force and bending moment diagrams for simply supported, overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.

UNIT - III	Torsion and Springs

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT - IV	Thin Cylinders, Spheres and Thick Cylinders

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame‟s theory – Application of theories of failure.

UNIT - V	Bending of curved bars & Unsymmetrical Bending

Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings. Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections.

Textbooks:

1. Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
2. Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 2002.

- Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
- Strength of Materials – R. K. Rajput – S. Chand & Company

Beer, F.P.,Johnston, E.R. and DeWolf, J.T.,Mechanics of Materials, 3rd ed., Tata McGraw-Hill Strength of Material – Dr. Sadhu Singh – Khanna Publishers Strength of Material, Vol. I and II – S. P. Timoshenko – EWP Press
Online Learning Resources:
https://nptel.ac.in/courses/112/107/112107146/ https://ocw.mit.edu/courses/materials-science-and-engineering/3-11-mechanics-of-materials-fall-1999/ https://www.coursera.org/courses?query=mechanics%20of%20materials https://www.udemy.com/course/strengthofmaterials/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES LAB		L	T	P	C
20A30109			0	0	3	1.5
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

By performing this laboratory, the student will be able to know the fluid flow measurements by considering different types flow measurement devices and working principles of various pumps and motors.

Course Outcomes (CO):

By performing the various tests in this laboratory the student will be able to know the principles of discharge measuring devices and head loss due to sudden contraction and expansion in pipes and working principles of various pumps and motors.

List of Experiments:

Verification of Bernoulli's equation.
Calibration of Venturi meter.
Calibration of Orifice meter
Determination of Coefficient of discharge for a small orifice by constant head method.
Determination of Coefficient of discharge for a small orifice by variable head method.
Determination of Coefficient of discharge for an external mouth piece by Constant head method.
Determination of Coefficient of discharge for an external mouth piece by variable head method.
Calibration of contracted Rectangular Notch.
Calibration of contracted Triangular Notch. Determination of friction factor
Determination of loss of head in a sudden contraction.
Determination of loss of head in a sudden Expansion.
Performance test on Impulse turbines
Performance test on reaction turbines (Francis and Kaplan Turbines)
Impact of jet
Performance test on centrifugal pumps, determination of operating point and efficiency

References:

Fluid Mechanics & Hydraulic Machines A Lab Manual by Ts Desmukh (Author), Laxmi Publications (P) Ltd
Fluid Mechanics & Machinery Laboratory Manual by N Kumara Swamy (Author), Charotar Books Distributors
Lab. Manual of Fluid Mechanics & Machines by Gupta, Chandra (Author), cbspd (Publisher)

Online Learning Resources/Virtual Labs:

1. http://eerc03-iiith.vlabs.ac.in/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Manufacturing Processes Lab**		**L**	**T**	**P**	**C**
20A30304			**0**	**0**	**3**	**1.5**
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes

Course Outcomes (CO):

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)

List of Experiments:

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Mechanics of Materials Lab**		**L**	**T**	**P**	**C**
20A30305			**0**	**0**	**3**	**1.5**
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

By performing this laboratory, the student will be able to know the structural behavior of various materials

Course Outcomes (CO):

By performing the various tests in this laboratory the student will be able to know the structural behavior of various structural elements when subjected to external loads

List of Experiments:

Tension test.
Bending test on (Steel/Wood) Cantilever beam.
Bending test on simply supported beam.
Torsion test.
Vickers Hardness Test
Rockwell Hardness Test
Brinell Hardness Test
Compression test on Open coiled springs
Tension test on Closely coiled springs
Compression test on wood/ concrete
Izod Impact test on metals
Charpy Impact test on metals
Shear test on metals
Direct Shear Test on Timber Specimen
Use of electrical resistance strain gauges.
Continuous beam – deflection test.

Note : Any 12 of the above equipments

References:

1. **Strength of Materials Lab Manual by** Anand Jayakumar A , **Notion Press**

Online Learning Resources/Virtual Labs:

http://sm-nitk.vlabs.ac.in/#

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Skill oriented course-I**		**L**	**T**	**P**	**C**
20A30306	Essentials for NX Designers		**1**	**0**	**2**	**2**
Pre-requisite	**NIL**	**Semester**	**III**			

Course objectives:

After successfully completing this course, you should be able to:

Open and examine NX models.
Create and edit parametric solid models.
Create and modify basic assembly structures.
Create and modify simple drawings.

Course Outcomes:

Open and examine NX models.
Create and edit basic assembly structures.
Create and edit drawings.
Use synchronous modeling.
Create component patterns.
Define revision identifier.

List of Course Contents

Opening and Working with Parts
Getting to know the NX Interface
Impact of Coordinate Systems on Parts
Creating Parts with Sketches
Sweeping geometry to create part features
Creating and editing geometric relationships with formulas
Creating datum geometry to support design intent
Examining the structure of a model
Editing and manipulating sketches
Trimming a solid body
Creating swept features with offset and draft
Creating and editing holes
Creating and manipulating shell features
Copying and mirroring part segments
Blending and chamfering edges
Modifying geometry of imported parts
Creating simple drawings

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. I Semester

Course Code	**Mandatory Noncredit course-II**		**L**	**T**	**P**	**C**
20A10803	**ENVIRONMENTAL SCIENCE** (Common to CE, MECH, CHEM)		**3**	**0**	**0**	**0**
Pre-requisite	**NIL**	**Semester**	**III Sem**			

Course Objectives:

To make the students to get awareness on environment
To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
To save earth from the inventions by the engineers.

Course Outcomes (CO):

At the end of the course, the student will be able to
Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
Understand flow and bio-geo- chemical cycles and ecological pyramids.
Understand various causes of pollution and solid waste management and related preventive measures.
About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
Casus of population explosion, value education and welfare programmes.

UNIT - I **8 Hrs**

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : 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 **12 Hrs**

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)

Biodiversity And Its Conservation : 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-sports 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		8 Hrs

Environmental Pollution: Definition, Cause, effects and control measures of :

Air Pollution.
Water pollution
Soil pollution
Marine pollution
Noise pollution
Thermal pollution
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		10 Hrs

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 - V		8 Hrs

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – 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.

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, and birds – river, hill slopes, etc..

Textbooks:

Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
Palaniswamy, “Environmental Studies”, Pearson education
S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**Numerical Methods & Probability Theory-** (Common to EEE, MECH) **B.Tech II Year**		**L**	**T**	**P**	**C**
20A45101			**3**	**0**	**0**	**3**
Pre-requisite	Basic Equations and Basic Probability	**Semester**	**IV**			

Course Objectives:

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.The theory of Probability and random variables.

Course Outcomes (CO): Student will be able to

- apply numerical methods to solve algebraic and transcendental equations
- derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- apply Probability theory to find the chances of happening of events.
- understand various probability distributions and calculate their statistical constants.

UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT - II	**Interpolation**	8 Hrs

Finite differences -Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT - III	**Numerical Integration & Solution of Initial valueproblems to Ordinary differential equations**	9 Hrs

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule
Numerical solution of Ordinary Differential equations: Solution by Taylor's series- Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

UNIT - IV	**Probability theory:**	9 Hrs
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.		
UNIT - V	**Random variables & Distributions:**	9 Hrs
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution		

Textbooks:

Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE.
Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
   Advanced Engineering Mathematics, by Alan Jeffrey,

Elsevier. Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc17_ma14/preview
nptel.ac.in/courses/117101056/17
http://nptel.ac.in/courses/111105090

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Applied Thermodynamics		L	T	P	C
20A40301			3	0	0	3
Pre-requisite	NIL	Semester	IV			

Course Objectives:

- To introduce students to the Working Principles of IC engines.
- To teach combustion process in SI and CI engines.
- To impart knowledge on different types of compressors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

Course Outcomes (CO):

After completing this course, the students can

- Understand the working of IC engines with combustion process. (L1)
- Select compressors for different applications. (L2)
- Use T-s diagram in vapour power and gas power cycles. (L3)
- Evaluate the relative performance of different steam turbines (L6)
- Select appropriate refrigerant for different applications. (L6)

UNIT - I	IC Engines	10 Hrs

Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.

Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of IC Engines.

Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting ignition lag, Flame propagation and knocking. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking.

UNIT - II	Air compressors	8 Hrs

Reciprocating Compressor: Single stage reciprocating compressors, work required, 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, working principle of centrifugal and axial flow compressors.

UNIT - III	Vapour & Gas Power Cycles	8 Hrs

Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variables effecting efficiency, Rankine cycle – reheating and regeneration.

Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating.

UNIT - IV	Nozzles & Steam Turbines	8 Hrs

Type of nozzles - gas and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - Nozzle efficiency - Super saturation.

Steam Turbines - impulse turbine and reaction turbine – compounding of impulse turbines - velocity diagrams in impulse and reaction turbines, blade efficiency, degree of reaction.

UNIT - V	Refrigeration & Air-Conditioning	8 Hrs

Refrigeration: Bell-Coleman cycle - vapour compression cycle, sub cooling and super heating-vapour absorption cycle, properties of common refrigerants.

Principles of Psychrometry and Air Conditioning: Psychometric properties, psychometric processes, summer and winter air conditioning systems.

Textbooks:

1. Thermal Engineering, Mahesh V Rathore, Tata McGraw Hill 2017
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014

Reference Books:
Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014. Refrigeration and Air Conditioning, C.P.Arora
Online Learning Resources: https://nptel.ac.in/courses/112/103/112103307/ https://nptel.ac.in/courses/112/103/112103275/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**KINEMATICS OF MACHINERY**		**L**	**T**	**P**	**C**
20A40302			**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

The Objectives of this course are to:

- To provide a foundation for the study of Dynamics of Machinery and machine design.
- Comprehend the fundamentals of kinematics and to understand the concept of machines, mechanisms and related terminologies.
- Analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To develop skills for designing and analyzing linkages and mechanisms.
- Formulate the concept of synthesis and analysis of different mechanisms.
- To understand the Principles and working of various straight line motion mechanisms.
- To analyze Steering gear mechanisms and working of Hooke's joint.
- To understand the theory of gears, gear trains and cams.

Course Outcomes (CO):

- Build up critical thinking and problem-solving capacity of various mechanical engineering problems related to kinematics of machines (L4)
- Understand the basic principles of mechanisms in mechanical engineering (L1)
- Assess various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams) and design related problems effectively (L6)
- Examine the velocity and acceleration diagram for a given mechanism (L3)
- Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design (L3)
- Construct the cam profile for a given motion (L3)
- Analyze various gear trains (L4)

UNIT - I — MECHANISMS AND MACHINES — 16 Hrs

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.

Steering & Straight-Line Motion Mechanisms :

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types – Peaucellier, Hart, 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 - II — KINEMATICS — 10Hrs

. **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, determination of Coriolis component of acceleration, Klein's 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 centers in-line theorem – Locating instantaneous canters for simple mechanisms and determination of angular velocity of points and links.

UNIT - III — Kinematic Synthesis — 10 Hrs

Kinematic Synthesis: Dimensional synthesis, function generation, path generation and motion generation, Synthesis of Four Bar linkage for specified Instantaneous conditions, Hirsch horn's method of components.

UNIT - IV	Gears & GEAR TRAINS	10 Hrs

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, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and Worm gears.

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 – Simple problems.

UNIT - V	CAMS & Followers	8 Hrs

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal, 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

Textbooks:

Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers.
Theory of Machines R.S Khurmi& J.K Gupta, S Chand Publishers.

Reference Books:

Theory of Machines by Thomas Bevan/ CBS
Theory of Machines / R.K Bansal
Theory of Machines Sadhu Singh PearsonsEdn
Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
The theory of Machines /Shiegley/ Oxford.
Theory of machines – PL. Balaney/khanna publishers
Mechanics Synthesis by RL Naathan

Online Learning Resources:

https://www.digimat.in/nptel/courses/video/112104121/L01.html
https://nptel.ac.in/courses/112/105/112105268/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Manufacturing Technology		L	T	P	C
20A40303			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- To introduce the parameters in the metal cutting operation.
- To relate tool wear and tool life and the variables that control them.
- To calculate machining times for different machining processes.
- To impart knowledge on various metal cutting processes. (Lathe, drilling, boring shaping, slotting, milling and grinding).
- To teach the principles of jigs and fixtures and types of clamping and work holding devices.

Course Outcomes (CO):

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)

UNIT - I	**Material Removal Processes & Lathe**	**8 Hrs**

Metal Cutting: Single and multi-point cutting tools, orthogonal and oblique cutting, Merchant circle Diagram, chip formation, tool wear and tool life, surface finish, machinability, cutting tools and materials, cutting fluids.

Lathe and Lathe Operations: Principles of working, specifications, types of lathes, operations, work and tool holders. Taper turning, thread turning attachments for lathes. Machining time calculations. Principles of working: Turret and capstan lathes.

UNIT - II	**Drilling Machines, Boring, Reaming and Taping**	12 Hrs

Drilling Machines: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of twist drill, Machining time calculations

Boring Machines- Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of boring tools, Machining time calculations

Reaming and Reamers: Principles of working, specifications, types, and operations performed – tool holding devices - nomenclature of reamers. Machining time calculations

Taping and Taps: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of taps

UNIT - III	**Milling, Shaping and Abrasive Machining**	8 Hrs

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.

Shaping, Slotting and planing machines - Principles of working - principal parts, specification, classification, operations performed, machining time calculations

Abrasive Machining: Grinding and grinding machines: Grinding process, types of grinding machines, grinding process parameters, honing, lapping, other finishing processes.

UNIT - IV	**Unconventional Machining Processes**	**10 Hrs**

principle and Processes parameters of Electrical discharge machining (EDM), electro-chemical machining (ECM), Laser beam machining (LBM), plasma arc machining (PAM), electron beam machining, Abrasive jet machining (AJM), water jet machining (WJM), and ultrasonic machining(UM)

UNIT - V	Jigs and Fixtures	8 Hrs
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.		

Textbooks:

P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e, Tata McGraw-Hill Education, 2013
R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012
Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

Milton C.Shaw , Metal Cutting Principles, 2/e, Oxford, 2012
Hindustan Machine Tools, Production Technology, TMH, 2001
V.K.Jain, Advanced Machining Process,12/e, Allied Publications, 2010
AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017
Halmi A Yousuf & Hassan, , Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008

Online Learning Resources:

https://www.digimat.in/nptel/courses/video/112107239/L01.html
https://nptel.ac.in/courses/112/104/112104304/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (R-20 Mechanical Engineering)
Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101a	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**	3	0	0	3

Pre-requisite **Semester -IV**

Course Objectives:

The objectives of this course are:

1.	To inculcate the basic knowledge of micro economics and financial accounting
2.	To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
3.	To know the various types of Market Structures & pricing methods and its strategies
4.	To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5.	To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

UNIT – I

Managerial Economics
Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand – DemandElasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.
LEARNING OUTCOMES: At the end of the Unit, the learners will be able to
State the Nature of Managerial Economics and its importance
- Understand the concept of demand andits determinants
- Analyze the Elasticity and degree of elasticity
- EvaluateDemand forecasting methods
- Design the process of demand estimation for different types of demand

UNIT - II
Production and Cost Analysis
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination–Shortrun and longrun Production Function- Isoquants andIsocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III
Business Organizations and Markets
Introduction – Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

UNIT - IV
Capital Budgeting
Introduction – Nature, meaning, significance, functions and advantages. Typesof Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals,Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V
Financial Accounting and Analysis
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis* -** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

B.Tech (R-20 Mechanical Engineering)

Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101b	**ENTREPRENEURSHIP& INCUBATION**	3	0	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To make the student understand about Entrepreneurship
2	To enable the student in knowing various sources of generating new ideas in setting up ofnew enterprise
3	To facilitate the student in knowing various sources of finance in starting up of a business
4	To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5	To encourage the student in creating and designing business plans

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Concepts related to the Entrepreneurship and Incubators
CO2	Understand the concept of Entrepreneurship and challenges in the world of competition.
CO3	Apply the Knowledge in generating ideas for New Ventures.
CO4	Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
CO5	Evaluate the role of central government and state government in promoting Entrepreneurship.
CO6	Create and design business plan structure through incubations.

UNIT-I: Entrepreneurship

Introduction-Nature, meaning, significance, functions and advantages. concept, characteristics-knowledge and skills requirement - process - Factors supporting entrepreneurship - Differences between Entrepreneur and Intrapreneur - entrepreneurial mindset and personality - Recent trends.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India

- Analyzerecent trends in Entrepreneurship across the globe
- Develop a creative mind set and personality in starting a business.

UNIT-II: Women Entrepreneurship

Introduction – Nature, meaning, significance, functions and advantages. Growth of women entrepreneurship in India. - Issues & Challenges - Entrepreneurial motivations.Entrepreneurship Development and Government. Role, of Central and State Government - incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Analyze the role of export-oriented units
- Evaluate the tax concessions available for Women entrepreneurs

UNIT-III:Product Development

Introduction – Nature, meaning, significance, functions and advantages. Startup Initiatives - Generating business/ Service idea – Sources and methods –Identifying opportunities - Feasibility study - Market feasibility, technical/operational feasibility, Financial feasibility. Developing business plan, Preparing project report, Presenting business plan to investors.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plansinproject preparation and prepare project reports

UNIT-IV:Startups

Introduction – Nature, meaning, significance, functions and advantages. Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence theType/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure -Value proposition

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Design their own business incubation/incubators as viable-business unit.

UNIT-V: Finance

Introduction – Nature, meaning, significance, functions and advantages. Sources - Long term and Short term - Institutional Finance – Commercial Banks, SFC's and NBFC's in India, Role in small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions supporting entrepreneurship development.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the various sources of finance in Starting the new venture
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluatethe need and importance of MSMEs in the growth of country

TEXT BOOKS

1. D F Kuratko and T V Rao, **Entrepreneurship** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit :login.cengage.com)
2. .Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

REFERENCES

1.Vasant Desai,Small Scale Industries and Entrepreneurship, Himalaya Publishing 2012.
2. Rajeev Roy Entrepreneurship, 2nd Edition, Oxford, 2012.
3.B.JanakiramandM.Rizwana|| Entrepreneurship Development: Text & Cases, Excel Books, 2011.
4.Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

E-RESOURCES

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

B.Tech (R-20 Mechanical Engineering)

Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101c	**BUSINESS ETHICS AND CORPORATE GOVERNANCE**	3	0	0	3

Pre-requisite **Semester -IV**

Course Objectives:

The objectives of this course are:

1.	To make the student understand the principles of business ethics
2.	To enable them in knowing the ethics in management
3.	To facilitate the student's role in corporate culture
4.	To impart knowledge about the fair-trade practices
5.	To encourage the student in creating knowing about the corporate governance

UNIT – I

ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior - Value systems - Business Ethics,Types, Characteristics, Factors, Contradictions and Ethical Practices inManagement- Corporate Social Responsibility – Issues of Management – Crisis Management.

UNIT - II

ETHICS IN MANAGEMENT

Introduction Ethics in production, finance, Human Resource Management and, Marketing Management - Technology Ethics and Professional ethics - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

UNIT - III

CORPORATE CULTURE

Introduction, Meaning,definition,Nature, Scope, Functions,andsignificance–

Cross cultural issues in Ethics - - Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive

Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

UNIT - IV

LEGAL FRAME WORK

Law and Ethics, Agencies enforcing Ethical Business Behavior, Legal Impact– Environmental Protection, Fair Trade Practices,legal Compliances, Safeguarding Health and wellbeing of Customers.

UNIT - V

CORPORATE GOVERNANCE

Introduction, meaning – scope Nature - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility. of BoDs composition, Cadbury Committee - various committees - reports - Benefits and Limitations.

Textbooks:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH.

Reference Books:

1.Dr. K. Nirmala, KarunakaraReddy: Business Ethics and Corporate Governance, HPH
2. H.R.Machiraju: Corporate Governance
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M.Khandelwal : Indian Ethos and Values for Managers

2020-2021

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

JNTUACEA **R-20**

2020-2021

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**Applied Thermodynamics Lab**		**L**	**T**	**P**	**C**
20A40304			**0**	**0**	**3**	**1.5**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- Understand the functioning and performance of I.C. Engines
- To find heat losses in various engines

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Explain different working cycles of engine
- Describe various types of combustion chambers in IC engines
- Illustrate the working of refrigeration and air conditioning systems
- Evaluate heat balance sheet of IC engine.
-

LIST OF EXPERIMENTS

Demonstration of diesel and petrol engines by cut models

1. Valve timing diagram of 4-stroke diesel engine
2. Port timing diagram of 2-stroke petrol engine
3. Performance of 2-stroke single cylinder petrol engine
4. Morse test on multi cylinder petrol engine
5. Performance of 4-stroke single cylinder diesel engine
6. Assembly and disassembly of diesel and petrol engines
7. Exhaust gas analysis
8. Performance of two stage reciprocating air compressor
9. Determination of nozzle characteristics
10. Performance of Refrigeration system
11. Performance of Air conditioning system
12. Performance of heat pump

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**Manufacturing Technology Lab**		**L**	**T**	**P**	**C**
20A40305			**0**	**0**	**3**	**1.5**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- Familiarize the construction and working of various machine tools.
- Teach selection of parameters for different machining processes.

Course Outcomes (CO):

After completion of this course the student may be able to

- Implement the concept of machining with various machine tools.(L5)
- Get hands on experience on various machine tools and machining operations. (L5)

List of Experiments:

1. Demonstration of operations on general purpose machines: Lathe, drilling, milling, shaper, slotting, cylindrical and surface grinding machines.
2. Step turning and knurling on lathe machine
3. Taper turning and knurling on lathe machine
4. Thread cutting (left hand or right hand) on lathe machine.
5. Drilling and Boring operations.
6. Reaming and tapping operations.
7. Milling (Gear cutting) by using simple and Compound indexing.
8. key way/Groove cutting on milling machine
9. Shaping and planning operations
10. Slotting operations
11. Cylindrical and surface grinding operations
12. Grinding of single point cutting tool

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Computer Aided Machine Drawing		L	T	P	C
20A40306			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

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 and 3D assembly drawings.
- Familiarize with limits, fits and tolerances in mating components

Course Outcomes (CO):

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.

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 with washer and locknut, stud joint, screw joint and foundation bolts.
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.
Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, 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)
Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

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.

Textbooks:

- K.L.Narayana, P.Kannaiah and K.Venkat Reddy, Production Drawing, New Age International Publishers, 3/e, 2014
- Software tools/packages- Auto CAD, Solid works or equivalent.

Reference Books:
Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
Online Learning Resources:
https://eeedocs.files.wordpress.com/2014/02/machinedrawing.pdf

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Skill oriented course-II		L	T	P	C
20A40307	Application Development with Python		1	0	2	2
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

1. To learn the basic concepts of software engineering and life cycle models
2. To explore the importance of Databases in application Development
3. Acquire programming skills in core Python
4. To understand the importance of Object-oriented Programming

Course Outcomes (CO):

Students should be able to

1. Identify the issues in software requirements specification and enable to write SRS documents for software development problems
2. Explore the use of Object oriented concepts to solve Real-life problems
3. Design database for any real-world problem
4. Solve mathematical problems using Python programming language

Module 1. Basic concepts in software engineering and software project management

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle
Software project management: project planning and project scheduling

Task:
Identifying the Requirements from Problem Statements

Module 2. Basic Concepts of Databases
Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements
Task:
Implement Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
Implement Data Manipulation Language(DML) Statements

Module 3. Python Programming:
Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements
Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments-Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:
1. OPERATORS

Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.

Read your name and age and write a program to display the year in which you will turn 100 years old.

Read radius and height of a cone and write a program to find the volume of a cone.

Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2. CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.

b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.

c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)

d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

LIST

Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).

Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)

Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).

Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]

b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [("GFG", "IS", "BEST"), ("GFg", "AVERAGE"), ("GfG",), ("Gfg", "CS")], Output : [(„GFG‟, „IS‟, „BEST‟)]).

Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).

Write a program to perform union, intersection and difference using Set A and Set B.

Write a program to count number of vowels using sets in given string (Input : "Hello World", Output: No. of vowels : 3)

Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

Write a program to do the following operations:

Create a empty dictionary with dict() method

Add elements one at a time

Update existing key‟s value

iv. Access an element using a key and also get() method

Deleting a key value using del() method

Write a program to create a dictionary and apply the following methods:

pop() method

popitem() method
clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS
a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS
A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
Write a fact() function to compute the factorial of a given positive number.
Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS
a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

CLASS AND OBJECTS
Write a program to create a BankAccount class. Your class should support the following methods for
Deposit
Withdraw
GetBalanace
PinChange
Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (dict).
Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

FILE HANDLING
a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
i. Count the sentences in the file.
Count the words in the file.
Count the characters in the file.
b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
c. Write a Python program to store N student"s records containing name, roll number and branch. Print

the given branch student‟s details only.
References:
Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018. Ramez Elmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6th Edition, 2013. 3.Reema Thareja, “Python Programming - Using Problem Solving Approach”, Oxford Press, 1st Edition, 2017. Larry Lutz, “Python for Beginners: Step-By-Step Guide to Learning Python Programming”, CreateSpace Independent Publishing Platform, First edition, 2018
Online Learning Resources/Virtual Labs:
http://vlabs.iitkgp.ernet.in/se/ http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php https://python-iitk.vlabs.ac.in

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Mandatory noncredit course-III		L	T	P	C
20A49102	Design Thinking for Innovation (Common to All branches of Engineering)		2	1	0	0
Pre-requisite	NIL	**Semester**	IV			

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

Define the concepts related to design thinking.
Explain the fundamentals of Design Thinking and innovation
Apply the design thinking techniques for solving problems in various sectors.
Analyse to work in a multidisciplinary environment
Evaluate the value of creativity
Formulate specific problem statements of real time issues

UNIT - I Introduction to Design Thinking 10 Hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process 10 Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation 8 Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design 8 Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT - V Design Thinking in Business Processes 10 Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

Change by design, Tim Brown, Harper Bollins (2009)
Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

Reference Books:

Design Thinking in the Classroom by David Lee, Ulysses press Design the Future, by Shrrutin N Shetty, Norton Press Universal principles of design- William lidwell, kritinaholden, Jill butter. The era of open innovation – chesbrough.H
Online Learning Resources:
https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

B. Tech (ME) III-I SEM (R20)

(20A50301) Theory -1 DESIGN OF MACHINE MEMBERS

CourseObjectives:

Provideanintroductiontodesignofmachineelements.
Familiarizewithfundamentalapproachestofailurepreventionforstaticandd ynamicloading.
Explaindesignprocedurestodifferenttypesofjoints.
Teachprinciplesofclutchesandbrakesanddesignprocedures.
Instructdifferenttypes ofbearingsanddesignprocedures.

CourseOutcomes:

Attheendofthecoursethestudentswillbeableto

Estimatesafetyfactorsof machinememberssubjectedtostaticanddynamicloads. (L5)
Designfastenerssubjectedtovarietyofloads. (L6)
Select of standard machine elements such as keys, shafts, couplings, springs and bearings. (L1)
Designclutchesbrakesandspurgears.(L6)

UNIT-I Introduction,DesignforStaticandDynamicloads

Mechanical Engineering Design: Designprocess, 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.

UNIT-II DesignofBoltedandWeldedJoints

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.

WeldedJoints: Strengthof lap andbutt welds, Joints subjectedtobendingandtorsion. Eccentrically loaded welded joints.

UNIT-III PowertransmissionshaftsandCouplings

Power TransmissionShafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Designofflangeandbushedpincouplings,universalcoupling.

UNIT-IV DesignofClutches, BrakesandSprings

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: Designofhelicalcompression,tension,torsionandleafsprings.

UNIT-V DesignofBearingsand Gears

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.

DesignofGears: Spurgears,beamstrength,Lewisequation,designfor dynamicandwear loads.

Textbooks:

R.L.Norton,MachineDesignanIntegratedapproach,2/e,PearsonEducation, 2004.
V.B.Bhandari,DesignofMachineElements,3/e,TataMcGrawHill,2010.
Dr.N.C.Pandya&Dr.C.S.Shah,Machinedesign,17/e,CharotarPublishingHouse Pvt. Ltd, 2009.

ReferenceBooks:

R.K.Jain,MachineDesign,KhannaPublications, 1978.
J.E.Shigley,MechanicalEngineeringDesign,2/e,TataMcGrawHill,1986.

M.F. SpottsandT.E. Shoup, DesignofMachineElements,3/e, Prentice Hall (Pearson Education), 2013.
K.Mahadevan&K.BalaveeraReddy,Designdatahandbook, CBSPublications,4/e,2018.

OnlineLearningResources:

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

B. Tech (ME)-III-I Sem (R20)

(20A50302) Theory 2 METROLOGY AND MEASUREMENTS

Course Objectives:

Introducethebasicconceptsof metrologyandmeasurementmethods.
Demonstratetheimportanceof metrologyin manufacturing.
Explaintheconceptsoftransducersanditspracticalapplications.
Exposewithvariousmeasuringinstruments.
Familiarizecalibrationmethodsofvariousmeasuringinstruments.

Course Outcomes: At the end of the course the students will be able to
Listvariousmeasuringinstrumentsusedinmetrology.L1
Examinegeometryofscrewthreadsandgearprofiles.L3
Measureforce, torqueandpressure.L3
Calibratevariousmeasuringinstruments.L5

UNIT I Concept of measurement

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: Vernierinstruments, 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.

UNIT–II FlatnessandSurfaceRoughnessmeasurement.

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-Ra, Rzvalues, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

UNIT–III ScrewThreadandGearMeasurement

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.

CoordinateMeasuringMachine(CMM)-Constructionandfeatures.

UNIT–IV MeasurementofDisplacementandStrain

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo-electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurements ofStrain: Various types of electrical strain gauges, gaugefactor, methodof usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque,straingaugerosettes.

UNIT–V MeasurementofForce,Torqueand Pressure

MeasurementofForce: Direct method-analyticalbalance, platformbalance; elastic members –load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

Measurement ofPressure: Standards and calibration, basic methods of pressuremeasurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

Textbooks:

Beckwith,Marangoni,Linehard,MechanicalMeasurements,6/e,PHI,2013.
R.K.Jain,EngineeringMetrology,20/e,KhannaPublishers,2013.

ReferenceBooks:

Mahajan,EngineeringMetrology,2/e,DhanpatRai,2013.
S.Bhaskar,BasicPrinciples-

MeasurmentsandControlSystems,AnuradhaPublications, 2014.
AnandKBewoor&VinayAKulkarni,Metrology&Measurement,15/e,McGrawHill, 2015.
D.S.Kumar,MechanicalMeasurements&Control,MetropolitanPublishers,5/e,2015.

OnlineLearningResources:

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech (ME) – III-I Sem (R20)

L	T	P	C
2	0	1	3

(20A50303) Theory -3 DYNAMICS OF MACHINERY

Course Objectives:

Analysisofforcesactinginmechanisms
Effectsofunbalanceforces
Modellingandanalyzingthevibrationbehaviorofspringmassdampersystem
Theprinciplesinmechanismsusedforgoverningofmachines.

Course Outcomes: Attheendofthecourse,thestudentwillbeable to

Determinetheforcesactingonvariouslinkageswhenamechanismissubjectedtoexternalforces.L5
IdentifyandcorrecttheunbalancesofrotatingbodyL1
AnalyzethevibratorymotionofSDOFsystems.L2
ReducethemagnitudeofvibrationandisolatevibrationofdynamicsystemsL3
DeterminedimensionsofGovernorsforspeedcontrol.L5

UNIT-I Friction and PowerScrews

Friction: Inclined plane, frictionof screws andnuts, pivot andcollar, uniformpressure, uniformwear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Powerscrews:Formsofthreads, self-locking ofscrews,efficiencyof different screws,Square, trapezoidal, screw threads.

UNIT-II Precession,Turning Moment Diagram and FlyWheel

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motorcycle,aeroplanes and ships. TurningMoment DiagramsandFlyWheels:Turningmoment diagrams for steamengine, 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.

UNIT-III Governors

Watt, Porterand Proell governors. Spring loaded governors– Hartnell and Hartung governors withauxiliary springs. Sensitiveness, isochronism and hunting.Effort and power of a governor.

UNIT-IVBalancing

Balancing: Balancing of rotating masses - single and multiple – single and different planes.
Balancing ofReciprocatingMasses:PrimaryandSecondarybalancingofreciprocatingmasses .
Analytical and graphical methods.Unbalanced forces and couples – V-engine, multi cylinder inline and radial engines for primary and secondary balancing.

UNIT-V Vibration

Freeandforced vibration ofsingledegreeoffreedomsystem, Roleof damping, whirlingofshafts and critical speeds.Simple problems on free, forced and damped vibrations.Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method.Torsional vibrations - two and three rotor systems.

Textbooks:

S.S.Rattan,TheoryofMachines,MGHPublishers,3/e,2013.
R.L.Norton,KinematicsandDynamicsofMachinery,TataMcGrawHill,2017.

ReferenceBooks:

ThomasBevan,Theoryofmachines,Pearson,3/e,2012.
J.E.Shigley,Thetheoryofmachinesandmechanisms,McGrawhill,2/e,1995.
R.S.Khurmi,J.K.Guptha,TheoryofmachinesS.Chandpublications,2005.

OnlineLearningResources:

https://nptel.ac.in/courses/112104114
https://nptel.ac.in/courses/112101096
https://archive.org/details/NPTEL-MechEngr-Dynamics_of_Machines
https://www.youtube.com/watch?v=OlZXxPVpmBs
https://www.digimat.in/nptel/courses/video/112104114/L01.html

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech (ME) – III-I SEM (R20)

(20A50304a) POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

(PROFESSIONAL ELECTIVE-I)

Course objective

Familiarizethesourcesofenergy,powerplant economicsandenvironmentalaspects.
Outlinetheworkingcomponentsofdifferentpower plant.
Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
Imparttypesofnuclearpowerplants,andoutlineworkingprincipleandadvant agesand hazards.

CourseOutcomes: At the end of the course the students will be able to

Outlinesourcesof energy,powerplanteconomics,andenvironmentalaspectsL1
Explainpowerplanteconomicsandenvironmentalconsiderations L1
Describeworkingcomponentsofa steampowerplantL2
IllustratetheworkingmechanismofDieselandGasturbinepowerplantsL3
SummarizetypesofrenewableenergysourcesandtheirworkingprincipleL4
Demonstratetheworkingprincipleofnuclear power plantsL3

UNIT-I Introduction to the Sources of Energy

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.

UNIT-II Steam PowerPlant

Modern High Pressureand Supercritical Boilers - Analysis of Power Plant CyclesModern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fueland Handling Equipments, Types ofCoals, CoalHandling,

ChoiceofHandlingEquipment, CoalStorage, AshHandlingSystems.
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.CO2Recorders

UNIT-III Diesel and Gas Turbine PowerPlants

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- FuelStorage
Gas Turbine Plant: Introduction - Classification - Construction - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT-IV HydroElectric Power Plants

HydroElectricPowerPlant: Waterpower-HydrologicalCycle/FlowMeasurement-Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways. **HydroProjects&Plant:**Classification-PlantAuxiliaries-PlantOperationPumpedStoragePlants.

UNIT-V Non-Conventional Source of Energy

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.

NuclearPowerStation: NuclearFuel-NuclearFission,ChainReaction,BreedingandFertile Materials - Nuclear Reactor - Reactor Operation.
TypesOfReactors: PressurizedWaterReactor,BoilingWaterReactor,Sodium-GraphiteReactor,

Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Textbooks:

P.K.Nag,PowerPlantEngineering,3/e,TMH,2013.
Arora andS. Domkundwar, AcourseinPower Plant Engineering, DhanpatRai&Co(P) Ltd, 2014.

ReferenceBooks:

Rajput,ATextbookofPowerPlantEngineering,4/e,LaxmiPublications, 2012.
Ramalingam,PowerplantEngineering,SciTechPublishers,2013.
P.C.Sharma,PowerPlantEngineering,S.K.KatariaPublications,2012.

OnlineLearningResources:

https://www.iare.ac.in/sites/default/files/lecture_notes/PPE_LECTURE_NOTES.pd f

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
B.Tech (ME) – III-I Sem (R20)

L	T	P	C
3	0	0	3

(20A50304b)TOOL DESIGN (PROFESSIONAL ELECTIVE-I)

Theobjectivesofthiscourseareto

DescribethebasicconceptsofToolDesign.
ClassifyFitsandTolerancesusedinToolDesign.
DefinethefundamentalconceptsofDesigningofJigsandFixtures.
Applybasicmathematicstodesignthepresstooldies.
Understandthen nomenclatureofthemillingcutters.
ExplaintheconceptualdesignofCNCmachinetools.

CourseOutcomes:

Attheendofthecoursestudentwillbeableto

ComparetheFerrous andnonferrous toolmaterialsL1
Classifythetypesofchipformationduringorthogonal cuttingL1
DesignDrillJigsandFixturesL6
Designas simplegripperforrobotL6
UnderstandtheconceptofdesignofdieandpiercingoperationsL2
Understandaboutthetoolholdingmethods,Automatictoolchangersandtoolp ositionsinCNC MachineL2

UNIT- INTRODUCTIONTOTOOLDESIGN

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non metallic tool materials-Designing with relation to heat treatment.

UNIT-II DESIGNOFCUTTINGTOOLS

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle -Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

UNIT-III DESIGNOFJIGSANDFIXTURES

Introduction–FixedGages –GageTolerances –selectionof materialfor Gauges – IndicatingGages – Automatic gages – 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 – Vice Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures.

UNIT-IV DESIGNOFPRESSTOOL DIES

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 – Short-run tooling for Piercing – Bending dies – Drawing dies-Design and drafting.

UNIT-V TOOLDESIGNFORCNCMACHINETOOLS

Introduction–Toolingrequirements for Numericalcontrolsystems – Fixturedesignfor CNCmachine 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 Brownand Sharp machine.

Textbooks:

CyrllDonaldson,GeorgeH.LeCain,V.C.Goold,“ToolDesign”,TataMcGrawHill Publishing Company Ltd., 2000.

E.G.Hoffman,”JigandFixtureDesign”, ThomsonAsia PvtLtd, Singapore,2004.

ReferenceBooks:

P.C.Sharma,ATextbookofProductionEngineering’s.ChandPublications,1999.

PrakashHiralalJoshi,“Toolingdata”,WheelerPublishing, 2000

VenkataramanK.,“DesignofJigs,FixturesandPress tools”, TMH,2005.

HaslehurstM.,“ManufacturingTechnology”, TheELBS,1978.

OnlineLearningResources:

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/#

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

B.Tech (ME)-III-I Sem (R20)

(20A50304c) AUTOMATION AND ROBOTICS

(PROFESSIONAL ELECTIVE-I)

Course objective: -

Theobjectivesofthiscourseareto

Describethebasicconceptsofautomationinmanufacturingsystems.
Acquirethefundamentalconceptsofautomatedflowlinesand theiranalysis.
Classifyautomatedmaterialhandling,automatedstorageandretrievalsystems.
Illustrateadaptivecontrolsystemsandautomatedinspection methods.
Definethefundamentalconceptsofindustrialrobotics.
Applybasicmathematicstocalculatetherobotkinematicanddynamicmechanics
- Understandtherobotprogrammingmethodsandsoftwarepackages.

CourseOutcomes:

Attheendofthecoursestudentwillbeableto

Classifythetypesof hardwarecomponentsofautomationandcontrolsystem.L1
Designa simplematerialhandlingsystemforlow-costmanufacturingL5
DesignasimplegripperforrobotL5
ComparethetypesofactuatorsusedinrobotmanipulatorL2
UnderstandtherequirementsandfeaturesofrobotprogrammingL2
DemonstratethevariousapplicationsofrobotsinmanufacturingL2

UNIT- Introduction

Introduction: Automationinproductionsystem,need,types,PrinciplesandStrategiesof automation, levels of automation, basic elements of an automated system, hardware components for automationandprocess control, mechanicalfeeders, hoppers, orienteers ,high speedautomaticinsertion devices.

Material handling and Identification Technologies: Overview of automatic material handling systems, principles anddesignconsideration, material transport systems, storagesystems, overview of automatic identification methods.

UNIT-II Assembly Line Balancing and Automated Manufacturing System

Assembly Line Balancing: Assembly process and systems assembly line, line

balancing algorithms, ways ofimprovinglinebalance,flexibleassemblylines.
Automated flow lines& transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

Automated Manufacturing Systems: Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

UNIT-III Introductionto Robotics

Introduction: Briefhistoryofrobots,classificationofrobot,functionallinediagram,degreesof freedom. Elements of robot - types and its functions, factors tobeconsideredinthe designofgrippers.
Robot Actuators and Feedback Components: Actuators, Pneumatic, Hydraulic actuators, Electric &Steppermotors,comparison.Positionsensors-potentiometers,resolvers,encoders-velocitysensors, Tactile sensors, Proximity sensors.

UNIT-IV Kinematics and Dynamics of a Manipulator

Manipulator Kinematics:
Homogenoustransformationsasapplicabletotranslation, rotations-D-H notation, Forwardand inverse kinematics.
Manipulator Dynamics: Differentialtransformations, Jacobians, Lagrange-Euler andNewton- Euler formations.

UNIT-V RobotProgrammingandApplications

Robot Programming: Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion,jointintegratedmotion,straightlinemotion;avoidanceof obstacles.
Robot Application in Manufacturing: MaterialTransfer -Materialhandling, loadingandunloading; Process - spotandcontinuousarcwelding&spraypainting; AssemblyandInspection.

Textbooks:

MikellP.Groover, Automation, ProductionSystems andComputer IntegratedManufacturing- Pearson Education.5/e, 2009.
MikellP.GrooverandMitchellWeiss,RogerN.Nagel,NicholasG.Odrey,Industrial Robotics — McGraw Hill, 1986.

ReferenceBooks:

S. R. Deb & Sankha Deb, Robotics Technology and Flexible

Automation, Tata McGraw-Hill Education, 2009.
R KMittal andI J Nagrath, Robotics andcontrol, IllustratedEdition, Tata McGrawHill India 2003.
SaeedB. Niku, IntroductiontoRobotics – Analysis, System, Applications, 2/e, JohnWiley& Sons, 2010.
RichardD. Klafter,ThomasRoboticEngineeringanintegratedapproach, PHIpublications 1988.

OnlineLearningResources:

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-I Sem (R20)

(20A50306) METROLOGY AND MEASUREMENTS LAB

L	T	P	C
-	-	3	1.5

CourseObjectives:

Toexperimentwithmeasuringequipment'susedforlinearandangularmeasurements.
Tofindcommontypesof errorsin measurement equipment.
Toexperimentwithdifferenttypesofsensors,transducersandstraingaugesequipment.
Tomakeuseofthermocouplesformeasurementoftemperature.

CourseOutcomes: Attheendofcoursethestudents willbeableto:

Applydifferentinstrumentstomeasurelength,width,depth,borediameters,in ternaland external tapers, tool angles, and surface roughness.L2
Measure effective diameter ofthreadprofile.L3
Conductdifferentmachinealignmenttests.L2
Measuretemperature,displacement,andpressure.L4

ListofExperiments:

SectionA:

Measurement ofboresbyinternalmicrometersanddialboreindicators.
Use of gear teeth Verniercallipers and checking the chordal addendum and chordal height of spur gear.
Alignmenttestonthelatheandmillingmachineusingdialindicators
StudyofToolmakersmicroscopeanditsapplication
AngleandtapermeasurementsbyBevelprotractor,Sinebar spiritleveletc.
ThreadmeasurementbyTwowire/Threewiremethod.
SurfaceroughnessmeasurementbyTalysurfinstrument.
Useofstraightedgeandsprit levelinfindingtheflatness ofsurfaceplate.

SectionB:

CalibrationofPressureGauges
Calibrationoftransducerorthermocouplefortemperaturemeasurement.
CalibrationofLVDTtransducerfordisplacement measurement.
Calibrationofcapacitivetransducerforangular measurement.
Calibrationofphotoandmagneticspeedpickupsfor themeasurementofspeed.
Study and use of a Seismic pickup for the measurement of vibration amplitude of an enginebed at various loads.

StudyandcalibrationofMcleodgaugeforlowpressure.

VirtualLab:

TouseVernierCallipersforthemeasurementofdimensions ofgivenobject.

To use Micrometer Screw Gauge for the measurement ofdimensions(Length,Thickness, Diameter) of given object.

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=156&cnt=4

TocalculateYoung'smodulusofelasticityofsteelwirebyVerniermethod

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=4

References:

Dr.R.Manikandan,MetrologyandMeasurementslaboratorymanual,Notion Press;1/e, 2020.

ArulR, MetrologyandMeasurementsLabManual,NotionPress;1/e,2020.

OnlineLearningResources/VirtualLabs:

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=16&cnt=4

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=156&cnt=4

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=36&cnt=4

https://www.sciencedirect.com/science/article/pii/S2212827116003929

https://sjce.ac.in/wp-content/uploads/2018/04/Metrology-and-Measurement-Laboratory- Manual.pdf

https://www.youtube.com/watch?v=jfUNqg8iWmg&list=PL9Q_yrlFD9Opks9GDke48rETYcnBFBumj&index=5

https://www.youtube.com/watch?v=X7PjoNEvlMs&list=PL9Q_yrlFD9Opks9GDke48rETYcnBFBumj&index=6

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

L	T	P	C
0	0	3	1.5

III Year B.Tech. M.E.I-Sem (R20)

(20A50307)DYNAMICS LAB

Course Objectives:	
	To supplement the principles learnt in kinematics and Dynamics of Machinery.
	To understand how certain measuring devices are used for dynamic testing.

Course Outcomes: At the end of the course the students will be able to	
	Ability to demonstrate the principles of kinematics and dynamics of machineryL1
	Determine the Mass moment of inertia, Range sensitivity.L2
	Drawing of Cam profile, determination of torsional ,undamped and damped natural frequencies.L3
	Determining of influence of coefficient and balancing of rotating ,reciprocating masses.L5
	Verify the laws of springs and forced vibration of cantilever beam.L6

LIST OF EXPERIMENTS

Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinderMechanisms.

Determination of Mass moment of inertia of Fly wheel and Axlesystem.

Determination of range sensitivity, effort etc., for Watts, Porter, Proell and HartnellGovernors.

Cams – Cam profile drawing, Motion curves and study of jumpphenomenon.

Determination of torsional natural frequency of single and Double Rotorsystems. Undamped and Damped Natural frequencies.

Multi degree freedom suspension system – Determination of influencecoefficient.

Determination of torsional natural frequency of single and Double Rotor systems.-damped Natural frequencies.

Determination of torsional natural frequency of single and Double Rotor systems.- UnDamped Natural frequencies

Balancing of rotating masses.

Balancing of reciprocatingmasses.

Determination of natural Frequency and verification of Laws ofsprings

Forced Vibration of Cantilever beam – Mode shapes and naturalfrequencies.

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III YEAR B-TECH I SEM (R20)

L	T	P	C
1	0	2	2

(20A50308)COMPUTER AIDED MODELING
(Skill Oriented Course-III)

CourseObjectives:

Totrainthestudents withCADpackages.
To importthe2Dand3Dmodelingskills tothestudents.
Toimportandexportdifferent IGES filesfromonesoftwaretoanother

CourseOutcomes: At the end of the course the students will be able to
Studentswillbeabletodesigndifferentpartsofmechanicalequipment's L2
StudentswillbeabletoapplytheirskillsinvariousdesigningandManufacturingIndustries.L2

ListofExperiments:

Generationofthefollowingcurvesusing"C"/Pythonlanguage -2 experiments
CubicSplines
Beziercurves
B-Splines.
Generationofthefollowingsurfacesusing"C"/Pythonlanguage -2 experiments
Beziersurfaces
B-Splinesurfaces
TypicaltasksofModeling using any solidmodeling packages such as PRO/E,IDEAS,CATIA, etc.,
SolidBooleanalgebra-1Exercise
Wireframe&SurfaceModelling– 3 Exercises
3D–Draftingindetail– 1Exercise
ProductionDrawingwithGeometricDimensioningandTolerances–3 Exercises (PreferablyfortheassemblydrawingsdrawninComputerAidedMachineDrawinginprevious semester)
Introduction to MATLAB Tools

References:

JamesDMeadows"GeometricDimensioningandTolerancing-Applications,Analysis&Measurement ASME Y14.5-2018.

KLNarayana,PKannaiahandK.VenkatReddy, ProductionDrawing, NewAgepublishers, 2014.

IbrahimZeid,TataMcGrawhill, CAD/CAMTheoryandPractice, 2012.

OnlineLearningResources/Virtual Labs:

https://www.youtube.com/watch?v=er7xJFKv5k&list=PL5w7L_xR0pu2wLbJtOuK49WxJJVjiyKks&index=2

https://www.youtube.com/watch?v=Gy0MKabzDa8&list=PLrOFa8sDv6jccqLnN7UDa1YW4s_hR6YX0

https://www.youtube.com/watch?v=k3kFC9uTdUk&list=PLM5xm8DJKViImdv5ZXxQ2NyIdSlid_jCB

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU DEPARTMENT OF MECHANICAL ENGINEERING
Year B.Tech. M.E. I Semester (R20)

CONSTITUTION OF INDIA

Common to Civil, Mech, Chem

Subject Code	Title of the Subject	L	T	P	C
20A59101	**INDIAN CONSTITUTION**	2	0	0	0

COURSE OBJECTIVES : The objective of this course is	
To	Enable the student to understand the importance of constitution
To	understand the structure of executive, legislature and judiciary
To	understand philosophy of fundamental rights and duties
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.
To	understand the central-state relation in financial and administrative control

Syllabus

UNIT-IIntroduction 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:-After completion of this unit student will

Understand the concept of Indian constitution
Apply the knowledge on directive principle of state policy
Analyze the History and features of Indian constitution
Learn about Preamble, Fundamental Rights and Duties

UNIT-IIUnion Government and its Administration

Structure of the Indian Union- Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat–LokSabha-RajyaSabha - The Supreme Court and High Court - Powers and Functions **LEARNING OUTCOMES:-**After completion of this unit student will

Understand the structure of Indian government
Differentiate between the state and central government
Explain the role of President and Prime Minister
Know the Structure of supreme court and High court

UNIT-IIIState Government and its Administration

Structure of the State Govt. -Governor - Role and Position -CM and Council of Ministers - State Secretariat-Organization Structure and Functions

LEARNING OUTCOMES:-After completion of this unit student will

Understand the structure of state government

Analyze the role of Governor and Chief Minister

Explain the role of State Secretariat

Differentiate between structure and functions of state secretariat

UNIT-IV Local Administration

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation PanchayatiRaj - Functions– PRI– ZillaParishath - Elected officials and their roles – CEO, ,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES:-After completion of this unit student will

Understand the local Administration

Compare and contrast district administration's role and importance

Analyze the role of Mayor and elected representatives of Municipalities

Learn about the role ofZillaParishath block level organization

UNIT-VElection Commission

Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

LEARNING OUTCOMES:-After completion of this unit student will

Know the role of Election Commission

Contrast and compare the role of Chief Election commissioner and Commissionerate

Analyze the role of state election commission

Evaluate various commissions vizSC/ST/OBC and women

TEXT BOOKS

Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

SubashKashyap, Indian Constitution, National Book Trust

REFERENCES:

J.A. Siwach, Dynamics of Indian Government & Politics,

H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

3. .J.C. Johari, Indian Government andPolitics, Hans India

M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

E-RESOURCES:

1.nptel.ac.in/courses/109104074/8
2.nptel.ac.in/courses/109104045/
3.nptel.ac.in/courses/101104065/
4.www.hss.iitb.ac.in/en/lecture-details
5.www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	State the historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the governmentie., executive, legislative and judiciary.
CO3	Demonstrate the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government
CO5	Appraise the knowledge in strengthening of the constitutional institutions like CAG,Election Commission and UPSC for sustaining democracy.
CO6	Develop themselves as responsible citizens and pave way to build a democratic country.

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B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60301) Theory -1 CAD/CAM

	Course Objectives:
To	impart the students to CAD/CAM and CIM and the basics of computer graphics.
To	impart knowledge on geometric modeling.
To	impart fundamental knowledge on NC and concepts of part programming.
To	introduce the philosophy of group technology, basics of Flexible Manufacturing Systems and computer aided quality control.
To	impart the concepts of Computer Aided Process Planning, Computer Integrated Process Planning and introduce the trends in manufacturing.

	Course Outcomes: At the end of the course the students will be able to
CO1	To implement the concepts of CAD/CAM and CIM in industry. L2
CO2	Use CAD software for solid modeling. L1
CO3	To implement suitable NC part programming concepts. L2
CO4	Implement appropriate suitable production systems and computer aided quality control. L2
CO5	Utilize suitable computer aided process planning and computer integrated production planning for a customized manufacturing system. L3

UNIT –I

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

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

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 representations

UNIT- III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining center, 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.

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 andCIM.

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.

Text Books:

CAD/CAM, A Zimmers &Groover, PE, PHI

CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition,2010

References:

Automated Production Systems and CIM by P. Groover Pearson Education, Limited.

CAD/CAM/CIM (Revised second edition)- P. Radhakrishnan, S. Subramanyan, V. Raju- New Age International Edition

CAD/CAM- Theory and practice- Irahim Zeid- Tata McGraw Hill publications.

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60302)Theory 2 FINITE ELEMENT METHODS

Course Objectives:

Familiarize basic principles of finite element analysis procedure.
Explaintheoryandcharacteristicsoffiniteelementsthatrepresentengineeringstructures.
Applyfiniteelementsolutionstostructural,thermal,dynamic problem.
Learntomodelcomplexgeometryproblemsandsolutiontechniques.

Course Outcomes: Uponsuccessfulcompletionofthiscourse,youshouldbeableto

Understandtheconceptsbehindvariationalmethodsandweightedresidualmethodsin FEM.L1
IdentifytheapplicationandcharacteristicsofFEAelementssuchasbars,beams,and isoparametric elements, and 3-D element.L2
Develop element characteristicequationprocedureand generationofglobalstiffness equation will be applied.L2
Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.L1
Abletoidentifyhowthefiniteelementmethodexpandsbeyondthestructuraldomain,for problems involving dynamics, heat transfer and fluid flow.L1

UNIT-I Introduction to finite element methods

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 Problems: Finite element modelling of ID bar elements coordinates and shape functions. Requirements for ConvergenceandInterpolationfunctions, Pascal‟s Triangle, Assemblyof global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT-II ID Analysis of Trusses and Beams

Analysisof trusses: StiffnessMatrixfor1Dtruss element, StressCalculationsandProblemswith maximum of three elements.

Analysisofbeams: ElementStiffnessMatrixandLoadvector for 1Dbeamelement, Hermiteshape functions and simple problems.

UNIT-III 2D Analysis

Finiteelementmodelingoftwo-dimensionalstressanalysiswithconstantstraintrianglesand treatment of boundary conditions.Estimation of load Vector, Stresses.
Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT-IV Quadrilateral Elements & Thermal Analysis

Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modellingof 4 nodded and 8 nodded quadrilateral elements and simple problems. Numerical Integration.

Steady state heat transfer analysis: Onedimensionalanalysisofcompositeslabandfin.

UNIT-V Dynamic analysis

Analysisofa1Duniformshaftsubjectedtotorsion –Simpleproblems

Dynamicanalysis: Formulationoffiniteelementmodel,element–massmatrices,evaluationof Eigen values and Eigen vectors for a bar and shaft.

Textbooks:

T.Chandragupta,AshokBelegundu,IntroductiontoFiniteElementinEngineering, Pearson Publications, 4/e, 2011.
S.S.Rao,TheFiniteElementMethodsinEngineering,ElsevierButterworth -Heinemann,2/e, 2011.
S.Md.Jalaludeen,FiniteElementAnalysisinEngineering,2/e,AnuradhaPublications,2016

Reference Books:

JNReddy, AnintroductiontotheFiniteElementMethod,McGraw–Hill, NewYork, 1993.
RDCook,DSMalkusandMEPlesha,ConceptsandApplicationsofFiniteElement Analysis, 3/e, John Wiley, New York, 1989.
KJBathe,FiniteElementProceduresinEngineeringAnalysis,Prentice-Hall,Englewood Cliffs, 1982.
G.LakshmiNarasaiah,FiniteElementAnalysis,1/e, B.S. Publications,2008.
OCZienkiewiczandRLTaylor,theFiniteElementMethod,3/e.McGraw-Hill, 1989.

Online Learning Resources:

https://nptel.ac.in/courses/112/104/112104193/
https://nptel.ac.in/courses/112/104/112104205/
https://nptel.ac.in/courses/105/105/105105041/
https://nptel.ac.in/courses/112/106/112106130/
https://nptel.ac.in/courses/112/103/112103295/

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B-Tech (ME)-III-II Sem (R20)

(20A60303)Theory -3 HEAT TRANSFER

L	T	P	C
3	0	0	3

Course Objectives:

- Toimpartthebasiclawsofconduction,convectionandradiationheattrans ferandtheir applications
- Tofamiliarizetheconvectiveheattransferconcepts
- Toexplainbasicsofradiationheat transfer
- Tomakeconversantwiththeheattransferanalysisrelatedtothermalsystemslikeheat exchangers, evaporator, and condenser.

CourseOutcomes:

At theendofthecourse,thestudentwillbeableto

Applytheconceptsofdifferentmodesofheattransfer. (L3)

Applyknowledgeofconductionheattransferinthedesignofinsulationoffurnacesand pipes. (L3)

Analyzefreeandforcedconvectionphenomenainexternalandinternalflows. (L4)

Designofthermalshieldsusingtheconceptsofblackbodyandnon-blackbodyradiation. (L5)

Applythebasicsofmasstransferforapplicationsindiffusionofgases. (L3)

UNIT-I Introduction

Basic modes of heat transfer- rate equations- generalized heat conduction equation-various forms - steady state heat conduction solution for plane 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- lumpedsystemanalysis and use of Heisler charts.

UNIT-II Convection

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 andvertical 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- problems.

UNIT-III Boiling and Condensation

Different regimes ofboiling- nucleate, transitionandfilmboiling – condensation– filmwiseanddrop wise condensation-problems.

UNIT-IV 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-problems.

UNIT-V

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect- simple problems.

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.

Textbooks:

P.K.Nag,HeatTransfer,3/e, Tata McGraw-Hill, 2011.

J.P. Holman, HeatTransfer,9/e, Tata McGraw-Hill, 2008.

S. C. Arora&S. Domkundwar , A Coursein Heat and Mass Transfer, Dhan pat Rai& CO.(P) LTD-Delhi , 2007.

R.C.Sachdeva, Fundamentals of Engineering Heat& Mass transfer, New Age International Publishers, 2017.

ReferenceBooks:

F.P. IncroperaandD.P.Dewitt,FundamentalsofHeatandMassTransfer, 6/e, John Wiley, 2007.

Cengel.A.Yunus,HeatTransfer-APracticalApproach,4/e,TataMcGraw-Hill, 2007.

S.P. Sukhatme,ATextbookofHeatTransfer,UniversitiesPress,2005

LienhardandLienhard, AHeatandMassTransfer,CambridgePress,2011.

C.P.KothandaramanandS.Subramanyan,HeatandMassTransferdatabook,NewAge Publications, 2014.

Er.R.K.Rajput,AText bookofHeat &MassTransfer,S.Chandpublishers,1/e,2018.

OnlineLearningResources:

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

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B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60304a) PRODUCTION AND OPERATIONS MANAGEMENT
(Professional Elective–II)

CourseObjectives:
Attheendofthecourse,thestudentwillbeableto learn

- Introductiontothetechnicaldesignandmanufacturingoperationsandsupplymanagementt o the sustainability of an enterprise.
- Needforforecastingandtypesofforecasting.
- Importthebasicprinciples ofproject managementandother businessfunctionssuchasvalue engineering, purchasing, marketing, finance etc.
- Analyzethenewdemandsofthegloballycompetitivebusinessenvironmentthatsupply chain managers face today.
- Knowledgeonvariousschedulingalgorithmsapplicabletosinglemachine,parallel machines, flow shop and job shop models.

CourseOutcomes:
At theendofthecourse,thestudentwillbeableto

- Demonstratetheoperations and supply management to the sustainabilityofanenterpriseL3
- Identifythe need for forecastingandunderstanddifferentforecasting methodsL3
- Identifyvarious production and plant layoutsL3
- Examine the quality control of the productionL3
- ApplyJust in Time (JIT)basicprinciples and applicationsL2
- Recommendtheproductionschedule for productivityL3
- Design, analyze and implementsingle machine,parallel machine, flow shopand job shop scheduling algorithmsL5

UNIT-I **Introduction** 10 Hours **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.

UNIT -II Forecasting: 8 Hours

Forecasting: Introduction, Statistical Forecasting Techniques, Moving Average, ExponentialSmoothingTechnique,ErrorsinForecastingandEvaluationofForecasting Techniques.

UNIT -III ValueEngineeringandPlantLayout: 8 Hours

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 Diagramand 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 Layouts, Line Balancing

UNIT -IV AggregatePlanningandMRP: 8 Hours

Aggregate Planning and MRP: Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning- Transportation and Graphical Models, Master scheduling, MaterialRequirement Planning (MRP)- Terminology, TypesofDemands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, ManufacturingResourcesPlanning(MRPII), Justin Time (JIT)Philosophy,Kanban

System, Calculation of Number of Kanban‟s, Pull Systems vs. Push Systems, Requirement for Implementation of JIT, JIT Production Process, Benefits of JIT.

UNIT -V **Scheduling:** 8 Hours

Scheduling: Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loadin Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flo Shop Scheduling, Job Shop Scheduling, Line of Balance. Textbooks:

Buffa E.S. and Sarin R.K., Modern Production / Operations Management, 8th Editio Wiley India Pvt. Ltd., New Delhi, 2009.

Joseph G. Monks, Operations Management-Theory and Problems, 3rd Edition, McGraw Hill Education, 1987.

Reference Books:

James L. Riggs, Jim Rigs, Production Systems: Planning, Analysis and Control, 4th Edition, Wave Land Press, 1992.

Chary S.N., Production and Operations Management, 5th Edition, McGraw Hill Education, 2017.

Richard B. Chase, Ravi Shankar, Robert Jacobs., Operations and Supply Chain Management, 15th Edition, McGraw Hill Education, 2018.

Pannerselvam R., Production and Operations Management,3rd Edition, PHI Learnin Pvt. Ltd., New Delhi, 2012.

Steven Nahmias, Tava Lennon Olsen, Production and Operation Analysis: Strategy Quality – Analytics – Applications, 7th Edition, Waveland Press Inc., 2015.

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

(20A60304b)NON-DESTRUCTIVE TESTING (NDT)

(Professional Elective–II)

L	T	P	C
3	0	0	3

CourseObjectives:

Introducebasicconceptsofnon-destructive testing.
Familiarizewithcharacteristicsof ultrasonic test,transducers,rejectionandeffectiveness.
Describeconceptof liquid Penetrant, eddy current andmagneticparticletests,its applications and limitations.
Explainthe principles of infraredand thermal testing,applicationsandhoney comb and sandwich structures case studies.

Explainvariousmethods of non-destructivetesting.L1
Applyrelevantnon-destructivetestingmethoddifferentapplications.L1
Explaintheapplicationsofrailways,nuclearandchemicalindustries.L2
Outlinethelimitationsanddisadvantagesof NDE.L2
Explainthe applicationsofNDAofpressure vessels,casting andwelding constructionsL2

UNIT-I Introductiontonon-destructivetesting 8Hrs

Introduction tonon-destructive testing: Radiographic test**,**SourcesofX and Gamma Rays andtheir interactionwithMatter,Radiographicequipment, RadiographicTechniques, Safety Aspects of Industrial Radiography.

UNIT -II Ultrasonictest 8Hrs

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversionand Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducersand their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT -III Liquidpenetrant,EddyCurrent&Magnetic Particle Test 10Hrs

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing**.**

Eddy Current Test: Principle ofEddyCurrent, EddyCurrent 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.

UNIT -IV **Infrared&ThermalTesting** 8Hrs

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–othertemperaturesensitivecoatings–Inspectionmethods–Infraredradiationand infrared detectors–thermos mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

UNIT -V **Industrial Applications of NDE:** 8Hrs

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. Acoustics Test facilities.

Textbooks:

J Prasad, GCK Nair, Nondestructive test and evaluation of Materials, Tata McGraw-Hill Education Publishers, 2008.

JosefKraut Kramer, HerbertKrautkrämer,Ultrasonictestingofmaterials,3/springer-Verlag, 1983.

3. X. P. V. Maldague, Nondestructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

Gary Workman, PatrickO. Moore, DoronKishoni,Non-destructive, Handbook, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.

ASTMStandards, Vol3.01, Metal sandalloys.

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.pdf

https://lecturenotes.in/subject/390/non-destructive-testing

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60304c) TOTAL QUALITY MANAGEMENT(TQM)
(Professional Elective–II)

CourseObjectives:

Introduce the students,thebasic concepts of Total QualityManagement.
Expose with various quality issues in Inspection.
GainKnowledgeon qualitycontrol andits applicationstore all time.
Knowtheextentofcustomersatisfactionbytheapplicationofvariousqualityconcepts.
Understand the importance of Quality standards in Production.

Course Outcomes (CO):

At the end of this course, the student will be ableto

Develop an understanding on quality Management philosophies andframeworksL3
AdoptTQMmethodologies for continuous improvement of qualityL2
Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvementL3
Applybenchmarkingandbusinessprocessreengineeringtoimprovemanagement processes.L2
Determine the setoff indications to evaluate performance excellence of an organization.L3

UNIT-I Introduction LectureHrs:10

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.

UNIT -II Historical Review: LectureHrs:9

Historical Review: 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.

UNIT -III TQMPrinciples: Lecture Hrs:8

TQM Principles: 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.

UNIT -IV TQMTools: Lecture Hrs:9

TQM Tools: 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–StagesofFMEA, The seven tools of quality, process capability,Concept of Six Sigma, New Sevenmanagementtools,Casestudies.

UNIT -V Quality Systems: Lecture Hrs:8

Quality Systems: 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.

Textbooks:

Dale H Biesterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.

Subbu raj Rama swamy, Total QualityManagement,Tata McGraw Hill Publishing Company Ltd., 2005.

Joel E. Ross,TotalQuality Management, Third Edition,CRCPress, 2017.

Reference Books:

Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

Robert L Flood,BeyondTQM, First Edition,John Wiley&SonsLtd, 1993.

RichardS.Leavenworth&EugeneLodewick Grant, Statistical Quality Control, Seventh Edition, Tata McGraw Hill, 2015

SamuelHo,TQM–An Integrated Approach,KoganPageLtd, USA,1995.

OnlineLearningResources:

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/

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)– III-II Sem (R20)

(20A60306)COMPUTER AIDED DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- TovalidateaFiniteElementmodel using 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.

Course Outcomes

Ability to solve engineering problems using the commercial software‟s such as ANSYS, SIMUFACT, ABAQUS, SIMULIA, Mathematical, MAT LAB, GNU Octave, Scilab, MAPLE/ COMSOL.L5

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:

StaticAnalysis

Stressanalysisof2Dtruss.
StressanalysisofaplatewithacircularholeandL-Bracket –2Dand3D
Stressanalysisofbeams-cantilever
Stress analysis of beams -simplysupported
Stressanalysisofanaxi-symmetriccomponent
TorsionbasedProblem

ThermalAnalysis

Conductiveheattransfer analysisofa 2Dand3Dcomponents
ConductionandConvectiveheattransfer analysisofa2Dcomponent
Heattransfer rateofa composite wall
Coupledfieldanalysisofacomponent

ModalAnalysis

Modefrequencyanalysisofa2Dcomponent
Modefrequencyanalysisofbeams (cantilever,simplysupported)

Note: Students should practice the above problems with combinations of ANSYS, Octave, Scilab, MATLAB/ Mathematica, MAPLE/COMSOLetc. based onthe available software's of either licensed or freeware. Staffcanmake useofFreeware insolvingtheFEAProblemswith different combination of simulation packages.

References:

Nitin S Gokhale and Sanjay Deshpande, Practical Finite Element Analysis, Finite to Infinite Publishers, 1/e, 2008.

JoeStefanelli,FiniteElement AnalysisinPractice-InstructorManual,Auto-desk,2010.

J.M.Ferreira,MATLABcodesforFiniteElementMethod", Springer Publications, 2020.

Heinrich, JuanC.,Pepper, DarrellW, Thefiniteelementmethod:basicconceptsand applications with MATLAB, MAPLE, and COMSOL: CRC Press, 3/e, 2017.

OnlineLearningResources/VirtualLabs:

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=PL3YYYtsmbXgdRoY27y3ZEjF 5qE7YYeX_I

https://www.youtube.com/watch?v=n3FDQqrRJqA

https://www.youtube.com/watch?v=oHYVzAih_VM

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

Tech (ME)–III-II Sem (R20)

(20A60307)COMPUTER AIDED MANUFACTURING LABORATORY

L	T	P	C
0	0	3	1.5

CourseObjectives:

- To get practical knowledge on manual part programming of CNC lathe machine by using G codes and M codes.
- TogetpracticalknowledgeonmanualpartprogrammingofCNCmillinganddrillingmachine by using G codes and M codes.
- TogetthepracticalknowledgeonAPTlanguage.
- Toget practicalapplicationofIndustrialRobots

CourseOutcomes: Uponsuccessfulcompletionstudentsshouldbeableto:

UseandunderstandingofPreparatoryandMiscellaneous(G&M) codestogenerateor edit a program which will operate a CNC Lathe/ Milling and Drilling.L1
ApplymathematicalmethodstocalculateWorld/Joint/Toolcoordinatesinrobotics.L2
ApplytheprogrammingconceptsofRobotsfor simpleapplicationsinmaterialhandlingand assemblyL3

ListofExperiments:

Manualpartprogramming(usingGandMcodes)inCNC LatheMachine:
Partprogrammingforlinearinterpolation,circularinterpolation,chamferingandgrooving.
Part programming by using standard Canned cyclesforfacing,turning,taperturning and thread cutting, Chess Bishop profile
Multiple turningoperationswhichcoveralllathe operationscoveringmaximum Gcodes and M codes

Manualpart programming(usingGandMcodes)inCNC MillingMachine:
Partprogrammingforlinearinterpolation,circularinterpolationandcontour motions.
PartprogramminginvolvingCannedcyclesfordrilling,Peckdrilling andboringandpocketing & Mirroring.
PartprogrammingforGear cuttingprofile

APT(AutomaticallyProgrammedTools)Language-Cuttingtoolpathgenerationbyusingany CAM simulation package / Experiment for different machining operations.
APT LatheProgramming"s –2 Experiments
APTMillingProgramming"s-2Experiments

Robotics: Byusing5or6–Axis robot
PickandPlacewithpalletizing/de-palletizingofcomponents
Nut,BoltandWasherAssemblywithrobot.

References:

PRadhaKrishnan,ComputerNumericalControl(CNC)Machines,NewCentralBookagency, 2013.
S.R.DEB,RoboticsTechnologyandFlexibleAutomation,McGrawHillEducation, 2017.
CHAO-

HWACHANGandMICHEL.A.MELKANOFF,NCMachineProgrammingand software Design, Prentice Hall Publishers, 1989.

OnlineLearningResources/VirtualLabs:

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=osqX7iQEnuI
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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

(20A60308)HEAT TRANSFER LAB

L	T	P	C
0	0	3	1.5

CourseObjectives:

Studentsundergoingthiscoursewould

- Understanddifferentmodesofheat transfer
- Gainknowledgeabout naturalandforce convectionphenomenon
- Estimateexperimentaluncertainty inmeasurements

CourseOutcomes:

Upon thesuccessfulcompletion ofcourse, students will be able to

Explain differentmodes ofheat transfer L1
Identifyparametersformeasurementforcalculatingheat transfer L3
Determineeffectivenessofheat exchanger L3
Designnewequipmentrelatedtoheat transfer L5
Applyprinciplesofheat transfer inwideapplicationin industries. L2

ListofExperiments:

Determinetheoverallheat transfer coefficientacross thewidth ofcompositewall
Determinethethermalconductivityof metal rod
Determine thethermal conductivityof insulating
powdermaterial throughconcentricsphere apparatus
Determinethe thermal conductivityof insulatingmaterial throughlaggedpipe apparatus
Determine theefficiency of apin fininnaturalandforced convection.
Determinetheheat transfercoefficient foraverticalcylinderinnatural convection
Determinetheheat transfercoefficient inforcedconvectionofairina horizontal tube.
Determinetheheat transfercoefficients onfilm and dropwisecondensationapparatus.
Determinetheeffectivenessofa parallelandcounter flowheat exchanger.
Studythepool boilingphenomenon anddifferent regimesofpool boiling.
Experimentonpool boiling
Determinetheemissivityofthetestplate surface.
Experiment onStefan-Boltzmannapparatus
Determine theheat transfer rate coefficient in fluidized bed apparatus.

Virtual Lab: -

Determination of thermal conductivity of metal rod
https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/determination-of- thermal-conductivity-of-a-metal-rod
NaturalConvection heat transfer

https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/natural-convection
Heat Transfer by Radiation
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&
cnt=1
Heat transfer byConduction
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&
cnt=1
The Study of phase change
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&
cnt=1
Blackbody Radiation:Determinationof Stefan"s
Constanthttps://vlab.amrita.edu/index.php?sub=1&brch=194&sim
=548&cnt=1
Newton's Law of Cooling
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=354&
cnt=1
Lee's Disc
Apparatushttps://vlab.amrita.edu/index.php?sub=1&brch=194&si
m=353&cnt=1
Thermos Couple- See beck Effect
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=351&cnt=1

References:

Abdul Matheen, Heat Transfer Laboratory Manual, Laxmi Publications;2/e,2007.

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%2 0Lab.pdf
https://mrcet.com/downloads/ME/Mech%20III-II.pdf

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

Skill oriented course – IV

Course Code	**Soft Skills**	**L**	**T**	**P**	**C**
20A65502		**1**	**0**	**2**	**2**
Pre-requisite					

Common to CIVIL,MECH, CHEM

Course Objectives:

To encourage all round development of the students by focusing on soft skills
To make the students aware of critical thinking and problem-solving skills
To develop leadership skills and organizational skills through group activities
To function effectively with heterogeneous teams

Course Outcomes (CO):
By the end of the program students should be able to

- Define various elements of effective communicative skills
- Understanding people using emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Assess the situation and take necessary decisions as a leader
- Creating a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being

UNIT – I	**Soft Skills & Communication Skills**	Lecture Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:
Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity
(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)
Inter personal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.
Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.
Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II Lecture Hrs

Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities
:
Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III Lecture Hrs

Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:
Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.
Case Study & Group Discussion

UNIT – IV **Emotional Intelligence & Stress Management** Lecture Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:
Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.
Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V **Leadership Skills** Lecture Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities
Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making , Group discussion etc.

NOTE-:
1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources

which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.)Publisher : Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

1. Reference Books:

1.Soft skills: personality development for life success by prashantsharma,

BPB publications 2018.

2. Soft Skills By Alex K. Published by S.Chand

3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra

Singh Chauhan, Sangeetha Sharma Published by Wiley.

4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books

5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press

6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher : Vayu Education Of India

Online Learning Resources:

1. **https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q**
2. **https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ**
3. **https://youtu.be/-Y-R9hDl7lU**
4. **https://youtu.be/gkLsn4ddmTs**
5. **https://youtu.be/2bf9K2rRWwo**
6. **https://youtu.be/FchfE3c2jzc**

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B-Tech (ME)-III-II Sem (R20)

(Mandatory Non-Credit Course) (CIVIL, ME, CHEM))
INTELLECTUAL PROPERTY RIGHTS AND PATENTS

20A69901

L	T	P	C
2	0	0	0

CourseObjectives:
This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws,
Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

CourseOutcomes: At the end of the course the students will be able to

UnderstandIPRlaw&Cyberlaw
Discussregistration process,maintenance andlitigations associatedwith trademarks
Illustrate thecopyright law
Enumerate thetrade excretal.

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration–Limitations–Infringement of Copyright –International Copyright Law-Semiconductor Chip Protection Act.

UNIT III

IntroductiontoPatentLaw–RightsandLimitations–RightsunderPatentLaw–Patent Requirements –Ownership and Transfer –Patent Application Process and Granting of Patent –Patent InfringementandLitigation–InternationalPatentLaw–DoublePatenting–PatentSearching–Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trademark – Trademark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trademark– Likelihood of confusion –Trademark claims – Trademarks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Textbooks:

Deborah E. Bouchoux: "Intellectual Property". Cengage learning, New Delhi

KompalBansal&ParishitBansal "Fundamentals of IPR for Engineers‟ S Publications (Press)

Cyber Law. Texts& Cases, South-Western‟s Special Topics Collections

References:

PrabhuddhaGanguli: „Intellectual Property Rights" Tata Mc-Graw–Hill, New Delhi

Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.

R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.

M.Ashok Kumar and Mohd. Iqbal Ali: "Intellectual property Right "Serials Pub

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

(20A70301a) REFRIGERATION AND AIR CONDITIONING

(Professional Elective-III)

L	T	P	C
3	0	0	3

CourseObjectives:

Provides insightsin howthermodynamicprinciples areapplied withintherefrigerationandair conditioningindustry.

Introduce the studentshowrealsystemsusedincommercial,industrial refrigerationandair conditioning industries arebuilt-up.

ExposethestudentsonvariousrefrigerationmethodslikeVCR,VARandlatest developments.

Know the various air conditioning methods like summer, winter and year-round air conditioningandtomakethestudenttounderstandthepracticalapplication sofrefrigeration andair conditioningsystems.

CourseOutcomes: At theendthestudent willbeableto

Appraisetheimportanceofhumidifiersand dehumidifiersL1
Selecttherequirementsoftemperatureandhumidityfor humancomfortL1
DemonstratetheheatpumpworkinganditscomponentsL2
ListthevariousairconditioningequipmentsL2

UNIT I

IntroductiontoRefrigeration

Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit ofRefrigeration,COP,EER,DifferentRefrigerationMethods.

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - NumericalProblems-RefrigerationNeeds ofAirCrafts.

UNITIIVaporCompressionRefrigeration(VCR)System

Vapor 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- SecondaryRefrigerants-Lubricants-OzoneDepletion-GlobalWarming-NewerRefrigerants.

UNITIIIVaporAbsorptionRefrigeration(VAR)System

Vapor AbsorptionRefrigeration (VAR)System-Descriptionand Working of NH3 - Water System and Li Br -Water (Two Shell & Four Shell) System - Calculation of Max COP, Principleof Operation of Three Fluid Absorption System

STEAMJETREFRIGERATIONSYSTEM:
WorkingPrincipleandBasicComponents-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

UNITIVIntroductiontoAirConditioning:

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,CentralAirConditioningSystems.

UNITVAirConditioningEquipment

AirConditioningEquipment-Humidifiers-Dehumidifiers-AirFilters,FansandBlowers. Human Comfort**:** Requirements of Temperature, Humidity and Concept of Effective Temperature, ComfortChart.HeatPump-HeatSources-DifferentHeatPumpCircuits.

Textbooks:

RefrigerationandAirConditioning,CPArora,TMH,15/e,2013.
S.CArora&Domkundwar,ACourseinRefrigerationandAirconditioning,Dhanpatrai&Co, 2018.

ReferenceBooks:

RefrigerationandAirConditioning/ManoharPrasad/NewAge,2/e, 2013
Principles ofRefrigeration-Dossat/PearsonEducation,4/e,2007
RefrigerationandAirConditioning-P.L. Ballaney,2/e,2012.
BasicRefrigerationandAir-Conditioning-P.N. Ananth Narayanan/TMH,4/e,2013.

NOTE: Tables/Codes:ThermalEngineeringDataBookcontainingrefrigerantandPsychrometric propertyTables and charts arepermitted inExam

OnlineLearningResources:

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME) – IV-I Sem (R20)

(20A70301b) OPERATIONS RESEARCH

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course objective:

Toimpartthebasicconceptsofmodelling,modelsandstatementsoftheoperationsresearch.
Formulateandsolvelinear programmingproblem/situations.
Modelstrategicbehaviourindifferenteconomicsituations.
Tosolvetransportationproblemstominimize cost.
ApplyQueuingtheorytosolveproblemsoftrafficcongestion,countersinbanks,railway bookings etc.
Explainschedulingandsequencingofproductionrunsanddevelopproperreplacement policies.

CourseOutcomes: At theendofthecourse,thestudent willbeableto

Developmathematicalmodelsforpracticalproblems. (L3)
Applylinearprogrammingtotransportationproblems.(L3)
Solvegamesusingvarioustechniques.(L3)
Solveproductionschedulinganddevelopinventorypolicies.(L6)
Applyoptimalityconditionsforconstrainedandunconstrainednonlinearproblems.(L3)
Applydynamicprogrammingmethods.(L3)

UNITIIntroductiontoOR

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

UNIT–IITransportationandAssignment Problems

TransportationProblem – Formulation; Different Methods ofObtainingInitial BasicFeasibleSolution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, DegenerateProblem. Assignment Problem – Formulation, HungarianMethodfor SolvingAssignment Problems, Traveling Salesman problem.

UNIT–IIIGametheory&JobSequencing

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.

UNIT–IVQueuingTheory&InventoryControl

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.

UNIT–VReplacementandMaintenanceAnalysis& DP

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 –ApplicationsofDynamicProgramming–ShortestPathProblem–CapitalBudgetingProblem–

SolutionofLinearProgrammingProblembyDP.

Textbooks:

Sharma S.D.,OperationsResearch:Theory,MethodsandApplications, 15/e,KedarNathRam Nath, 2010
TahaH.A.,OperationsResearch,9/e,PrenticeHallofIndia,NewDelhi, 2010.

ReferenceBooks:

Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
SharmaJ.K.,OperationsResearch:TheoryandApplications,4/e,LaxmiPublications, 2009.
PremKumar Gupta and Hira, Operations Research,3/e, S Chand Company Ltd., New Delhi, 2003.
PannerselvamR.,OperationsResearch,2/e,PenticeHallofIndia,NewDelhi, 2006.
Sundaresan.V,andGanapathySubramanian.K. S,ResourceManagementTechniques:Operations Research, A.R Publications, 2015.

OnlineLearningResources:

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/

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

(20A70301c) DESIGN FOR MANUFACTURING

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course objective:

Explaintheproductdevelopmentcycleandmanufacturingissuestobeconsideredindesign.
Familiarizemanufacturingconsiderationincast,forged,andweldcomponents.
Describethemanufactureofsheetmetalcomponents.
Impartknowledgeplasticsas substitutiontometallicparts.

CourseOutcomes: After successfulcompletionofthecourse,thestudentwillbeableto

Designmechanicalcomponentswitheconomicalconsideration L3
Selectmaterialsandmachiningprocesses L1
Identifythenecessityforredesigningcomponentsoutofmanufacturingconsiderations L2
Considerthemanufacturingconsiderationswhiledesigningcast,forgedweldandsheet metal components L4
Designplasticpartswithmanufacturingconsiderations L5

UNIT I Introduction

Introduction: Design philosophy-steps in design process-general design rules for manufacturability- basic principles of designing for economical production-creativity in design.
Materials: Selectionof materialsfor design-developmentsinmaterialtechnology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNITII Machiningprocesses

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.

UNITIII MetalCastingandJoining

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.
Metal joining: Appraisal of various welding processes, factors in design of weldments – general designguidelines-preandpost treatment ofwelds-effectsofthermalstressesinweldjoints-designof brazed joints.

UNITIV Forging, Extrusion&Sheetmetalwork

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion&Sheet metalwork: Designguidelines extrudedsections-designprinciplesfor punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT V Plastics

Viscoelasticandcreepbehaviorinplastics-designguidelinesforplasticcomponents-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Textbooks:

GeorgeEDieterandLindaSchmidt,EngineeringDesign,4/e,McGrawHill, 2015.
A.K. ChitaleandR.C. Gupta,ProductDesignandManufacturing,5/e,PHILearning2011.
DavidMAnderson,DesignforManufacturability,CRCPress, 2013.

ReferenceBooks:

JamesGBralla,DesignforManufacturabilityHandbook,2/e,McGrawHill,2004.
Dr.P.C. Sharma,ProductionTechnology,S. Chand&Company,2009.
G.Boothroyd,ProductDesignforManufacture&Assembly,CRCPress,3/e, 2010.

OnlineLearningResources:

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

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

(20A70302a) AUTOMOBILE ENGINEERING

(Professional Elective-IV)

L	T	P	C
3	0	0	3

CourseObjective:

Imparttheknowledgeofvehiclestructureanditscomponents.
Demonstratevariouscomponentsofpetrolenginesanddiesel engines.
Trainsaboutthevariouselectricalsystem,circuits,andtestingofautomobiles.
Explaintheconceptsofsteering,suspensionandbrakingsysteminautomobile.

CourseOutcomes: Aftersuccessfulcompletionofthiscourse,thestudentwillbeableto
Identifydifferentpartsofautomobile L2
Explaintheworkingofvariouspartslike engineandbrakes L2
Describetheworkingofsteeringandthesuspensionsystems. L2
Summarizethewheelsandtires L3
Outlinethefuturedevelopments intheautomobileindustry L1

UNITI Introductiontovehiclestructureandenginecomponents

Vehicle construction - Chassis and body - Specifications – Chassis Layout and its components, Types of chassis. Engine - Types - Construction -Location of engine - Cylinder arrangement - Construction details. Lubricationsystem- Types - Oil pumps - Filters. Crankcase ventilation.

UNITII Ignitionandfuelsupplysystems

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.

UNIT–III Steeringandsuspensionsystem

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering – Ackerman's steering gear mechanism & Davis's steering gear mechanism front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

UNIT–IV BrakingSystem

Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assisted – Retarders – Anti-lock Braking System (ABS).

UNIT–V Automobileelectricalsystemsandadvancesinautomobileengineering

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, Fuel Cell.

Textbooks:

KirpalSingh,AutomobileEngineering,Vol.1&2,StandardPublications,13/e,2020.
William.H. Crouse,AutomotiveMechanics,10/e,McGraw-Hill,2006.
David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.
Richard Stone,Jeffrey K.Ball,Automotive Engineering Fundamentals" SAEInternational, 2004.

ReferenceBooks:

Bosch,AutomotiveHandBook,6/e,SAEPublications,2007.
K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
JosephHeitner,AutomotiveMechanicsPrinciplesandPractices,2/e,CBSpublishing2004.

OnlineLearningResources:

https://nptel.ac.in/courses/107106088
https://nptel.ac.in/courses/107106080
https://hindustanuniv.ac.in/assets/pdf/ug/CBCS/cbcs-automobile-2018.pdf
https://ed.iitm.ac.in/~shankarram/Course_Files/ED5160/ED5160.htm
https://dbatu.ac.in/wp-content/uploads/2020/07/B-Tech-Automobile_Final-Yr_22.06.2020-1. pdf
https://www.youtube.com/channel/UCGLlbmSTaLNUPhDwsMe-SgQ

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

(20A70302b) MECHANICAL VIBRATIONS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

CourseObjective:

- 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.
- Toanalyzethetwodegreeand multidegreeoffreedomsystems.

CourseOutcomes: Aftersuccessfulcompletionofthecourse,thestudentwillbeableto

Findnaturalfrequencyofun-dampedsingledegreefreedomsystems L3
Analyzethetwo-degreefreedomsystemswithandwithoutdamping L3
Calculatetransmissibilityandisolation L4
Solveproblemsonvibrationabsorber L4
CalculatenaturalfrequenciesofmultidegreefreedomsystemL4
MeasurevibrationparametersL3
Usemechanicalexcitersandelectrodynamicshaker L1

UNIT ISingleDegreeFreedomSystems

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 dampingcoefficient.Simpleproblems.**Whirling of shafts: Transverse vibrations:** Dunkerley's lower bound approximation, Critical speedof shafts.

UNITIIForcedvibrationsofSingleDegreeFreedomSystems

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed forceduetounbalance, motion excitation, transmissibilityandisolation, performance of different type of isolators, power absorbed by viscous damping.

UNITIII TwoDegreeFreedomSystems:

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

UNITIV MultiDegreeFreedomSystems:

Lagrangianmethodforformulationofequationofmotion Influenceco-efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of freeand forced vibrations.

UNITV VibrationmeasurementandApplications

Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velocimeter and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker.

Textbooks:

SingiresuS.Rao,MechanicalVibrations,6/e,PearsonEducation,2018.
G.K. Groover,MechanicalVibrations,Nemchand&Bro,8/e,2009.

ReferenceBooks:

L.Meirovich,ElementsofVibrationsAnalysis,TataMcGrawHill,1986.
S.GrahamKelly,MechanicalVibrations,TataMcGrawHill,1996
WilliamThomson,TheoryofVibrationswithApplications,5/e,Pearson,2008
WilliamWeaver,Timoshenko,andYoung,VibrationProblemsinEngineering,5/e,John Wiley, 2013.
C.Nataraj,VibrationofMechanicalSystems,1/e,CengageLearning,2012.

OnlineLearningResources:

https://nptel.ac.in/courses/112107212
https://nptel.ac.in/courses/112103111
https://nptel.ac.in/courses/112103112
https://nptel.ac.in/courses/101105081
https://www.iare.ac.in/sites/default/files/PPT/MVSD%20PPT.pdf
https://www.iare.ac.in/sites/default/files/lecture_notes/MV_LECTURE_NOTES.pdf

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

(20A70302c) MODERN MANUFACTURING METHODS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives:

DefinevariousModernMachiningProcesses.
Acquireknowledgeintheelementarymechanismandmachinabilityofmaterialswith different Modern Machining Processes.
Determinebasicprinciplesofoperationfor eachprocessandtheir applications.
StatevariousparametersinfluencingMRRinNon–TraditionalMachiningProcess.
ClassifyandunderstandtheworkingofAdditiveManufacturingProcesses.

Course Outcomes: At theendofthecourse,thestudent willbeableto

Illustrateadvancedmachiningprocesses,cuttingtoolsandcuttingfluidsforaspecificmateria l and part features.L3
Classifythemechanism ofMechanicalEnergybasedmachiningprocesses,itsapplications and limitations.L1
DifferentiateElectricalEnergyBasedmachiningprocesses,mechanismofmetalremoval, machine tool selection.L2
InterpretElectroChemicalmachiningprocess,economicaspectsofECMandproblems on estimation of metal removal rate.L2

UNITI

Non – Traditional Machining Processes: Introduction, Need, Classification and Brief Overview,ConsiderationsinProcessselection,Materials,Applications.

Mechanical Energy Based Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water JetMachining, Ultra SonicMachining–WorkingPrinciple, DescriptionofEquipment, Process Parameters, Metal Removal Rate, Applications, Advantages and Limitations.

UNIT II

ElectricalEnergy Based Processes: Electric DischargeMachining – WorkingPrinciples, Description of Equipment, Process Parameters, Surface Finish and MRR, Electrode / Tool, Power and Control Circuits, Tool Wear, Dielectric Fluid, Flushing, Advantages, Limitations and Applications. Wire cut EDM – Working Principle and Applications.

UNIT III

Chemical and Electro Chemical Energy Based Processes: Chemical Machining and Electro Chemical Machining – Working Principle, Description of Equipment, Etchants, Maskants,Techniques of Applying Maskants, Process Parameters, Surface Finish and MRR, Electro Chemical Grinding, Electro Chemical Honing,Applications, Advantages and Limitations.

UNIT IV

Thermal Energy Based Processes: Laser Beam Machining and Drilling, Plasma Arc Machining, Electron Beam Machining – Working Principle, Description of Equipment, Process Parameters, Applications, Advantages and Limitations.

UNIT V

Additive Manufacturing: Introduction to Additive Manufacturing, Classification of Additive Manufacturing Processes, Working Principle, Advantages, Limitations and Applications of Stereolithography (SLA), Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing

Textbooks:

Jain V.K., Advanced Machining Processes, 1st Edition, Allied Publishers Pvt. Ltd., New Delhi, 2007.

PandeyP.CandShanH.S.,ModernMachiningProcesses, 1/e,McGrawHill,NewDelhi, 2007.

IanGibson,DavidW.Rosen,BrentStucker,AdditiveManufacturingTechnologies:Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.

ReferenceBooks:

ChuaC.K.,LeongK.F.andLimC.S.,RapidPrototyping:PrinciplesandApplications,2/e, World Scientific Publishers, 2003.

BenedictG.F.,NontraditionalManufacturingProcesses,1/e,CRCPress, 1987.

MishraP.K.,NonconventionalManufacturing,1/e,NarosaPublishingHouse,NewDelhi, 2014.

McGeoughJ.A.,AdvancedMethodsofMachining,1/e,Springer, 1988.

OnlineLearningResources:

https://nptel.ac.in/courses/112/107/112107078/
https://youtu.be/t3y_Ys3LgGM
https://www.youtube.com/watch?v=E4VZ_rFqpG4&t=1s
https://youtu.be/-tcaR7oSx_w
https://youtu.be/Uybg6VDLoRQ
https://youtu.be/Uybg6VDLoRQ

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

Professional Elective Course– V (MOOC)

L	T	P	C
3	0	0	3

20A70303

1. Heat exchangers, Fundamentals and design analysis
2. Mechatronics
3.Theory of Composite Materials

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech IV-I Sem (R20)

Course Code (20A75401a)	1. MANAGEMENT SCIENCE (Humanities Elective)	L	T	P	C
		3	0	0	3

Common to All Branches

COURSE OBJECTIVES: The objectives of this course are

	To provide fundamental knowledge on management, administration, organization & its concepts.
	To make the students understand the role of management in Production process and marketing management
	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
	To make the students aware of the contemporary issues in management

Course Outcomes (CO): At the end of the course, students will be able to

	Define the Management, and its Functions
	Understand the concepts & principles of management and designs of organization in a practical world
	Apply the knowledge of Work-study principles & Quality Control techniques in industry
	Analyse the concepts of HRM in Recruitment, Selection and Training & Development.
	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyse the business through SWOT.
	Create Modern technology in management science.

UNIT - I **INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - Systems Theory - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Analyze the organization chart & structure for an enterprise.
- Apply the concepts & principles of management in real life industry.
- Evaluate and interpret the theories and the modern organization theory.

UNIT - II **OPERATIONS & MARKETING MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), - Statistical Quality Control- **Materials Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Method of Production principles in real life industry.
- Analyze Marketing Mix Strategies for an enterprise
- Evaluate Materials departments & Determine EOQ
- Create and design advertising and sales promotion

UNIT - III **HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Evolution of HRM - Definition and Meaning – Nature - Managerial and Operative functions - - Job Analysis - Human Resource Planning (HRP) – Process of Recruitment & Selection - Training and Development - Performance Appraisal - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

LEARNING OUTCOMES: At the end if the Unit, the learners will

Understand the concepts of HRM in Recruitment, Selection, Training & Development
Apply Managerial and operative Functions of HRM
Analyze the need of training
Evaluate performance appraisal Techniques
Design the basic structure of salaries and wages Administration.

UNIT - IV **STRATEGIC & PROJECT MANAGEMENT**

Strategy Definition & Meaning - Vision - Mission - Goals - Steps in Strategy Formulation and Implementation SWOT Analysis **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

Understand Mission, Objectives, Goals & strategies for an enterprise
Apply SWOT Analysis to strengthen the project
Analyze Strategy formulation and implementation
Evaluate PERT and CPM Techniques
Creative in completing the projects within given time

UNIT - V **Contemporary Issues In Management**

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Business Process Outsourcing (BPO) - Business Process Re-engineering - knowledge Management.

LEARNING OUTCOMES At the end if the Unit, the learners will be able to

Understand modern management techniques
Apply Knowledge in Understanding in modern management techniques
Analyze Concept of CRM, MRP, TQM
Evaluate Six Sigma concept and SCM

Textbooks:

A.R Aryasri, Management Science, TMH, 2013
Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005.
Thomas N.Duening & John M.Ivancevich, Management Principles and Guidelines, Biztantra.
Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
Samuel C.Certo, Modern Management, 9/e, PHI, 2005

Online Learning Resources:

www.slideshare.net/jhayabesamis/chapter-1-the-nature-and-concept-of-management-122625641?
www.slideshare.net/vivekpratapsingh14/school-of-management-thoughts?
https://www.slideshare.net/89ajpaul/organizational-design-anf-structure
https://www.slideshare.net/sujeet2685/plant-layout-46555840#
https://www.slideshare.net/drmadhurverma/materials-38395397
https://www.slideshare.net/ShaliniShetty3/introduction-to-marketing-management-72210724?
https://www.slideshare.net/srinidhiraman/human-resource-management-ppt-43320777
https://www.slideshare.net/wicaksana/training-and-development-33535063
https://www.slideshare.net/ayushijain107/strategic-management-ppt-58012275

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech IV-I Sem (R20)

Course Code (20A75401b)	2. BUSINESS ENVIRONMENT (Humanities Elective)	L	T	P	C
		3	0	0	3

Common to All Branches

Course Objectives:

	To make the student understand about the business environment
	To enable them in knowing the importance of fiscal and monitory policy
3	To facilitate them in understanding the export policy of the country
	To Impart knowledge about the functioning and role of WTO
	To Encourage the student in knowing the structure of stock markets Course

Outcomes (CO): At the end of the course, students will be able to

1.	Define Business Environment and its Importance.
2.	Understand various types of business environment.
3	Apply the knowledge of Money markets in future investment
4	Analyse India's Trade Policy
5	Evaluate fiscal and monitory policy
	Develop a personal synthesis and approach for identifying business opportunities

UNIT - I **Overview of Business Environment**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types - Internal & External, Micro and Macro. Competitive structure of industries - Environmental analysis - advantages & limitations of environmental analysis & Characteristics of business.

Learning Outcomes: - After completion of this unit student will

- Understand the concept of Business environment
- Classify various types of business environment
- Evaluate the environmental analysis in business
- Discuss the Characteristics of Business.

UNIT - II **Fiscal Policy**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of GOI. 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: - After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Identify the functions of RBI and its role
- Analyze the Monitory policy in India

Know the recent trends and the role of Finance Commission in the development of our country
Differentiate between Fiscal and Monitory Policy

UNIT - III **India's Trade Policy**

Introduction – Nature, meaning, significance, functions and advantages. 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: - After completion of this unit student will
Understand the role of Indian international trade
Understand and explain the need for Export and EXIM Policies
Analyze causes for Disequilibrium and correction measure
Differentiate between Bilateral and Multilateral Trade Agreements

Introduction – Nature, meaning, significance, functions and advantages. 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: - After completion of this unit student will
Understand the role of WTO in trade
Analyze Agreements on trade by WTO
Understand the Dispute Settlement Mechanism
Compare and contrast the Dumping and Anti-dumping Measures.

Introduction – Nature, meaning, significance, functions and advantages. 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: - After completion of this unit student will
Understand the components of Indian financial system
Know the structure of Money markets and Capital markets
Analyze the Stock Markets
Apply the knowledge in future investments
Understand the role of SEBI in investor protection.

Textbooks:

1.Business Environment Text & Cases: JUNE 2017
Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
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.
Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
Chari. S. N (2009), International Business, Wiley India.
4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Online Learning Resources:
https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/jitenparmar313/fiscal-policy-65521889
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
https://www.slideshare.net/prateeknepal3/ppt-mo

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech IV-I Sem (R20)

Course Code	**3. ORGANIZATIONAL BEHAVIOUR**	**L**	**T**	**P**	**C**
	20A75401c (Humanities Elective)	**3**	**0**	**0**	**3**

Common to All Branches

Course Objectives:

1	**To make them aware of concepts & analysis in organizational behaviour**
2	**To offer knowledge to students on self-motivation, leadership and management**
3	**To facilitate them to become powerful leaders**
4	**To Impart knowledge about group dynamics**
5	**To make them understand the importance of change and development**

COURSE OUTCOMES: At the end of the course, students will be able to

1	Define the Organizational Behaviour, its nature and scope
2	Understand the nature and concept of Organizational behaviour
3	Apply theories of motivation to analyse the performance problems
4	Analyse the different theories of leadership
5	Evaluate group dynamics

UNIT - I

6	Develop as powerful leader

Introduction Of Organizational Behavior and Various Concepts

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning – Personality.

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Organizational Behavior
Contrast and compare Individual & Group Behavior and attitude
Evaluate personality types

UNIT - II **Motivation and Organization Outcome**

Theories of Motivation - Maslow’s Hierarchy of Needs - Hertzberg’s Two Factor Theory - Vroom’s theory of expectancy - McClelland’s theory of needs – Mc Gregor’s theory X and theory Y – Adam’s equity theory – Locke’s goal setting theory –

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Motivation
Analyze the Theories of motivation
Explain how employees are motivated according to Maslow’s Needs Hierarchy

UNIT - III**Leadership**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Alderfer’s ERG theory – traits - Leaders Vs Managers.

Conflict Management - Evaluating Leader - Women and Corporate leadership.

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Leadership
Contrast and compare Trait theory and Managerial Grid
Distinguish the difference between Transactional and Transformational Leadership
Evaluate the qualities of good leaders

UNIT - IV **Organizational Culture**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

Understand the importance of organizational change and development
Apply change management in the organization
Analyze work stress management
Evaluate Managerial implications of organization

UNIT - V **Organizational Change and Development**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

Understand the importance of organizational change and development
Apply change management in the organization
Analyze work stress management
Evaluate Managerial implications of organization

Textbooks:

Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011
P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

Reference Books:

McShane, Organizational Behaviour, TMH 2009
Nelson, Organisational Behaviour, Thomson, 2009.
Robbins, P.Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.
Aswathappa, Organisational Behaviour, Himalaya, 2009

https://www.slideshare.net/payalrchhabra/organisational-behavior-15668552
https://www.slideshare.net/nilendrakumar7/motivation-and-team-building
https://www.slideshare.net/Knight1040/organizational-culture-9608857
https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
https://www.slideshare.net/kohlisudeep18/organisational-developmet

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech (ME)–IV-I Sem (R20)

Open Elective Course – III

Common to All Branches

L	T	P	C
3	0	0	3

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech(ME)–IV-I Sem (R20)

Open Elective Course – IV

Common to All Branches

L	T	P	C
3	0	0	3

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech(ME)–IV-I Sem (R20)

20A70306 INDUSTRIAL AUTOMATION

(Skill Oriented Course-III)

L	T	P	C
1	0	2	2

Course Objectives

- IntroducebasicconceptsandprinciplesofIndustrialAutomation.
- Familiarizewithfluidpowersystemscircuits.
- DescribeconceptsofSCADAsoftware
- ExplaintheprinciplesofPLCand8085microprocessor.
- Exposethestudents onMechatronics.

CourseOutcomes: Attheendofthecourse,studentwillbeableto

Summarizesthehowfluidpowersystemwork L3
DiscussaboutSCADAsoftware L1
Developtheskillsrelatedtopredicttheoutputfor various programs.L2
ExplaintheconceptsofmechatronicsL1

ListofExperiments:

Module1: Design and testing of fluid power circuits to control
IntroductiontoFluidpowersystems,Symbolicrepresentationofhydraulicandpneumaticcomponent s.

Tasks:-

Pneumatictrainer kitwithFRLUnit,Singleactingcylinder,pushbutton.
PneumatictrainingkitwithFRLunit,Doubleactingcylinder,manuallyactuatedDCV.
PneumatictrainerkitwithFRLunit,Doubleactingcylinder,PilotactuatedDCV.
Pneumatictrainer kitwithFRLunitDoubleactingcylinder,
DoublesolenoidactuatedDCV, DCV with sensor / magnetic reed.
Hydraulicpower packwithpumpsandpressurereliefvalve.

Module2:

OpensourceSCADAsoftwaresuchasFreeSCADA,OpenSCADA,
IndigoSCADACodeSysOpensourcefor PLC
programmingandinterfacingwithrealtime PLC
DeltaPLCsoftware–freewareandcorrespondingPLCprogrammingsoftware.
8085MicroprocessorTrainerwithPowerSupply
TrafficLightControlSystem

Module3: Mechatronics

Experiment onP,PIandPIDController.
SimulationofHydraulicActuationSystem.

SimulationofPneumaticActuationSystem.
SimulationonStepperMotor.
SimulationonLogicgates,decodersandflip-flops.

References:

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.

Groover, Mikell ,Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2014.

Lamb, Frank. Industrial Automation: Hands On (English Edition). NC, McGraw-Hill Education, 2013. ISBN 978-0071816458.

Note:-Trainercanusefreewaresimulationsoftware's.

OnlineLearningResources/VirtualLabs:

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): ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech(ME)–IV-I Sem (R20)

20A70307 Evaluation of Industry Internship

L	T	P	C
0	0	0	3

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
III B.TECH – I SEMESTER (R20) (common to all branches) **- 2020 Admitted Batch** (THEORY)

Open Elective Course – I

Subject Code	Title of the Subject	L	T	P	C
2050305	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Course Objectives:

To introduce various optimization techniques i.e classical, linear programming,

Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

Electrical and electronic engineering circuits design problems in real world situations.

To explain the concept of Dynamic programming and its applications to project

Learn the knowledge to formulate optimization problems

UNIT - I

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.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : 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,

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Course Outcomes:

After completion of this course, the student will be able to explain the need of optimization of engineering systems

understand optimization of electrical and electronics engineering problems

apply classical optimization techniques, linear programming, simplex algorithm,

• transportation problem apply unconstrained optimization and constrained non-linear programming and

dynamic programming Formulate optimization problems.

TEXT BOOKS:

Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

Genetic Programming- Koza

Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
III B.TECH – II SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – II

Subject Code	Title of the Subject	L	T	P	C
20A60305	**SOLAR ENERGY SYSTEMS**	3	0	0	3

Course objectives

Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.

Study of various solar energy technologies with different types of concentrating collectors.

Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.

Understanding the basics of economics involves in the solar system.

Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I
SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces.
Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II
SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III
SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV
ECONOMICS:
Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V
THERMAL POWER:
The power concepts- design aspects, thermo-chemical reactor.
SOLAR POND AND SOLAR STILLS:
Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :

Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.

Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.

Developing solar cells in the field of nano technology.

Calculating the cash flow and costs involves in the solar energy systems.

Designing and developing of thermo chemical reactor with respect to thermal power.

Reference Books:

Solar Energy Thermal Process Diffice and Beckman

Solar Heating and Cooling by Kreith and Kreider

Solar Energy Utilization by G.D.Rai

Solar Energy Utilization by G.D.Rai , Khanna Publishers.

Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,

Applied Solar Energy by Meinel and Meinel

Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill

Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
IV B.TECH – I SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – III

Subject Code	Title of the Subject	L	T	P	C
20A70304	**MODERN MANUFACTURING METHODS**	3	0	0	3

Course Objectives:

- To learn the importance and basics of unconventional machining.
- To understand the rapid prototyping processes.
- To have the knowledge of different micro machining methods
- To understand the working principles of various Non-traditional machining methods.
- To learn about Non-traditional forming processes.

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.

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.

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.

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 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.

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.

Course Outcomes:

At the end of this course the student should be able to understand

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

- Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.
- Advanced machining processes, VK Jain, Allied publishers.

REFERENCES:

- New Technology , Bhattacharya A, The Institution of Engineers, India 1984
- Manufacturing Technology, Kalpakzian, Pearson
- Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
IV B.TECH – I SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – IV

Subject Code	Title of the Subject	L	T	P	C
20A70305	**MATERIAL HANDLING EQUIPMENTS**	3	0	0	3

Course Objectives:

To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.

To sensitize the students on the materials management functions – Planning, Purchase, Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing.

To realize the importance of materials both in product and service.
planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

It also aims to explore the layout planning by computer applications following different algorithms.

UNIT-I

Overview of Material Handling: Principles of Material Handling, Principal groups of Material Handling equipment – General Characteristics and application of Material Handling Equipment, Modern trends in material handling.

UNIT-II

Lifting Equipments: Hoist- Components of Hoist – Load Handling attachments hooks, grabs and clamps – Grabbing attachments for bulk material – Wire ropes and chains.

UNIT-III

Lifting tackle pulleys for gain of force and speed: Tension in drop parts – Drums, Shears and sprockets – Arresting gear and brakes – Block brakes, Band brakes, thrust brakes – Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms – Slewing Mechanisms – Elevators and lifts.

UNIT-IV

CONVEYORS: Types - description -applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors

UNIT-V

ELEVATORS: Bucket elevators: Loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes :

The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.

The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.

The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system

The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.

The students will be able to design of fork lift trucks.

REFERENCES

Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.

Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		MATERIAL SCIENCE FOR ENGINEERING	L	T	P	C
Semester		20A03M11	3	1	0	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.
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.

Course Outcomes (CO):

Explain the principles of binary phases
Apply heat treatment to different applications
Select steels and cast irons for a given application
Utilize nonferrous metals and alloys in engineering
Choose composites for various applications
Assess the properties of Nano-scale materials and their applications

UNIT - I **Structure of Metals & Constitution of Alloys** 8 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.

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

UNIT - III **Steels and Cast Irons** 10 Hrs

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels- stainless steels and tool steels.

Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - IV **Non-ferrous Metals and Alloys** 10 Hrs

Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Microstructure, properties and applications of titanium and its alloys.

UNIT - V **Ceramics, Polymers and Composites:** 10 Hrs

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Textbooks:

V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley Sons, 2009.

Reference Books:

Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Online Learning Resources:

https://nptel.ac.in/courses/113102080
https://www.digimat.in/nptel/courses/video/113102080/L01.html

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		COMPUTER AIDED MACHINEDRAWING	L	T	P	C
Semester		20A03M12	3	1	0	4

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.

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

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.

UNIT - II **Perspective projections** 8 Hrs

Perspective projections –Planes and simple solids. Vanishing point Method only.

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.

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.

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.

Textbooks:

K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.
Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.

Reference Books:

James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		**3D PRINTING MATERIALS**	L	**T**	**P**	**C**
Semester		**20A03M13**	**3**	**1**	**0**	**4**

Course Objectives:

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.

Course Outcomes (CO):

After successful completion of the course, the student will be able to

Development mechanical components with powder metallurgy technique
Select materials for Additive Manufacturing
Explain the concept of material characterization
Understand the concepts of powder shaping and sintering

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

UNIT - II **Polymers Basic Concepts** 10 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.

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

UNIT - IV **Powder Shaping and Sintering** 10 Hrs

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic 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

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.

Textbooks:

Chee Kai Chua, Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific.
G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4/e, 2005.

Reference Books:

Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		APPLICATIONS OF 3D PRINTING	L	T	P	C
Semester		20A03M14	3	1	0	4

Course Objectives:

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 onApplications in Automotive, Civil and other fields.

Course Outcomes (CO):

After successful completion of the course, the student will be able to

Design CAD model and verification of CAD model
Select type of 3D printing technology for different applications
Identify the various applications of 3D printing in manufacturing and aerospace
Explain the various Applications of 3D printing in Automotive, Civil and other fields
List the various applications of 3D printing technology

UNIT - I **Typical application areas of Additive Manufacturing:** 8 Hrs

Finishing Processes- Cutting Processes, Sand-Blasting and Polishing, Coating, Painting.

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,

UNIT - III **Applications in Manufacturing and Tooling**: 8 Hrs

Classification of rapid tooling, Direct Soft Tooling, Indirect Soft Tooling, Direct Hard Tooling.

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.

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.

Textbooks:

Chee Kai Chua, Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific.
Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.

Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.

Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.

RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) Anantapur COURSES OFFERED FOR HONOURS DEGREE IN Advanced Manufacturing systems (offered only for Mechanical Students)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Additive Manufacturing	3	1	4
2		Precision Engineering	3	1	4
3		Quality Engineering in Manufacturing	3	1	4
4		Simulation of Manufacturing Systems	3	1	4
5		MOOC I:Laser based Manufacturing			2
6		MOOC II: Automation in Manufacturing			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) Anantapur COURSES OFFERED FOR HONOURS DEGREE IN INTERNAL COMBUSTION ENGINES (offered only for Mechanical Students)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Internal combustion Engine Design	3	1	4
2		Engine Auxiliary Systems	3	1	4
3		Alternative fuels for I.C.Engines	3	1	4
4		Engine pollution and control	3	1	4
5		MOOC I: Hybrid and Electric vehicles			2
6		MOOC II: Automotive safety			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ADDITIVE MANUFACTURING	L	T	P	C
Semester			3	1	0	4

Course Objectives: Student will be able to

- To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
- To teach students about mechanical properties and geometric issues relating to specific rapid prototyping applications.

Course Outcomes (CO): Student will be able to

CO1: describe additive manufacturing and explain its advantages and disadvantages

CO2: explain the processes used in additive manufacturing for a range of materials and applications

CO3: understand the role of additive manufacturing in the design process and the implications for design

CO4: describe the effects of surface finish and microstructural properties on behaviour for components produced using additive manufacturing

CO5: display an awareness of residual stresses that may occur during additive manufacturing and their effects.

UNIT - I		Lecture Hrs:

INTRODUCTION:
Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits-Applications.

UNIT – II		Lecture Hrs:

REVERSE ENGINEERING AND CAD MODELING:
Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT – III		Lecture Hrs:

LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS:
Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT – IV		Lecture Hrs:
POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.		
UNIT – V		Lecture Hrs:
OTHER ADDITIVE MANUFACTURING SYSTEMS Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.		
Textbooks:		
Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.		
Reference Books:		
Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005		
Online Learning Resources:		
https://nptel.ac.in/courses/112/103/112103306/		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		PRECISION ENGINEERING	L	T	P	C
Semester			3	1	0	4

Course Objectives:

To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering.

- Accuracy and alignment tests.
- Influences of static stiffness and thermal effects.
- Precision machining.
- Nano measuring systems.
- Various lithography techniques

Course Outcomes (CO): Student will be able to

- Apply fits and tolerances for parts and assemblies according to ISO standards
- Apply selective assembly concept for quality and economic production
- Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
- Evaluate the part and machine tool accuracies.

UNIT – I	**CONCEPTS OF ACCURACY**	Lecture Hrs:9

Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity lags.

GEOMETIC DEIMENSIONING AND TOLERANCING: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datum's – Datum Feature of Representation – Form controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT – II	**DATUM SYSTEMS**	Lecture Hrs:9

Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT – III	**TOLERANCE ANALYSIS**	Lecture Hrs:9

Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances. Surface finish, Review of relationship between attainable tolerance grades and different machining process, Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT – IV	**TOLERANCE CHARTING TECHNIQUES**	Lecture Hrs:9

Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples, Design features to facilitate machining; Datum Features – functional and manufacturing Components design – Machining Considerations, Redesign for manufactured, Examples.

UNIT – V	**FOUNDAMENTALS OF NANOTECHNOLGY**	Lecture Hrs:9

Systems of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

Textbooks:

Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London

Precision Engineering/VC Venkatesh& S Izman/TMH

Reference Books:

Precision Engineering in Manufacturing/Murthy R.L./New Age International (P) limited, 1996.

Geometric Dimensioning and Tolerancing / James D. Meadows / Marcel Dekker inc. 1995.

Nano Technology / Norio Taniguchi / Oxford University Press, 1996

Online Learning Resources:

https://www.itsligo.ie/courses/beng-precision-engineering-design-online/

https://www.bachelorsportal.com/studies/249110/precision-engineering-and-design.html

https://engineering.purdue.edu/online/courses/precision-manufacturing-systems

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		QUALITY ENGINEERING IN MANUFACTURING	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Explore knowledge of basic sciences engineering and manufacturing process.

Manage projects in various sectors of economy which facing on conceptual , technological and human aspects.

Identify the bottle ends and production process.

Similarity of the manufacturing process to analyze the overall performance

Course Outcomes (CO): Student will be able to

Applications of the user friendly software packages to simulate the manufacturing entities.

Analyze the data by using different performance analysis techniques.

Modelling various operators in manufacturing systems

UNIT - I	**QUALITY VALUE AND ENGINEERING**	Lecture Hrs:09

An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT - II	**TOLERANCE DESIGN AND TOLERANCING**	Lecture Hrs:09

Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT - III	**ANALYSIS OF VARIANCE (ANOVA)**	Lecture Hrs:09

Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV	**ORTHOGONAL ARRAYS**	Lecture Hrs:09

Typical test strategies, better test strategies, efficient test strategies, steps indesigning, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V	**SIX SIGMA AND THE TECHNICAL SYSTEM**	Lecture Hrs:09

Six sigma DMAIC methodology, tools fpr process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

Textbooks:

Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.

2**.** Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al **/**Mc.Graw Hill Intl. Edition, 1989**.**

Reference Books:

Taguchi Methods explained: Practical steps to Robust Design **/**Papan P. Bagchi*I* Prentice Hall Pvt. Ltd., New Delhi.

Online Learning Resources:

https://nptel.ac.in/courses/112/107/112107259/
https://onlinecourses.nptel.ac.in/noc20_me27/preview
https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-me27/

https://nptel.ac.in/courses/110/101/110101010/
https://onlinecourses.nptel.ac.in/noc20_mg18/preview

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		Simulation of Manufacturing Systems	L	T	P	C
Semester			3	1	0	4

Course Objectives:

- To provide knowledge simulation and simulation steps
- To provide knowledge on parameter estimation and hypothesis
- To provide knowledge on building simulation model how to validation and verification is done
- To provide knowledge on generation of random variants and variables
- To provide knowledge on some simulation languages
- To provide knowledge on some Applications of Simulation

Course Outcomes (CO): Student will be able to

- Students gain knowledge on various types of simulation and simulation languages steps in simulation and applications of simulation.
- Students gain knowledge on parameter estimation and hypothesis.
- Students can build simulation model and also can validation and verify model.
- Can Generation of random variants and variables.

UNIT - I Lecture Hrs:09

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- step - types l& 2 errors - Framing - string law of large numbers.

UNIT - II Lecture Hrs:09

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.

UNIT - III Lecture Hrs:09

Generation of random variables - 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 - S1MAN- SIMSCRIPT - Simulation of WMJI queue - comparison of simulation languages.

UNIT - IV Lecture Hrs:09

Output data analysis - Types of Simulation w. r. t output data analysis – warm up period- Welch algorithm - Approaches for Steady - State Analysis - replication - Batch means methods - corn pan Sons.

UNIT - V Lecture Hrs:09

Applications of Simulation - flow shop system - job shop system - M/MI1 queues with infinite and finite capacities - Simple fixed period inventory system – New boy paper problem.

Textbooks:

Simulation Modelling and Analysis / Law, A.M.&Kelton / McGraw Hill, Edition/ New York, 1991.

Discrete Event System Simulation *I* Banks J. & Carson J.S., PH *I* Englewood Cliffs N/ 1984.
Reference Books:
Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990. A Course in Simulation / Ross, S.M., McMillan, NY, 1990. Simulation Modelling and S1MNET/ Taha HA. / PH, Englewood Cliffs, NJ, 1987
Online Learning Resources:
https://nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=wbLItIE-78E https://www.youtube.com/watch?v=tiarT1YS-lM

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		MOOC-I Laser based manufacturing	L	T	P	C
Semester			0	0	0	2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		MOOC-II AUTOMATION IN MANUFACTURING	L	T	P	C
Semester			0	0	0	2

Course Objectives:

At the end of this course

- The course should enable to understand the principles of automation, importance of automated flow lines and its types.
- The Student should be able to understand outline the system configurations used in automated production
- Students should be able to recognize and articulate the foundational assumption of the transfer mechanism, types of transfer mechanism that may be used for work part transfer
- Student able to describe automated assembly systems, and their associated system configurations , list the hardware components used for parts delivery at workstations Outline typical automated assembly processes

Course Outcomes (CO): Student will be able to

- 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
- After completion of this course students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- After completion of this course 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
- Students are able to understand automated transfer and storage system, recognize the equipments used in automated transfer and storage system.

UNIT - I	**OVER VIEW OF MANUFACTURING AND AUTOMATION**	Lecture Hrs:09

Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers.

UNIT – II	**MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES**	Lecture Hrs:09

Material handling, equipment, Analysis. Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Automatic identification methods, Barcode technology, RFID.

UNIT – III	**MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES:**	Lecture Hrs:09

Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT – IV	**AUTOMATED ASSEMBLY SYSTEMS**	Lecture Hrs:09

Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis

UNIT – V	**QUALITY CONTROL AND SUPPORT SYSTEMS**	Lecture Hrs:09

Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vs non contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Textbooks:

Automation, production systems and computer integrated manufacturing/ Mikell.PGroover/PHI/3rd edition/2012.

Automation, Production Systems and CIM/ Mike J P. Grower/PHI

Reference Books:

CAD/CAM/CIM/ P. **R**adha Krishnan **& S**. Subrahamanyarn and Raju/New Age International Publishers/2003.

System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.

Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009

Online Learning Resources:

https://nptel.ac.in/courses/112/104/112104288/
https://nptel.ac.in/courses/112/103/112103293/
https://nptel.ac.in/courses/112/103/112103174/
https://youtu.be/v-3TmN4HhLc
https://youtu.be/-NINgz6KQTA
https://youtu.be/CmQa2xoQdzk
https://youtu.be/yeHE4se7u5M

COURSES OFFERED FOR HONOURS DEGREE IN INTERNAL COMBUSTION ENGINE (R20)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Internal combustion Engine Design	3	1	4
2		Engine Auxiliary Systems	3	1	4
3		Alternative fuels for I.C.Engines	3	1	4
4		Engine pollution and control	3	1	4
5		MOOC I: Hybrid and Electric vehicles			2
6		MOOC II: Automotive safety			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

CourseCode		INTERNAL COMBUSTION ENGINE DESIGN	L	T	P	C
Semester		20A03H11	3	1	0	4

CourseObjectives:		
Toprovidethebasic groundingonthepistonenginedesignphilosophy.		
CourseOutcomes(CO): Student willbeableto		
Thestudentwouldhavegainedaninsight/understandingontherudimentsofpistonenginedesig n philosophy as a prelude to higher level design activities for variedapplications.		
UNIT–I	**GENERAL DESIGN PRINCIPLES**	**Lecture Hrs:9**
Principleofsimilitude,Choiceofmaterial,Stress,FatigueandNoise,Vibration andHarshnessconsiderations(NVH)		
UNIT–II	**DESIGNSPECIFICSOFTWO-STROKEENGINESYSTEMS**	**Lecture Hrs:9**
Scavenging,Arrangementandsizingofports,pistonassembly,intakeandexhaustsystem,applicationtoa utomotivegasolineengines.		
UNIT–III	**DESIGNOF MAJOR COMPONENTS**	**Lecture Hrs:9**
Pistonsystem,Powercylindersystem,Connectingrodassembly,Crankshaftsystem,ValveGearing,Stres sanalyses		
UNIT–IV	**DESIGNOFOTHERCOMPONENTS/SUBSYSTEMS**	**Lecture Hrs:9**
Inlet and exhaust manifolds, cylinder block, cylinder-head, crankcase. Design aspects of enginemountings,gaskets,bearings.Basics ofignition,lubricationandcoolingsystemdesign. Introductiontodesignofcatalytic converters,particulatetrapsandEGR systems.		
UNIT–V	**DESIGN OF FUEL FLOW SYSTEMS**	**Lecture Hrs:9**
Design of injectors systems, carburetors and fuel supply systems in CI Engines		
Textbooks:		

AnIntroductiontoEngineTestingandDevelopment,RichardD.Atkids,SAEInternation al,USA,2009.
Design andSimulation ofFour-StrokeEngines,GordonP.Blair,SocietyofAutomotiveEngineers,Inc.,USA,1999.
Diesel Engine Reference Book, Second Edition, RodicaBaranescu and Bernard Challen(Editors),SocietyofAutomotiveEngineers,Inc.,USA,1999.
Engineering Design,A SystematicApproach,G.Pahl, W.Beltz J.Fieldhusen and K.H.Grote,Springer
ModernEngineTechnologyfromAtoZ,RichardVanBasshuysenandFredSchafer,SAEInternation al,USAandSiemensVDO,Germany,2007.
Springer–Verlag,Wien,Austria,2006.
VehicularEngineDesign,KevinL.Hoag,SAEInternational USA/

ReferenceBooks:

EngineeringFundamentalsoftheInternalCombustionEngine,WillardW.Pulkrabek,Second Edition,Prentice–HallofIndiaPvt.Ltd.,NewDelhi,2006.
InternalCombustionEngineDesign,A.KolchinandV.Demidov,MIRPublishers,Moscow,1984.
InternalCombustionEngineFundamentals,JohnB.Heywood,McGraw–HillBookCompany,1988.
InternalCombustionEngineHand book:Basics,Components,SystemsandPerpectives,RichardVanBasshuysenandFredSchafer(Editors)SAEInternationalUSAandSiemes VDOAutomotive,Germany,2002.
IntroductiontoEngineValvetrains,YushuWang, SAE International,USA,2007.
Introduction to Internal Combustion Engines, Richard Stone, Fourth Edition SAEInternational,USAandMacmillanPress,2012.

OnlineLearningResources:

1.https://nptel.ac.in/courses/112/104/112104033/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ENGINE AUXILIARY SYSTEMS 20A03H12	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Know about the concept of carburation.
Know about the concept of gasoline injection and ignition systems.
Understand diesel fuel injection.
Understand the design and construction of various intake systems and its components.
Know about the various types and the concepts of lubrication and cooling system.

Course Outcomes (CO): Student will be able to

Understand the concept of air fuel mixture and the various components in the carburetor
Understand the types of gasoline fuel injection , and the mechanism of ignition system.
Know about the various techniques involved in diesel fuel injection.
Understand the various design constraints and the types of intake and exhaust manifolds.
Understand the concept and various types of lubrication and cooling system

UNIT – I **CARBURETION** **Lecture Hrs:9**

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, Design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, Carburetor systems for emission control.

UNIT – II **GASOLINE INJECTION AND IGNITION SYSTEMS** **Lecture Hrs:9**

Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, Breaker mechanism and Spark plugs, Factors affecting energy requirement of the ignition system, Factors affecting spark plug operation, Electronic Ignition Systems.

UNIT – III **DIESEL FUEL INJECTION** **Lecture Hrs:9**

Factors influencing fuel spray atomization, Penetration and Dispersion of diesel and heavy oils and their properties, Rate and duration of injection, Fuel line hydraulics, Fuel pump, Injectors.

UNIT – IV **MANIFOLDS AND MIXTURE DISTRIBUTION** **Lecture Hrs:9**

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

UNIT – V **LUBRICATION AND COOLING SYSTEMS** **Lecture Hrs:9**

Lubricants, Lubricating systems, Lubrication of piston rings, Bearings, Oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, Coolants, Additives and lubricity improvers, Concept of adiabatic engines.

Textbooks:

1.Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India) Pvt.Ltd.2000.

2.Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.

3.Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998.

4.Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.

Reference Books:

1.Duffy Smith, Auto Fuel Systems, The Good Heart Willcox Company Inc., Publishers, 1987.
2.Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

Online Learning Resources

1. **https://nptel.ac.in/courses/112/103/112103262/**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ALTERNATIVE FUELS FOR IC ENGINES 20A03H13	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Togive anin-depthknowledge ofvarious fuels and alternative fuels used in IC Engines

Course Outcomes (CO): Student will be able to

Onsuccessfulcompletionofthiscoursethestudentwillbeabletounderstandabout the usage of alternative fuels in IC Engines and its effect on environment

UNIT – I	Introduction	Lecture Hrs:9

solid fuels, gases fuels, liquid fuels, chemical structure of petroleum, petroleum refining process, important requisite qualities of engine fuels, SAE rating of fuels.

UNIT – II	FUELS	Lecture Hrs:9

Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, Producer gas, Bio gas and Vegetable oils - Use in I.C.Engines-Merits and Demerits of various fuels.

UNIT – III	ALCOHOL FUELS	Lecture Hrs:9

Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle -Reformed alcohols.

Alcohols in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines - Surface ignition engines - Ignition accelerators - Manufacture of alcohol fuels.

UNIT – IV	GASEOUS FUELS	Lecture Hrs:9

Hydrogen - Properties - Use in C.I Engines - Use in S.I Engines - Storage methods - Safety precautions -Production methods.

Production of Producer gas and bio gas - Raw materials - Gasification - Properties - Cleaning up the gas -Use in S.I. and fuel engines, LPG & Natural gas - Properties - Use in S.I. and C.I. Engines.

UNIT – V	VEGETABLE OILS	Lecture Hrs:9

Properties - Esterification - Performance in Engines.

FUEL QUALITY:Fuel quality standards for Automotive Engines - Lead free gasolines, low and ultra -low sulphur diesels, LPG, CNG, and Biodiesels.

Textbooks:

Internal combustion engines by V . Ganesan, Tata McGraw Hill book cop. 2007

Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications,1997.

Reference Books:

Osamu Hirao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and sons, 1988.

Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

https://nptel.ac.in/courses/103/102/103102026/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		ENGINE POLLUTION AND CONTROL 20A03H14	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Understandeffectofvehiclepopulationandemittedpollutantsonhumanhealthandenvironmentandvarioustypesofemissions.
Understandtheformationmechanismofvarioustypesofpollutantsfrom SIandCIengines.
Conceivethesignificance.of.emission.control.methods.
Understandtheconstructionandworkingofemissionmeasuringinstruments.
Befamiliarwithemissionstandardsandtestprocedures.

Course Outcomes (CO): Student will be able to

- Analysetheimpact of vehiclepopulationonpollutionandtheeffectsHC,CO,CO2,NOX,smoke,particulates,leadandaldehydes onhealthandenvironment.

  Describetheeffectsoftransientoperationofvehicleonemissionsandtypesofemissions.Describetheformationmechanismof HC,CO,CO2,NOX,smoke,particulatesandaldehydesinSIandCIengines.

  Comprehendthefactorsthatleadtoglobalwarmingandtheissues.Analysethedesignandoperatingparametersonemissions.Describeaboutnoisepollution,measurementandcontrol.

  AwareofUS,Euro,JapanandIndianemissionnorms,standardsCVSsamplingandtestprocedures.Analysein-cylinderemissioncontrolmethodssuchasEGR,airinjection,fuelmodifications,waterinjection,ignitionandinjectiontiming.

  Describeengine-outemissioncontrolmethodsuchasthermalreactorsandcatalyticconverters.Describetheconstructionandworkingofemissionmeasuringinstrumentssuchas NDIR,FID,smokemetersChemiluminiscentanalyserandgaschromatograph.Differentiatebetweentwostrokeandfourstrokeenginepollutions.

UNIT – I	POLLUTANT FORMATION-ENGINES AND TURBINES	Lecture Hrs:9

Atmosphericpollutionfrompistonenginesandgasturbines,Globalwarming.Formationofoxidesofnitrogen, Carbonmonoxide,Hydrocarbon,aldehydesandSmoke,Particulateemission,Effectsofpollutionsonenvironment.

UNIT – II	POLLUTIONMEASUREMENT	Lecture Hrs:9

Nondispersiveinfraredgasanalyzer,Gaschromatography,Chemiluminescentanalyzerandflameionization detector,Smokemeasurement,Noisepollution,Measurementandcontrol.

UNIT – III	POLLUTIONCONTROL-INCYLINDERMETHODS	Lecture Hrs:9
Enginecomponent,Fuelmodification,Evaporativeemissioncontrol,EGR,Airinjection,WaterInjection,Applicationofmicroprocessorinemissioncontrol.		
UNIT – IV	**POLLUTIONCONTROLAFTERTREATMENT**	**Lecture Hrs:9**
Thermalreactors,Catalyticconverters,&ParticulateTraps		
UNIT – V	**CYCLESANDEMISSIONSTANDARDS**	**Lecture Hrs:9**
Useofdrivingcyclesforemissionmeasurement,Chassisdynamometer,CVSsystem,Nationaland Internationalemissionstandards.		
Textbooks:		
1.CrouseWilliam,AutomotiveEmissionControl,GreggDivision/McGraw-Hill.1980 2.Ernest,S.,Starkman,CombustionGeneratedAirPollutions,PlenumPress,1980.		
Reference Books:		
George,SpringerandDonaldJ.Patterson,Engineemissions,PollutantFormationandMeasurement ,Plenumpress,1972. Obert,E.F.,InternalCombustionEnginesandAirPollution,IntextEducationalPublishers,1980.		
Online Learning Resources:		
1. https://nptel.ac.in/courses/112/104/112104033/		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		MOOC I: HYBRID AND ELECTRICVEHICLES 20A03H15	L	T	P	C
Semester						2

Course Objectives:

Understand working of Electric Vehicles and recent trends.
Know-how & aptitude towards future trends in Hybrid Electric Vehicles

Course Outcomes (CO): Student will be able to

Familiarize on concepts of electric vehicle & performance of electric vehicles
Gain knowledge on Electric Propulsion Systems & Generators
Acquire the knowledge on hybrid electric drive train systems
Gain knowledge on motor controllers and control systems & energy storages
Attain the knowledge on Energy Storages -Fuel Cells & Solar Cars and Control systems.

UNIT – I	ELECTRIC VEHICLES	Lecture Hrs:9

Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

UNIT – II	ELECTRIC PROPULSION SYSTEMS & GENERATORS	Lecture Hrs:9

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking. DC generators, AC generators, voltage and frequency regulations

UNIT – III	HYBRID VEHICLES	Lecture Hrs:9

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design

UNIT – IV	MOTOR CONTROLLERS AND CONTROL SYSTEMS & ENERGY STORAGES	Lecture Hrs:9

Control system principles, speed and torque control – DC motors and AC motors.
Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultra-capacitors.

UNIT – V	FUEL CELLS & SOLAR CARS	Lecture Hrs:9

Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design.
Solar carsphotovoltaic cells, tracking, efficiency and cost comparison.

Textbooks:
MehrdadEhsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2014. James Larminie and John Loury, “Electric Vehicle Technology-Explained”, John
Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth –Heinemann, 2012. Donwhite Consultant Incorporate – Handbook of EMI / EMC – Vol I – 2015 Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2012 Ron Hodkinson and John Fenton, “Light Weight Electric/Hybrid Vehicle Design”, ButterworthHeinemann, 201
Online Learning Resources:
1. https://nptel.ac.in/courses/108/103/108103009/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		MOOC II: AUTOMOTIVE SAFETY 20A03H16	L	T	P	C
Semester						2

Course Objectives:

- Understand the Design of the body for safety.
- Understand the various types of safety concepts.
- Understand the concept of scavenging in two stroke engines.
- Understand the design concept of safety equipment's.
- Understand the experimental methods for comfort and convenience system.

Course Outcomes (CO): Student will be able to

- Know about the basics about the vehicle.
- Understand the safety aspects in the vehicle
- Know and understand the various safety aspects
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle
- To know about the comfort and convenience system

UNIT – I	INTRODUCTION	Lecture Hrs:9

Design of the body for safety, Energy equation, Engine location, Deceleration of vehicle inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of crumble zone, Safetysandwich construction.

UNIT – II	SAFETY CONCEPTS	Lecture Hrs:9

Active safety: Driving safety, Conditional safety, Perceptibility safety, Operating safety- Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact.

UNIT – III	SAFETY EQUIPMENTS	Lecture Hrs:9

Seat belt, Regulations, Automatic seat belt tightener system, Collapsible steering column, Tiltable steering wheel, Air bags, Electronic system for activating air bags, Bumper design for safety, Antiskid braking system, Regenerative Braking System, Cruise Control, Adaptive Cruise Control Devices

UNIT – IV	COLLISION WARNING AND AVOIDANCE	Lecture Hrs:9

Collision warning system, Causes of rear end collision, Frontal object detection, ear vehicle object detection system, Object detection system with braking system interactions, Driver Fitness Detection.

UNIT – V	COMFORT AND CONVENIENCE SYSTEM	Lecture Hrs:9

Steering and mirror adjustment, Central locking system , Garage door opening system, Tyre pressure controlsystem, Rain sensor system, Environment information system, Manual and Automated Wiper System, GPS.

1.Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.

J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc20_de06/preview

Open Elective Course – I Civil

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**Experimental Stress Analysis**	**L**	**T**	**P**	**C**
20A50105		**3**	**0**	**0**	**3**
	Semester		**V**		

Course Objectives:

1. To understand different methods of experimental stress analysis
2. To understand the use of strain gauges for measurement of strain
3. To be exposed to different Non destructive methods of concrete
4. To understand the theory of photo elasticity and its applications in analysis of structures
5. To understand different methods of photo elasticity

Course Outcomes (CO):

1. Understand different methods of experimental stress analysis
2. Understand the use of strain gauges for measurement of strain
3. Expose to different Non destructive methods of concrete
4. Understand the theory of photo elasticity and its applications in analysis of structures
5. Understand different methods of photo elasticity

UNIT - I

PRINCIPLES OF EXPERIMENTAL APPROACH:Merits of Experimental Analysis Introduction, uses of experimental stress analysisAdvantages of experimental stress analysis, Different methods –Simplification of problems.

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.

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.

UNIT - IV

THEORY OF PHOTOELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polar scope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law.

UNIT - V

TWO DIMENSIONAL PHOTOELASTICITY:Introduction – Isochramic Fringe patterns-Isoclinic 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.

Textbooks:

1. Experimental stress analysis by J.W.Dally and W.F.Riley, College House Enterprises2005
2. Experimental stress analysis by Dr.SadhuSingh.khanna Publishers 4th edition

Reference Books:

1. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications 2012 edition
2. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – I EEE
III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**ELECTRIC VEHICLE ENGINEERING (OE-I) EEE**		**L**	**T**	**P**	**C**
20A50205			**3**	**0**	**0**	**3**
Pre-requisite	AC & DC Machines	**Semester**	**V**			
Course Objectives: The student will be able to:						

- Understand latest trends in Electric Vehicles; parameters used in EV and types of EVs.
- Analyze various energy sources available to run EV like batteries, fuels cells etc.
- Analyze the dynamics and the propulsion system used in EVs, working of fuel cells, battery charging concept.

- Design a electromechanical system using various control techniques.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1: Understand the difference between conventional and latest trends in Electric Vehicles; understand the various parameters used in EV, types of HEVs.
CO2: Analyze various energy sources available to run EV like batteries, fuels cells etc.
CO3: Analyze the propulsion system of EV, its dynamics and the concept of battery charging.
CO4: Design EV system with battery charger using various fundamental concepts.

UNIT - I	INTRODUCTION TO EV SYSTEMS AND PARAMETERS	Lecture Hrs: 10

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.

UNIT - II	EV AND ENERGY SOURCES	Lecture Hrs: 08

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

UNIT - III	EV PROPULSION AND DYNAMICS	Lecture Hrs: 10

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.

UNIT - IV	FUEL CELLS	Lecture Hrs: 10

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

UNIT - V	BATTERY CHARGING AND VEHICLE CONTROL	Lecture Hrs: 10

Battery charging: Battery Chemistry, Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.
Battery Management System: Introduction and BMS functionality, Battery pack topology, Voltage, Temperature and Current Sensing.
Control: Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Textbooks:C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.

1. 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.
3. Tom Denton, “Electric and Hybrid Vehicles”, TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2^{nd} Edition, 2020.
4. MehrdadEhsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell

Vehicles: Fundamentals", CRC Press, 2010. 5. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.
Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Mechanical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
2050305	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Course Objectives:

To introduce various optimization techniques i.e classical, linear programming,

Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

Electrical and electronic engineering circuits design problems in real world situations.

To explain the concept of Dynamic programming and its applications to project

Learn the knowledge to formulate optimization problems

UNIT - I

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.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : 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,

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Course Outcomes:

After completion of this course, the student will be able to explain the need of optimization of engineering systems

understand optimization of electrical and electronics engineering problems

apply classical optimization techniques, linear programming, simplex algorithm,

- transportation problem apply unconstrained optimization and constrained non-linear programming anddynamic programming Formulate optimization problems.

TEXT BOOKS:

Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

Genetic Programming- Koza

Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I ECE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	BASICS OF ELECTRONICS AND COMMUNICATION	L	T	P	C
20A50405	ENGINEERING	3	0	0	3
	Semester	V			

Pre-requisite

Applied Physics

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.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic principle, construction and operation of semiconductor devices.
- Learn the real time applications of semiconductor devices.
- Comprehend the binary number systems, logic gates and digital logic circuits.
- Understand the basic principles of communication systems and their applications.

- Measure the 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.

UNIT - II

Applications of semiconductor devices: Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

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.

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.

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.

Textbooks:

1. Millman J, Halkias C.C and Jit 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. and Nashelsky L., "Electronic Devices and Circuit Theory", Pearson, 10th 2009 Edition.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I CSE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

INTRODUCTION TO JAVA PROGRAMMING

Course Code:20A50505 Semester V(R20) L T P C : 3 0 0 3

Course Objectives:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

Course Outcomes:

CO1: Solve real-world problems using OOP techniques.
CO2: Apply code reusability through inheritance, packages and interfaces
CO3: Solve problems using java collection framework and I/O classes.
CO4: Develop applications by using parallel streams for better performance and develop applets for web applications.
CO5: Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

UNIT – I: **Introduction**

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

UNIT – II: **Inheritance, Packages, Interfaces**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT – III: **Exception handling, Stream based I/O**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

UNIT – IV: **Multithreading, The Collections Framework**

Multithreading: The Java thread model, Creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

UNIT – V: **Applet, GUI Programming with Swings, Accessing Databases with JDBC**

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Textbooks:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

Reference Books:

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, KarthikandGajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Chemical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code		L	T	P	C
20A50805	**ENERGY CONVERSION AND STORAGE DEVICES**	**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

1. Understand the fundamentals of fossil energy sources, solar, biomass and electrochemical energy etc
2. Understand the basics of photosynthetic, photocatalytic and photoelectrochemical systems and devices for the efficient energy and fuels production.
3. Learn the principles and operations of electrochemical energy storage devices,

Course Outcomes (CO):

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

CO1 Understand the need of energyconversion and the various methods of energy storage

CO2 Identify Winds energy as alternateform of energy and to know how itcan be tapped

CO3 Understand the nuclear and bio energy, its mechanism of production and its applications

CO4 Analyse chemical, electrochemical energy storage devices and interpret the conversion efficiencies

CO5 Explain bio gas generation and itsimpact on environment

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Outline of the course. Introduction and scope of energy conversion. World Energy Production and Balance. Motivations for studying future energy systems (e.g. pollution, climate change, energy security).

UNIT - II

Fossil Energy: Overview of fossil fuel resources and energy contents. Cycle analysis (Rankine, Brayton, combined cycles, cogeneration)

Nuclear Energy: nuclear reaction and energy conversion physics (fission and fusion), nuclear power systems

UNIT - III

Solar-thermal energy: solar thermal radiation physics, Active and passive solar-thermal energy collection and conversion systems

Photoelectric energy: Photoelectric physics. Solar photovoltaic cell materials and technology

Wind Energy: Wind interaction with objects fluid dynamics. Wind harvesting devices and systems

UNIT - IV

Biomass and Waste to Energy: Potential and resources of biomass and waste energy. Thermal-chemical and bio-chemical conversion methods

Overview of Climate Control, CO_2 Sequestration and Energy Sustainability

UNIT - V

Basic of Electrochemical energy conversion and storage, Fundamentals of Fuel Cells, Basics of Fusion power, Energy Storage Technologies, Mechanical storage, Chemical storage, Electrical storage

Textbooks:

Energy Systems Engineering, F.M. Vanek, L.D Albright, and LargusAngenent, Second Edition, McGraw-Hill, Inc., 2012,

Reference Books:

- AngèleReinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic

Solar Energy:From Fundamentals to Applications, JOHN WILEY.

- Alexander P. Kirk, Solar Photovoltaic Cells: Photons to Electricity, ELSEVIER
- Francesco Dalena, Angelo Basile, Claudio Rossi, Bioenergy Systems For The Future: Prospects ForBiofuels And Biohydrogen, 1st Edition, ELSEVIER
- Jean-Marie Tarascon, Patrice Simon, ELECTROCHEMICAL ENERGY STORAGE,
- Electrochemistry by Carl H. Hamann, Andrew Hamnett and Wolf Vielstich, Wiley VCH, 1998.
- Modern Electrochemistry 1. Volume 1 and 2, by J. O'M. Bockris and A. K. N. Reddy, Kluwer Academic,2000.
- Electrochemical Methods, by A. J. Bard and L. R. Faulkner, John Willey, 1980
- John Love and John A. Bryant, Biofuels and Bioenergy, John Wiley
- Anju Dahiya, Bioenergy: Biomass to Biofuels, Elsevier

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – I Mathematics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Optimization Methods
B.Tech III Year
(Common for all)
Open elective course -1</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A55101</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>--</td><td>Semester</td><td colspan="4">I</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">• formulate a linear programming problem and solve it by various methods.
• give an optimal solution in assignment jobs, give transportation of items from sources to destinations.</td></tr>
</table>

- identify strategies in a game for optimal profit.
- implement project planning.

UNIT - I		8 Hrs

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

UNIT - II		8 Hrs

Transportation problems- assignment problems-Game theory.

UNIT - III		9 Hrs

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

UNIT - IV		8 Hrs

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs-Group replacement .

UNIT - V		9 Hrs

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

Textbooks:

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, HardikSoni, PHI publishers

Reference Books:

1. Problems on Operations Research, Er. Premkumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

Online Learning Resources:

https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf
https://slideplayer.com/slide/7790901/
https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Physics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A55201	**MATERIALS CHARACTERIZATION TECHNIQUES**	3		-	3

COURSE OBJECTIVES	
1	To provide an exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the basic principle of Scanning electron microscope along with its limitations and applications.
4	To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To explain the structural analysis by X-ray diffraction.
CO2	To understand the morphology of different materials using SEM and TEM.
CO3	To recognize basic principles of various spectroscopic techniques.
CO4	To apprehend the electric and magnetic properties of the materials.
CO5	To make out which technique has to be used to analyse a material

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

Credit: 3 **Hours of teaching: - 45 H**

UNIT-I **9H**

Structure analysis by Powder X-Ray Diffraction: 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 Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT-II **9H**

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (SecondaryElectron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT-III **9H**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): 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, Advantage and Limitations of Transmission Electron Microscopy.

UNIT-IV **9H**

Spectroscopy techniques – 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).

UNIT-V **9H**

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.

TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Hand book of Materials Characterization -by **Sharma** S. K. - S**pringer**

REFERENCES:

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, PrenticeHall, 2001 – Science
3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-Yang Leng- John Wiley & Sons
4. Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N - John Wiley(Bp)
5. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan,John Wiley & Sons Ltd., 2008.

NPTEL courses

https://nptel.ac.in/courses/115/103/115103030/
https://nptel.ac.in/content/syllabus_pdf/113106034.pdf

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I H & SS

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

Course Code	E-Business	L	T	P	C
20A55401		3	0	0	3
Pre-requisite					

Course Objectives:

1.	To provide knowledge on emerging concept on E-Business related aspect.
2.	To understand various electronic markets models which are trending in India
3.	To give detailed information about electronic payment systems net banking.
4.	To exact awareness on internet advertising, market research strategies and supply chain management.
5.	To understand about various internet protocols-security related concept.

Course Outcomes (CO):

1	They will be able to identify the priority of E-Commerce in the present globalised world.
2	Will be able to understand E-market-Models which are practicing by the organization
3.	Will be able to recognize various E-payment systems & importance of net banking.
4.	By knowing E-advertisement, market research strategies, they can identify the importance of customer role.
5.	By understanding about E-security, they can ensure better access control to secure the information
6	Develop a personal synthesis and approach towards E-Business

UNIT – I **Electronic Business**

Definition of Electronic Business - Functions of Electronic Commerce (EC) - Advantages of E-Commerce – E-Commerce and E-Business Internet Services Online Shopping-Commerce

Opportunities for Industries.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of E-Business
- Contrast and compare E-Commerce E-Business
- Analyze Advantages of E-Commerce
- Evaluate opportunities of E-commerce for industry

UNIT - II **Electronic Markets and Business Models**

E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models-Business to Business(B2B)-Business to Customers(B2C)-Business to Government(B2G)-Auctions-B2B Portals in India

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze Advantages of portals
- Explain the B2B,B2C and B2G model

UNIT - III **III Electronic Payment Systems**

Digital Payment Requirements-Designing E-payment System- Electronic Fund Transfer (EFT)-Electronic Data Interchange (EDT)-Credit Cards-Debit Cards-E-Cash-Electronic Cheques -Smart Cards-Net Banking-Digital Signature.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and EDT
- Analyze debit card and credit card
- Explain the on Digital signature

UNIT - IV **E-Security**

Internet Protocols - Security on the Internet –Network and Website Security – Firewalls – Encryption – Access Control – Secure Electronic transactions.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand E-Security

- Contrast and compare security and network
- Analyze Encryption
- Evaluate electronic transitions

UNIT - V **E-Marketing**

Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Online Market Research– Data mining and Marketing Research Marketing Strategy On the Web – E-Customer Relationship Management(e-CRM) –E- Supply Chain Management.(e-SCM) –New Trends in Supply Chain Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of online marketing
- Analyze advantages of online marketing
- Compare the e-CRM and e-SCM
- Explain the New trends in supply chain management

Textbooks:

1. **E-Commerce by C.S.V Murthy** Himalaya publication house, 2002.
2. **E-Commerce by** P.T.S Joseph, Fourth Edition, Prentice Hall of India 2011

Reference Books:

1. **E-Commerce: by** KamaleshKBajaj,DebjaniNa, Second Edition TataMcGrwHills 2005
2. **E-Commerce E-Management: by Dave Chaffey** – Second Edition, Pearson, 2012.
3. **E-Commerce Fundamentals and Application; by** Henry Chan, Raymond Lee,Tharm Wiley India 2007
4. **E-Commerce: by** S. Jaiswall Galgotia Publication Pvt Ltd 2003.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
20A55301	**CHEMISTRY OF ENERGY MATERIALS**	2	1	-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To understand and apply the basics of calculations related to material and energy flow in the processes.

COURSE OUTCOMES	
CO1	Solve the problems based on electrode potential,Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	Describe the working Principle of Fuel cell,Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells,Classify the fuel cell
CO3	Differentiate Chemical and Physical methods of hydrogen storage,Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures

	Describe the liquification methods
CO4	Apply the photo voltaic technology,Demonstrate about solar energy and prospects Illustrate the Solar cells,Discuss about concentrated solar power
CO5	Differentiate between Photo and Photo electrochemical Conversions,Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion

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: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batterie**s.-**

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: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

UNIT-4: Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells .

UNIT-5: 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.

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 7^{th} 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

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II Civil
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Disaster Management	L	T	P	C
20A60105		3	0	0	3

Course Objectives:
1. To give knowledge types of disasters and stages in disaster rehabilitation process.
2. To make awareness on change in climates and their impacts on occurrence of environmental disasters.
3. To impart knowledge on Consideration of wind and water effects as per codal provisions to withstand disasters.
4. To familiarize the student with the Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. To illustrate the methodology in Planning and design considerations of various structures constructing in disaster prone areas.

Course Outcomes (CO):
1. About various types of disasters and stages in disaster rehabilitation process.
2. Impact of change in climates and their impacts on occurrence of environmental disasters.
3. Adopting suitable codal provisions to study the effect of wind and water effects on various structures constructed at disaster prone areas.
4. Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. Adopt suitable Planning and design considerations of various structures constructing in

disaster prone areas.

UNIT - I

Brief introduction to different types of natural disaster, Occurrence of disaster in different climatic and geographical regions, hazard (earthquake and cyclone) map of the world and India, Regulations for disaster risk reduction, Post disaster recovery and rehabilitation (socioeconomic consequences)

UNIT - II

Climate change and its impact on tropical cyclone, Nature of cyclonic wind, velocities and pressure, Cyclone effects, Storm surge, Floods, Landslides. Behavior of structures in past cyclones and wind storms, case studies. Cyclonic retrofitting, strengthening of structures and adaptive sustainable reconstruction. Life–line structures such as temporary cyclone shelter.

UNIT - III

Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated unsteadiness along and across wind forces. Lab: Wind tunnel testing, its salient features. Introduction to Computational fluid dynamics. General planning/design considerations under wind storms & cyclones; Wind effects on buildings, towers, glass panels etc, & wind resistant features in design. Codal Provisions, design wind speed, pressure coefficients; Coastal zoning regulation for construction & reconstruction phase in the coastal areas, innovative construction material & techniques, traditional construction techniques in coastal areas.

UNIT - IV

Causes of earthquake, plate tectonics, faults, seismic waves; magnitude, intensity, epicenter, energy release and ground motions. Earthquake effects – On ground, soil rupture, liquefaction, landslides. Performance of ground and building in past earthquakes: Behavior of various types of buildings, structures, and collapse patterns; Behavior of Non-structural elements like services, fixtures, mountings- case studies. Seismic retrofitting-Weakness in existing buildings, aging, concepts in repair, restoration and seismic strengthening.

UNIT - V

General Planning and design consideration; Building forms, horizontal and vertical eccentricities, mass and stiffness distribution, soft storey etc.; Seismic effects related to building configuration. Plan and vertical irregularities, redundancy and setbacks. Various Types and Construction details of: Foundations, soil stabilization, retaining walls, plinth fill, flooring, walls, openings, roofs, terraces, parapets, boundary walls, under-ground – overhead tanks, staircases and isolation of structures; innovative construction material and techniques; Local practices: traditional regional responses; Computational investigation techniques.

Textbooks:

1. Disaster Management by Rajib Shah, Universities Press, India, 2003
2. Disaster Management by R.B. Singh (Ed) Rawat Publication, New Delhi, 2000

Reference Books:

1. Natural disasters. By Abbott, L. P. (2013) 9th Ed. McGraw-Hill.
2. Earthquake Resistant Design of Structures. By Agarwal, P. and Shrikhande, M.

(2009). New Delhi : PHI Learning.
3. Mapping Vulnerability: Disasters, Development and People. byBankoff, G., Frerks, G. and Hilhorst, D. (2004). London :Earthscan.
4. Improving Earthquakes and Cyclone Resistance of Structures:Guidelines for the Indian Subcontinent. TERI
5. Disaster Mitigation, preparedness, recovery and Response. By Sinha, P. C. (2006). New Delhi : SBS Publishers.
6. World Bank. (2009). Handbook for Reconstructingafter Natural Disasters.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II EEE
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">RENEWABLE ENERGY SYSTEMS
(OE-II)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60205</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• Various sources of Energy and the need of Renewable Energy Systems.
• The concepts of Solar Radiation, Wind energy and its applications.
• Operation of Solar thermal and solar PV systems
• The concept of geo thermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): At the end of the course the student will be able to:</td></tr>
</table>

CO 1 Understand various alternate sources of energy for different suitable application requirements.
CO 2 Analyze the concepts of solar energy generation strategies and wind energy system
CO 3 Design Solar and Wind energy systems.
CO 4 Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT - I	**SOLAR ENERGY**	Lecture Hrs: 10

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.

UNIT - II	**PV ENERGY SYSTEMS**	Lecture Hrs: 10

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.

UNIT - III	**WIND ENERGY**	Lecture Hrs: 10

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.

UNIT - IV	**GEOTHERMAL ENERGY**	Lecture Hrs: 8

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.

UNIT - V	**MISCELLANEOUS ENERGY TECHNOLOGIES**	Lecture Hrs: 10

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.

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.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
https://www.slideshare.net/VikramNani/e-commerce-business-models
https://www.slideshare.net/RiteshGoyal/electronic-payment-system
https://www.slideshare.net/WelingkarDLP/electronic-security
https://www.slideshare.net/Ankitha2404/emarketing-ppt

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Mechanical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A60305	**SOLAR ENERGY SYSTEMS**	3	0	0	3

Course objectives

Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.

Study of various solar energy technologies with different types of concentrating collectors.

Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.

Understanding the basics of economics involves in the solar system.

Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I

SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces. Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS:

Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V

THERMAL POWER:

The power concepts- design aspects, thermo-chemical reactor.

SOLAR POND AND SOLAR STILLS:

Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :

Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.

Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.

Developing solar cells in the field of nano technology.

Calculating the cash flow and costs involves in the solar energy systems.

Designing and developing of thermo chemical reactor with respect to thermal power.

<u>Reference Books:</u>

Solar Energy Thermal Process Diffice and Beckman
Solar Heating and Cooling by Kreith and Kreider
Solar Energy Utilization by G.D.Rai
Solar Energy Utilization by G.D.Rai , Khanna Publishers.
Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,
Applied Solar Energy by Meinel and Meinel
Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
Energy Resources Utilization and Technologies ByAnjaneyulu, BS Pub.

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II ECE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	BASICS OF INTEGRATED CIRCUITS APPLICATIONS	L	T	P	C
20A60405		3	0	0	3

\Pre-requisite

Basics of Electronics and Communication Engineering

Course Objectives:

- To introduce the basic building blocks of linear & digital integrated circuits.
- To learn the linear and non - linear applications of operational amplifiers.
- To introduce the theory and applications of 555 and PLL.
- To learn the theory of ADC and DAC
- To understand different families of digital integrated circuits and their characteristics.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic concepts of Op -AMPs, characteristics and specifications.
- Design circuits using operational amplifiers for various applications.
- Develop, apply and analyze circuits for advanced applications using Op-Amps, PLL, VCO and Analog multipliers.
- Understand different families of digital integrated circuits and their characteristics
- Design various and sequential circuits using digital ICs.

UNIT - I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT - III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate, IC interfacing- TTL Driving CMOS & CMOS Driving TTL

Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic ICs and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Textbooks:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", PHI, 2003.
2. Floyd and Jain, "Digital Fundamentals", Pearson Education, 8th Edition, 2005.

Reference Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (p) Ltd, Second Edition, 2003.
2. James M. Fiore, "Op Amps and Linear Integrated Circuits-Concepts and Applications", Cengage Learning/ Jaico, 2009.
3. K.Lal Kishore, "Operational Amplifiers with Linear Integrated Circuits", Pearson, 2009.
4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson, Third Edition, 2005.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II CSE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Introduction to Linux Programming

Course Code:20A60505 **L T P C : 3 0 0 3**

Course Objectives:

- To study the commands according to user requirements.

- To utilize Shell scripts to perform the given task.
- To enable writing own programs in UNIX.
- To know AWK programs.

Course Outcomes:
CO1: Develop text data processing applications using Unix commands and filters.
CO2: Design and develop text based user interface components
CO3: Understand user management, network management and backup utilities
CO4: Use the system calls for file management
CO5: Understands the Concept of Process Threads and File Structure.

UNIT-I: Introduction,Unix File System,Unix Commands

Operating System, History of UNIX, Overview and Features of Unix System,Structure of Unix System, Unix Environment. **Unix File System**: Introduction of Files, Organization of File Systems, Accessing File Systems, Structure of File Systems. **Unix Commands**: Basic Commands, Advanced Unix Commands: File Access Permissions, Pipe Operator, cut, paste, wc, sort, head, tail, diff, cmp, uniq, comm, time, Conversions between DOS and Unix, man.

UNIT-II: File management and Compression Techniques,Manipulating Processes and Signals

Managing and Compressing Files, Computer Devices, Disk related Commands, Compression and Uncompressing Files, Important Unix System Files, Shell Variables, Export of Local and Global Shell Variables.

Manipulating Processes and Signals: Process Basics, Processes States and Transitions, Zombie Process, Context switching, Threads, ps-status of Process.

UNIT-III: System calls

Introduction, File-related System calls (open, create, read, write, lseek), File-related System calls (close, mknod, link and unlink, access, and chown, chmod), Directory Handling System calls (mkdir, rmdir, chdir, opendir, readdir, telldir, closedir), Process related System calls (exec, fork, wait,exit).

Editors in Unix: introduction, Stream editor, Emacs Editor.

UNIT-IV: AWK Script,Burne Shell

AWK Command, print, printf, Displaying Content of Specified Patterns, Comparison Operators, Compound Expressions, Arithmetic Operators, Begin and end Sections, User-defined Variables, if else Statement, Built-in Variables, Changing Input Filed Separator, Functions, Loops, Getting Input from User, Search and Substitute Functions, Copying results into Another file.

Bourne Shell: Introduction, beginning Bourne Shell Scripting, Writing Shell Scripts, Command Line Parameters, read, for Loop, While Loop, if Statement, Bourne Shell Commands.

UNIT-V: InterprocessCommunicaation, Unix System Administration and Networking

Interprocess Communication, Synchronization, Filters.

Unix System Administration and Networking: Unix Booting Procedure,Mounting Unix File System, Unmounting Unix File System, Managing User Accounts, Networking Tools, mail Command, Distributed File System, Firewalls, Backup and Restore.

TEXT BOOKS

1. "UNIX and SHELL Programming", B.M. HARWANI, OXFORD UNIVERSITY PRESS.

REFERENCES

1. "UNIX and Linux System Administration Handbook", Evi Nemeth, Garth Snyder, Trent R. Hein and Ben Whaley, PHI

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II Chemical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	OE2. GREEN TECHNOLOGY	L	T	P	C
20A60805		3	0	0	3

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

CO1 Understand the basic knowledge of environmental issues and estimate the risk
CO2 Evaluate the exposures
CO3 To discuss the type of wastes and emissions that drive the environmental impacts
CO4 Estimation of the environmental properties, persistence, ecosystem risk,
CO5 To present approaches and methodologies for evaluating and improving the environmental performance of chemical processes and chemical products.

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT - I

An introduction to environmental issues: Role of chemical processes and chemical products, Global environmental issues, Air and water quality issues, Ecology.

Risk concept: Description of risk, Risk assessment concept, Dose-response, Exposure assessment.

UNIT - II

Evaluating exposures: Occupational exposures: recognition, evaluation, control, Exposure assessment for chemicals in the ambient environment, Designing safer chemicals.

Green chemistry:Green chemistry methodologies, Optimization based frameworks for the design of green chemical synthesis pathway.

UNIT - III

Evaluating environmental fate: Chemical and physical property estimation, estimating environmental persistence, estimating ecosystem risk, classifying environmental risk based on chemical structure.

UNIT - IV

Life-cycle concepts: Life-cycle assessment, Life-cycle impact assessment

UNIT - V

Material flows in chemical manufacturing, Assessing opportunities for waste exchanges and by-product synergies.

Textbooks:

SHONNARD, DALLEN, D. Green Engineering: Environmentally Conscious Design of Chemical Processes.

Reference Books:

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	**Mathematical Modelling & Simulation (Common for CIVIL,MECH&CHEM)**		**L**	**T**	**P**	**C**
20A65101			**0**	**3**	**0**	**3**
Pre-requisite		**Semester**	**II**			
Course Objectives:						
This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.						
Course Outcomes (CO): Student will be able to						
• understand basic Model Forms. • understand basic Simulation Approaches. • evaluate handling Stepped and Event-based Time in Simulations. • distinguish Discrete versus Continuous Modeling. • apply Numerical Techniques.						

- calculate Sources and Propagation of Error.

UNIT - I		8 Hrs
Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modelling-Numerical Techniques-Sources and Propagation of Error		
UNIT - II		9 Hrs
Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations		
UNIT - III		8 Hrs
Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies		
UNIT - IV		8 Hrs
Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis		
UNIT - V		9 Hrs
Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results.		

Textbooks:

1. Mathematical modeling, JN Kapur, Newage publishers
2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers
   by Kai Velten, Wiley Publishers

Reference Books:

1. Introduction to Mathematical Modeling and Computer Simulations
   By Vladimir Mityushev,WojciechNawalaniecNataliaRylko Published by Chapman and Hall/CRC.

Online Learning Resources:

http://www.cse.chalmers.se/~dag/docs/matmodReport6.pdf
https://www.slideshare.net/arupparia/introduction-to-mathematical-modelling-42588379
https://www.slideshare.net/mailrenuka/simulation-for-queuing-problems-using-random-numbers

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Wavelet transforms and its Applications (Common for EEE&ECE)		L	T	P	C
20A65102			0	3	0	3
Pre-requisite	Fourier Series	Semester	II			
Course Objectives:						
This course provides the students to understand Wavelet transforms and its applications.						
Course Outcomes (CO): Student will be able to						
• understand wavelets and wavelet expansion systems. • illustrate the multi resolution analysis ad scaling functions. • form fine scale to coarse scale analysis. • find the lattices and lifting. • perform numerical complexity of discrete wavelet transforms. • find the frames and tight frames using Fourier series.						
UNIT - I	Wavelets		9 Hrs			
Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems - Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform The Discrete-Time and Continuous Wavelet Transforms.						

UNIT - II	A Multiresolution Formulation of Wavelet Systems	8 Hrs
Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.		
UNIT - III	Filter Banks and the Discrete Wavelet Transform	9 Hrs
Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.		
UNIT - IV	Time-Frequency and Complexity	9 Hrs
Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.		
UNIT - V	Bases and Matrix Examples	8 Hrs
Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.		
Textbooks:		
1. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”,Prentice Hall, (1997). 2. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999).		
Reference Books:		
1. Raghuveer Rao, “Wavelet Transforms”, Pearson Education, Asia.		
Online Learning Resources:		
https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	**Statistical Methods for Data Science CSE (Data Science)**		**L**	**T**	**P**	**C**
20A65103				**3**		**3**
Pre-requisite		**Semester**	**II**			

Course Objectives:

This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.

Course Outcomes (CO): Student will be able to

- Understand the basic concepts of Statistics
- Analyze data and draw conclusion about collection of data under study using Point estimation
- Analyze data and draw conclusion about collection of data under study using Interval estimation
- Analyzing the tests and types of errors for large samples
- Apply testing of hypothesis for small samples.

UNIT - I	**Basic Concepts**	**9 Hrs**

Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency – Factorization Theorem – Minimal sufficiency; Efficiency – Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator,applications of Lehmann-Scheffe's Theorem, Rao - Blackwell Theorem and applications

UNIT - II	**Point Estimation**	**8 Hrs**

Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator(without proof)- applications , Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

UNIT - III	**Interval Estimation**	**8 Hrs**

Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

UNIT - IV	Testing of hypotheses	9 Hrs
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.		
UNIT - V	**Small sample tests**	**9 Hrs**
Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances,CRD,RBD,LSD; Chi-square test for goodness of fit and test for independence of attributes, $\chi 2$ test for testing variance of a normal distribution Sign test, Signed rank test, Median test, Mann-Whitney test, Run test and One sample Kolmogorov –Smirnov test ,Kruskal – Wallis H test(Description, properties and applications only).		
Textbooks:		
1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014. 2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference,9th edition,Pearson publishers,2013.		
Reference Books:		
1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons. 2. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition.		
Online Learning Resources:		
1. https://www.statstutor.ac.uk/resources/uploaded/1introduction3.pdf 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/		

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
PHYSICS OF ELECTRONIC MATERIALS AND DEVICES

COURSE OBJECTIVES

1 To impart the fundamental knowledge on various materials, their properties and **Applications.**

2 To provide insight into various semiconducting materials and their properties.
3 To elucidate the characteristic behavior of various semiconductor devices.
4 To provide the basics of dielectric and piezoelectric materials and their properties.
5 To explain different categories of magnetic materials, mechanism and their advanced applications.

COURSE OUTCOMES

At the end of the course the student will be able
CO1 To understand the fundamentals of various materials.
CO2 To exploit the physics of semiconducting materials
CO3 To familiarize with the working principles of semiconductor-based devices.
CO4 To understand the behavior of dielectric and piezoelectric materials.
CO5 To make use of the magnetic materials for advanced applications.

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 **Credit: 3 Hours of teaching: - 45 H**

UNIT-1 Fundamentals of Materials Science: 9H

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects.Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT-2: Semiconductors: 9H

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT-3: Physics of Semiconductor Devices: 9H

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium.and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

UNIT-4: Dielectric Materials and their Applications: 9H

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties- Ferroelectricity-Applications.

UNIT-5: Magnetic Materials and their Applications: 9H

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

Text Books

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, DhanpatRai and Co.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R.Askeland,Chapman& Hall Pub.
6. Electrical Engineering Materials-by A.J. Dekker, PHI Pub

NPTEL courses links
https://nptel.ac.in/courses/113/106/113106062/
https://onlinecourses.nptel.ac.in/noc20_mm02/preview
https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II H& SS

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**Academic Writing and Public Speaking**		**L**	**T**	**P**	**C**
20A65501			**3**	**0**	**0**	**3**
Pre-requisite						

Course Objectives:

- To encourage all round development of the students by focusing on writing skills
- To make the students aware of non-verbal skills
- To develop analytical skills
- To deliver effective public speeches

Course Outcomes (CO):

By the end of the program students will be able to

- Define various elements of Academic Writing
- Understand how to paraphrase sources and avoid plagiarism
- Demonstrate the knowledge in writing a Research paper
- Analyse different types of essays
- Assess the speeches of others and know the positive strengths of speakers
- Build confidence in giving an impactful presentation to the audience

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	**Academic Journal Article**	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT - III	**Essay & Writing Reviews**	Lecture Hrs
Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review-		
UNIT - IV	Public Speaking	Lecture Hrs
Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events		
UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs
Body Language – Kinesics – Oculesics – Proxemics – Haptics – Paralanguage		
Textbooks:		
3. **Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)** 4. **A Course In Academic Writing Paperback – 1 January 2017Publisher : The Orient Blackswan; Second edition (1 January 2017)**		
Reference Books: 1. **A Handbook For Academic Writing and Composition Paperback – 1 January 2014** by Nzanmongi Jasmine PattonPublisher : Pinnacle Learning; 1st edition (1 January 2014) 2. Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010Publisher : Pearson Education; First edition (1 January 2010) by Marilyn Anderson (Author) 3. Effective Academic Writing Second Edition: 1: Student Book: The Paragraph Paperback – Student Edition, 9 June 2014 by Alice Savage (Author), MasoudShafiei (Author)Publisher : Oxford University Press; Student, Workbook edition (9 June 2014) 4. A Course In Academic Writing Paperback – 1 January 2017 by Renu Gupta (Author) Publisher : The Orient Blackswan; Second edition (1 January 2017)		
Online Learning Resources:		
1. https://youtu.be/NNhTIT81nH8 2. phttps://www.youtube.com/watch?v=478ccrWKY-A 3. https://www.youtube.com/watch?v=nzGo5ZC1gMw		

4. https://www.youtube.com/watch?v=Qve0ZBmJMh4

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
	CHEMISTRY OF POLYMERS AND ITS APPLICATIONS	2	1	-	3

COURSE OBJECTIVES	
1	To understand the basic principles of polymers
2	To synthesize the different polymeric materials and their characterization by various instrumental methods.
3	To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
4	To enumerate the applications of polymers in engineering

COURSE OUTCOMES	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers, Characterize the properties of polymers by IR, NMR, XRD etc.
CO3	Describe the properties and applications of polymers, Interpret the properties of cellulose, lignin, starch, rosin, latex etc., Discuss the special plastics of PES, PAES, PEEK etc., Explain modified cellulosics
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery, Demonstrate the advanced drug delivery systems and controlled release
CO5	Demonstrate electrical phenomena at interfaces including electrokinetics, miselles, reverse micelles etc., Explain photoelectron spectroscopy, Discuss ESCA and Auger

	spectroscopy to the study of surfaces, Differentiate micelles and reverse micelles

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: Polymers-Basics and Characterization :-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, co polymerization and coordination. 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.

Unit – II: 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 of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol – formaldehyde. Melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD

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.

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.

Unit – V: 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.

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 – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III CIVIL

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Building Technology for Engineers	L	T	P	C
20A70104		3	0	0	3

Course Objectives :

1. To make the student familiar with varioustypes of Buildings and its components
2. To teach the students about general requirements of building regarding safety and transportation
3. To impart knowledge on various special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. To make the student familiar with the concepts of various Prefabrication systems.
5. To Teach the students about various construction equipments used in building.

Course Outcomes:

By the end of this course the student will be able to

1. Classify various types of buildings and its components.
2. Understand the general requirements of building regarding safety and transportation.
3. Understand the Special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. Familiarize with the concepts of various Prefabrication systems.
5. Understand various construction equipments used in building.

UNIT-1

Building planning: Types of Buildings — components, definitions, economy and design, Principles and aspects of building planning, Definitions and importance of Grouping and circulation; Lighting and ventilation; Sustainability and Green Buildings.

UNIT-II

General requirements: Requirements for safety against fire, termite, damping, earthquakes, Vertical transportation in building — planning of vertical transportation, Stairs, different forms of stairs, Other modes of vertical transportation.

UNIT-III

Special Requirements: Air conditioning — process and classification of air conditioning, Dehumidification. Systems of air-conditioning, ventilation, functional requirements of ventilation. Thermal insulation. Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation.

UNIT-IV

Prefabrication systems: Prefabricated walls, openings, cupboards, shelves etc., planning and modules and sizes of components in prefabrication. Plumbing services — water supply system, maintenance of building pipe line, Sanitary fittings, Design of building drainage.

UNIT-V

Construction Equipment: Introduction and Planning for construction Equipment, Earthmoving and Excavating equipment, Pile driving equipment, Lifting and Concreting Equipment.

<u>Learning Resources:</u>

Text Books:

1. Building Construction, Punmia B. C., Jain A.J., and Jain A.J., Laxmi Publication, 2016, Eleventh Edition.

2. The Text book for Building Construction, Arora S. P., and Bindra S. P., Dhanpat Rai Pubications, 2010.

Reference Books:

1. Building Construction, Varghese P.C., PHI Learning Pvt. Ltd., 2017, 2nd Edition.
2. Construction Planning, Equipment and Methods, Robert P., Clifford J. S., and Aviad S., McGrawHiIl Education, 2010

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III EEE

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**BATTERY MANAGEMENT SYSTEMS (OE-III)**		**L**	**T**	**P**	**C**
20A70204			**3**	**1**	**0**	**4**
Pre-requisite	**Basic Electrical Engineering**	**Semester**	**VI**			
Course Objectives: To make the students learn about:						
• Understand the role of battery management system and the requirements of BMS. • Interpret the concept associated with battery charging / discharging process • Analyze various parameters of battery and battery pack • Design the model of battery pack						
Course Outcomes (CO): After completion of this course, student will be able to						
CO1: Understand and remember the basic concepts and terminologies of Cells and Batteries, charging, discharging methods, concept of cell balancing. **CO2:**Analyze BMS functionality, various sensors used, control techniques, Sate of Charge estimation, cell total energy and cell total power. **CO3:** Apply the equivalent circuits, physical models, empirical modelling of BMS. **CO4:** Design of Battery management system considering various parameters and through simulation.						
UNIT - I	**INTRODUCTION**		Lecture Hrs: 14			
Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes						

of Charging		
UNIT - II	**BATTERY MANAGEMENT SYSTEM**	Lecture Hrs: 14
Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power		
UNIT - III	**BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION**	Lecture Hrs: 12
Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing		
UNIT - IV	**MODELLING AND SIMULATION**	Lecture Hrs: 12
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs		
UNIT - V	**DESIGN OF BATTERY MANAGEMENT SYSTEMS**	Lecture Hrs: 12
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system		
Textbooks:		
1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015. 2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.		
Reference Books:		
1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002. 2. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010 3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008. 4. RuiXiong, "Battery management Algorithm for Electric Vehicles", China Machine Press, Springer,2020. 5. Bergveid, Krujit, Notten, " Battery Management Systems: Design by Modelling", Philips Research Book Series, Kluwer Academic Publishers.		
Online Learning Resources:		
1. https://www.coursera.org/learn/battery-management-systems		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MECHANICAL ENGINEERING

Subject Code	Title of the Subject	L	T	P	C
20A70304	**MODERN MANUFACTURING METHODS**	3	0	0	3

Course Objectives:

To learn the importance and basics of unconventional machining.
To understand the rapid prototyping processes.
To have the knowledge of different micro machining methods
To understand the working principles of various Non-traditional machining methods.
To learn about Non-traditional forming processes.

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.

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.

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.

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 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.

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.

Course Outcomes:

At the end of this course the student should be able to understand

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non-traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

- Manufacturing processes for engineering materials by SeropeKalpakjian and Steven R Schmid, 5edn, Pearson Pub.
- Advanced machining processes, VK Jain, Allied publishers.

REFERENCE:

- New Technology , Bhattacharya A, The Institution of Engineers, India 1984
- Manufacturing Technology, Kalpakzian, Pearson
- Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

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Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronic & Communication Engineering

Course Code	**DIGITAL ELECTRONICS**		**L**	**T**	**P**	**C**
20A70404			3	0	0	3
Pre-requisite		**Semester**	**VII**			

Basics of Electronics and Communication Engineering

Course Objectives:

- To learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- To understand and design various combinational logic circuits like adders and code converters.
- To know the design of various combinational circuits useful to implement logic functions.
- To study the design of sequential logic circuits in synchronous and asynchronous modes.
- To introduce programmable logic devices.

Course Outcomes (CO): At the end of this course, the students will be able to

- Learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- Understand and design various combinational logic circuits like adders and code converters.
- Know the design of various combinational circuits useful to implement logic functions.

- Gain knowledge on the design of sequential logic circuits in synchronous and asynchronous modes.
- Understand the operation and uses of programmable logic devices.

UNIT - I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine – McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT - III

Combinational Logic Design 2: Decoders (3 to 8, octal to decimal), Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT - IV

Sequential Logic Design: Latches, Flipflops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions, set up and hold times, Ripple and Synchronous counters, Shift registers.

UNIT - V

Programmable Logic Devices:ROM, Programmable Logic Devices (PLDs), Introduction to logic families and their comparisons.

Textbooks:

1. Digital Design, M. Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and Nirah K. Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth, Jr., 5th Edition, Brooks/coleCengage Learning, 2004.
2. Digital & State Machine Design, Comer, 3rd Edition, OXFORD.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Compute Science & Engineering
Cyber Security

Course Code:20A70504 **L T P C : 3 0 0 3**

Course Objectives:
- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

Course Outcomes:
CO1: Recognize the Java programming environment.
CO2: Select appropriate programming constructs to solve a problem.
CO3: Develop efficient programs using multithreading.
CO4: Design reliable programs using Java exception handling features.
CO5: Extend the programming functionality supported by Java.

UNIT-I: Cybercrime
Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-II: Cyber Offenses
Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-III: Cybercrime in Mobile and Wireless Devices

Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT-VI: Tools and Methods Used in Cybercrime

Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks

UNIT-V: Cyber Forensics, Cybercrime in Real-World

Forensics of Computer and Handheld Devices: Cyber forensics, Cyber forensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites, Forensics of handheld devices – Smartphone forensics, EnCase, Device Seizure, MOBIL edit.

Cybercrime examples, mini-cases, online scams: Real-life examples - Official website of Maharashtra Government hacked, Indian banks lose millions of rupees, Game source code stolen; Mini-cases - Indian Case of online gambling, Indian case of intellectual property crime; Online scams - Cheque cashing scam, Charity scams.

References:

1. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
2. Cyril Prasanna Raj P., “CMOS digital circuit design manual”, Volume 1, MSEC E-publication, Edition 2016

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Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemical Engineering

Course Code	INDUSTRIAL POLLUTION CONTROL	L	T	P	C
20A70804	**ENGINEERING**	**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

CO1 Understand the different types of wastes generated in an industry, their effects on living and non-living things & environmental regulatory legislations and standards and climate changes.

CO2 Quantify, analyse and treat wastewater

CO3 Apply the different unit operations and unit processes involved in conversion of highly polluted water to potable standards

CO4 Apply the operating principles, design calculations of particulate control devices.

CO5 Estimate the different waste generated from the industries

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards. Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

UNIT - II

General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry. Air pollution sampling and measurement: Types of pollutant and sampling and measurement,ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozones, hydrocarbons, particulate matter

UNIT - III

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP and their constructional details and design aspects. Scrubbers: wet scrubbers, spray towers, centrifugal scrubbers, packed beds and plate columns, venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids, equipment and the design aspects

UNIT - IV

Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, attached growth processes, trickling filters, rotary drum filters, anaerobic processes.

UNIT - V

Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. A brief study of carbon absorption, ion exchange, reverse osmosis, ultra-filtration, chlorination, ozonation, treatment and disposal. Hazardous waste management: nuclear wastes: health and environment effects, sources and disposal methods. Chemical wastes: health and environmental effects, treatment and disposal: treatment and disposal by industry, off site treatment and disposal, treatment practices in various countries. Biomedical wastes: types of wastes and their control.

Textbooks:

1. Environmental Pollution and Control Engineering, C. S. Rao – Wiley Eastern Limited, India, New Delhi, 1993.
2. Pollution Control in Process Industries, S.P. Mahajan, Tata McGraw-Hill, New Delhi, 1985.

Reference Books:

1. Wastewater Treatment, M. Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Numerical Methods for Engineers (Common for all Branches)		L	T	P	C
20A75101			**0**	**3**	**0**	**3**
Pre-requisite	---					

Course Objectives:
This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
Course Outcomes (CO): Student will be able to
• apply numerical methods to solve algebraic and transcendental equations. • understand fitting of several kinds of curves. • derive interpolating polynomials using interpolation formulae. • Solve differential and integral equations numerically.

UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.		
UNIT - II	**Curve Fitting**	8 Hrs
Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.		
UNIT - III	**Interpolation**	9 Hrs
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula		
UNIT - IV	**Numerical Integration**	8 Hrs
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule		
UNIT - V	**Solution of Initial value problems to Ordinary differential equations**	9 Hrs

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.
Textbooks:
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
https://slideplayer.com/slide/8588078/

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Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75201	**SMART MATERIALS AND DEVICES**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to smart materials and their engineering applications.

2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain theproperties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of smart materials
CO2	To understand the working principles of smart materials
CO3	To know different techniques used to synthesize and characterize smart materials
CO4	To exploit the properties of smart materials
CO5	To make use of smart materials for different applications

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

Credit: 3 **Hours of teaching: - 45 H**

UNITI : Introduction to Smart Materials: 9H

Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

UNIT II: Properties of Smart Materials: 9H

Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III: Synthesis of Smart materials: 9H

Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method,Co-precipitaiton.Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV: Characterization Techniques: 9H

X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

UNIT V:Smart Materials and Devices: 9H

Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials. Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

Text Books:

1.Encyclopaediaof Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002

2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Champman and Hall, 1992

Texts/References:

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.

2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.

3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, , 2nd Edn., John Wiley & Sons, 2003.

4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers,G.Gautschi, Springer, 2002.

5. Optical Metamaterials: Fundamentals and Applications-W. Cai and V. Shalaev, ,springer,2010.

6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

NPTEL courses links

https://nptel.ac.in/courses/112/104/112104173/
https://nptel.ac.in/courses/112/104/112104251/
https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat_lec_1.pdf

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H &SS

Course Code	Employability Skills		L	T	P	C
20A75501			3	0	0	3
Pre-requisite		Semester-VII				

Course Objectives:

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):

CO1: Define goals and try to achieve them
CO2: Understand the significance of self-management
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes
CO4: Analyse various forms of Presentation skills
CO5: Judge the group behaviour
CO6: Develop skills required for employability.

UNIT - I	Goal Setting and Self-Management	Lecture Hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOT Analysis

UNIT - II	Writing Skills	Lecture Hrs

Definition, significance, types of writing skills – Resume writing, E-Mail writing, Cover Letters, - E-Mail Etiquettes

UNIT - III	Technical Presentation Skills	Lecture Hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics – PPT & Poster Presentation

UNIT - IV	Group Presentation Skills	Lecture Hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion

UNIT - V	Job Cracking Skills	Lecture Hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success - Answering Strategies – Mock Interviews

Textbooks:

- 1. Soft Skills & Employability Skills (English, Paperback, SABINA PILLAI, AGNA FERNANDEZ)Publisher: Cambridge

2.Personality Development and Soft Skills (English, Paperback, MitraBarun K.)

Reference Books:

1. Learning How To Fly - Life Lessons for the Youth (English, Paperback, Kalam Abdul A. P. J.), Rupa& Co
2. Personality Development and Soft Skills - Preparing for Tomorrow 1 Edition (English, Paperback, Shikha Kapoor)Publisher: Dreamtech Press

3. Skills for Employability - Skills for Employability with 0 Disc (English, Paperback, Dr. M. Sen Gupta)Publisher: Innovative Publication
Online Learning Resources:
7. https://youtu.be/gkLsn4ddmTs 8. https://youtu.be/2bf9K2rRWwo 9. https://youtu.be/FchfE3c2jzc 10. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75301	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT**	2	1	-	3

COURSE OBJECTIVES	
1	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.
2	Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

COURSE OUTCOMES

CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, Describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Organic solvents and importance of solvent free systems, Discuss Super critical carbondioxide, Explain Super critical water and water as a reaction solvent, Interpret Ionic Liquids as Catalyst and Solvent
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry and Green Chemistry, Apply Green Chemistry for Sustainable Development , Discuss the importance of Renewable resources
CO5	Discuss green Chemistry Principles for practicing Green nano synthesis, Illustrate Microwave Assisted Synthesis, Differentiate Hydrothermal and Reflux synthesis, Demonstrate Green Chemistry applications of Inorganic nanomaterials

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: 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, Heterogeneous and 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

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 Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, 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: ALTERNATIVE ENERGY SOURCES

Photo redox catalysis, single electron transfer reactions (SET), Advantages 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.

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.

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Civil Engineering

		L	T	P	C
20A70105	**Environmental Impact Assessment**	**3**	**0**	**0**	**3**

Course Objectives:
1. To impart knowledge on different concepts of Environmental Impact Assessment.
2. To teach procedures of risk assessment.
3. To teach the EIA methodologies and the criterion for selection of EIA methods.
4. To teach the procedures for environmental clearances and audit.
5. To know the impact quantification of various projects on the environment.

Course Outcomes (CO):
1. To prepare EMP, EIS, and EIA report.
2. To identify the risks and impacts of a project.
3. To choose an appropriate EIA methodology.
4. To evaluation the EIA report.
5. To Estimate the cost benefit ratio of a project.

UNIT - I

Concepts and methodologies 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- 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 - II

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 - III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment :Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment

UNIT - IV Environmental 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 Environmental Acts and Notifications

The Environmental protection Act, The water preservation Act, The Air (Prevention &Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

Textbooks:

1. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers
3. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi.

Online Learning Resources:

https://nptel.ac.in/courses/124107160

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electrical & Electronic & Engineering

Course Code	IoT APPLICATIONS IN ELECTRICAL ENGINEERING (OE-IV)	L	T	P	C
20A70205		3	0	0	3
Pre-requisite					

Course Objectives: To make the students learn about:

- Basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process.
- The concept of motion less and motion detectors in IoT applications.
- Applications of IoT in smart grid.
- The concept of Internet of Energy for various applications.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the concept of IoT in Electrical Engineering.
CO 2 Analyze various types of motionless sensors and various types of motion detectors
CO 3 Apply various applications of IoT in smart grid.
CO 4 Design future working environment with Energy internet.

UNIT - I	SENSORS	Lecture Hrs: 10

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

UNIT - II	OCCUPANCY AND MOTION DETECTORS	Lecture Hrs: 10

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

UNIT - III	MEMS	Lecture Hrs: 10

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

UNIT - IV	IoT FOR SMART GRID	Lecture Hrs: 8

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

UNIT - V	INTERNET of ENERGY (IoE)	Lecture Hrs: 10

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 .

Textbooks:
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
Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview 2. https://nptel.ac.in/courses/108108123 3. https://nptel.ac.in/courses/108108179

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Mechanical Engineering

Subject Code	Title of the Subject	L	T	P	C
20A70305	**MATERIAL HANDLING EQUIPMENTS**	3	0	0	3

Course Objectives:

To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.

To sensitize the students on the materials management functions – Planning, Purchase, Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing.

To realize the importance of materials both in product and service.

planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

It also aims to explore the layout planning by computer applications following different algorithms.

UNIT-I

Overview of Material Handling: Principles of Material Handling, Principal groups of Material Handling equipment – General Characteristics and application of Material Handling Equipment, Modern trends in material handling.

UNIT-II

Lifting Equipments: Hoist- Components of Hoist – Load Handling attachments hooks, grabs and clamps – Grabbing attachments for bulk material – Wire ropes and chains.

UNIT-II

Lifting tackle pulleys for gain of force and speed: Tension in drop parts – Drums, Shears and sprockets – Arresting gear and brakes – Block brakes, Band brakes, thrust brakes – Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms – Slewing Mechanisms – Elevators and lifts.

UNIT-IV

CONVEYORS: Types - description -applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors

UNIT-V

ELEVATORS: Bucket elevators: Loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes :

The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.

The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.

The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system

The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.

The students will be able to design of fork lift trucks.

REFERENCES

Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

P.S.G. Tech., “Design Data Book”, KalaikathirAchchagam, Coimbatore, 2003.

Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronics & Communication Engineering

Course Code	PRINCIPLES OF DIGITAL SIGNAL PROCESSING	L	T	P	C
20A70405		3	0	0	3

Pre-requisite

Basics of Electronics and Communication Engineering

Course Objectives:

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete Fourier series and Fourier transforms.
- To design &analyzeIIR 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.

Course Outcomes (CO): At the end of this course, the students will be able to

- Articulate the frequency domain analysis of discrete time signals.
- Understand the properties of discrete Fourier series and Fourier transforms.
- Design &analyzeIIR digital filters from analog filters.
- Design various structures used in implementation of FIR digital filters.
- Summarize 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.

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.

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.

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 techniques, comparison of IIR & FIR filters, basic structures of FIR systems.

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.

Textbooks:

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.

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.
4. B. Venkataramani and M. Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications”, TATA McGraw Hill, 2002.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Computer Science & Engineering

Introduction to Database Management Systems

Course Code:20A70505 **L T P C : 3 0 0 3**

Course Objectives:

- To introduce the concept of Internet of Things.
- To Practice programs and build real time applications.
- Students will be explored to the interconnection and integration of the physical world.
- Students will gain practical experience in the development of Cloud-based IoT systems.
- To get knowledge on cloud platforms

Course Outcomes (CO):

CO1: Design reliable real time applications using microcontrollers and microprocessors .
CO2: Extend the programming functionality and design new modules.
CO3: Able to design & develop IOT Devices.

UNIT-I: Introduction

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database system, approaches to building a database, data models, database management system, Data Independence, DBMS

system architecture, challenges in building a DBMS, various components of a DBMS

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence, DBMS

system architecture, challenges in building a DBMS, various components of a DBMS

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence, DBMSsystem architecture, challenges in building a DBMS, various components of a DBMS

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence, DBMS

system architecture, challenges in building a DBMS, various components of a DBMS.

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence,DBMS system architecture, challenges in building a DBMS, various components of a DBMS.

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database system, approaches to building a database, data models, database management system, Data Independence, DBMSsystem architecture, challenges in building a DBMS, various components of a DBMS.

Introduction to database systems, Characteristics of databases, File system V/s Database system, Users of Database system, approaches to building a database, data models, database management system, Data Independence, DBMS system architecture, challenges in building a DBMS, various components of a DBMS.

UNIT-II: E/R Model

Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship

types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples

Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship

types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples

Conceptual Data Modeling - motivation, entities, entity types, various types of attributes, relationships, relationship types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples.

UNIT-III: Relational Data Model

Concepts of relations, schema-instance distinction, keys, referential integrity & foreign keys, converting the database specification in ER notation to the relational schema, Relational algebra operators: selection, projection, cross product, various types of joins, division, set operations, example queries, tuple relational calculus, domain relational calculus, Fundamentals of SQL.

UNIT-VI: Relational Database Design

Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, Normalization, Normal Forms - INF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, multi valued dependencies and 4NF, join dependencies and 5NF, Concept of Denormalization.

UNIT-V: Transaction Processing,Data Storage & Indexing

Transaction processing and Error recovery-Concepts of transaction processing, ACID properties, concurrency control, Serializability, locking based protocols, Timestamp based protocols, recovery and logging methods.

Data Storage and Indexes - File organizations, primary, secondary index structures, various index structures - hasb based, dynamic hashing techniques, multi-level indexes, B and B-trees.

References:

3. K. A. Navas, "Electronics Lab Manual", Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
4. Cyril Prasanna Raj P., "CMOS digital circuit design manual", Volume 1, MSEC E-publication, Edition 2016

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemical Engineering

Course Code	SOLID WASTE MANAGEMENT	L	T	P	C
20A70805		3	0	0	3
Pre-requisite					

Course Objectives:

- Material flow in society and generation of solid waste source
- Clarification of solid waste on characterization of the same
- Understand the sense of onsite handling storage and collection systems including transportation
- Understand processing technologies with mechanical volume reduction and thermal volume reduction corporate land filling, deep well injections.
- Learn to estimate material recovery energy recovery from a given waste data using case

standing

Course Outcomes (CO):

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

CO1 Identify sources and relationship between various functional elements of solid waste management and methods of storage and collection and transport of solid wastes.

CO2 Know the importance of transfer station and suggest suitable methods of solid waste disposal based on the composition of solid waste.

CO3 Suggest suitable methods for the management of plastic and E-wastes

CO4 Identify hazardous wastes and suggest suitable management techniques for radioactive wastes and Bio-medical wastes.

CO5 Adopt the suitable management method for a given industry

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT - I

Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes.

General aspects Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations

UNIT - II

Engineered systems: Typical generation rates. Estimation and factors effecting generation rates. On site handling. Storage and processing. Collection systems and devices. Transfer and transport.

UNIT - III

Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deep well injection.

UNIT - IV

Material recovery: Mechanical size alteration. Electromagnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products.

Energy recovery: Energy recovery systems and efficiency factors. Determination of output and efficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels (RDF).

UNIT - V

Case studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

Textbooks:

1. Howard S. Peavy, Environmental Engineering, McGraw Hill International Edition, 1986.
2. Dutta, Industrial Solid Water Management and Land Filling Practice, Narose Publishing House, 1999.

Reference Books:

1. Sastry C.A., Waste Treatment Plants, Narose Publishing House, 1995.
2. Lagrega, Hazardous Waste Management, McGraw Hill, 1994.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Number theory and its Applications		L	T	P	C
20A75102			0	3	0	3
Pre-requisite	-----	Semester	I			

Course Objectives:		
This course enables the students to learn the concepts of number theory and its applications to information security.		
Course Outcomes (CO): Student will be able to		
• understand number theory and its properties. • understand principles on congruences • develop the knowledge to apply various applications • develop various encryption methods and its applications.		
UNIT - I	**Integers, Greatest common divisors and prime Factorization**	8 Hrs
The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations		
UNIT - II	**Congruences**	8 Hrs
Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences		
UNIT - III	**Applications of Congruences**	9 Hrs
Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem-Pseudo primes- Euler's theorem- Euler's p hi-function- The sum and number of divisors- Perfect numbers and Mersenne primes.		
UNIT - IV	**Finite fields & Primality, factoring**	8 Hrs
Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.		
UNIT - V	**Cryptology**	9 Hrs
Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers- Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.		

Textbooks:
1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories. 2. A course in Number theory & Cryptography, Neal Koblitz, Springer.
Reference Books:
1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers 2. Introduction to Analytic number theory-Tom M Apostol, springer **3.** Elementary number theory, VK Krishnan, Universities press
Online Learning Resources:
https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75202	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering

	applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of sensors and actuators
CO2	To understand working principles of various sensors and actuators
CO3	To identify different type of sensors and actuators used in real life applications
CO4	To exploit basics in common methods for converting a physical parameter into an electrical quantity
CO5	To make use of sensors and actuators for different applications

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

Credits: 3 **Hours of teaching:- 45 H**

UNIT – I: Introduction to Sensors and Actuators 9H

Sensors: Types of sensors:temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition:ChemicalVapor Deposition, Pattern: photolithography and Etching: Dry and WetEtching.

Actuators: 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, Applications of Actuators.

UNIT –II: Temperature and Mechanical Sensors 9H

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, Tactile sensors, Pressure sensors: Semiconductor, Piezoresistive, capacitive, Variable Reluctance Sensor (VRP).

UNIT –III: Optical and Acoustic Sensors 9H

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors:thermal, Passive Infra Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

UNIT –IV: Magnetic, Electromagnetic Sensors and Actuators 9H

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

UNIT –V: Chemical and Radiation Sensors 9H

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Muller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

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

NPTEL courses links

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H & SS

Subject Code	Title of the Subject	L	T	P	C
20A79102	English Literary Spectrum	3		0	3

COURSE OBJECTIVES	
1	To develop aesthetic sense to appreciate the beauty of life
2	To introduce to Elizabethan drama and be able to appreciate the nuances of humour
3	To familiarize with Victorian novel and industrialization
4	To expose to the historical significance of ideas of different periods
5	To give exposure to the vicissitudes of life through short stories

COURSE OUTCOMES	
CO1	Awareness to lead a life of quality than quantity
CO2	Able to understand humour and Elizabethan culture
CO3	Enable to appreciate human relations in this mechanized world
CO4	Tolerant and receptive to different ideas
CO5	Be imaginative and understanding of human aspirations

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: Poetry

1. Ode to a Grecian Urn- John Keats
2. To a Skylark- P.B.Shelley
3. Satan’s Speech from Paradise Lost Book I- 140-170 lines- John Milton
4. My Last Duchess- Robert Browning

UNIT II: Drama

1. Twelfth Night- William Shakespeare
    a) Elizabethan theatre
    b) Shakespearean tragedy
    c) Shakespearean Comedy
    d) Themes of Shakespearean Dramas

UNIT III: Novel

1. Hard Times- Charles Dickens

a) Rise of the English Novel
b) Victorian Novel
c) Utilitarianism
d) Humanism

UNIT IV: Prose

1. Of Studies – Francis Bacon
2. On Seeing People Off- A.G.Gardiner
3. Sweetness and Light- Mathew Arnold
4. I too have a Dream- Martin Luther King Junior

UNIT V: Short Stories

1. The Last Leaf- O.Henry
2. Useless Beauty- Guy de Maupassant
3. After the Dance – Leo Tolstoy
4. The Selfish Giant- Oscar Wilde

Text Books:

The Oxford Book of English Verse by Christopher Ricks (Editor)
Twelfth Night (2010 edition): Oxford School Shakespeare (Oxford School Shakespeare Series)
Dickens Charles, Hard Times (Penguin Classics)
The Art of the Personal Essay: An Anthology from the Classical Era to the Present, Anchor Books Publication

References:

Legois and Cazamian, *A History of English Literature*

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75302	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**	2	1	-	3

COURSE OBJECTIVES	
1	'o understand synthetic principles of Nanomaterials by various methods
2	ınd also characterisae the synthetic nanomaterials by various instrumental methods
3	'o enumerate the applications of nanomaterials in engineering

COURSE OUTCOMES	
CO1	Classify the nanostructure materials, Describe scope of nano science and technology, Explain different synthetic methods of nano materials, Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material
CO2	Describe the top down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapour deposition method and electrodeposition method, Discuss about high energy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis, Apply different spectroscopic techniques for characterization
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, Describe liquid crystals
CO5	Illustrate applications of nanaomaterials, Discuss the magnetic applications of nanomaterials, list the applications of non-linear optical materials, Describe the applications fullerenes, carbon nanotubes

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

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

Unit – II

Synthesis of nanomaterials : 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 method.
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-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 and liquid crystals.

UNIT-V

Engineering Applications of Nanomaterials : Applications of Nano Particle, nano rods of nano wires, Fullerenes, carbon nano tubes, Graphines nanoparticles and other applications of nonmaterials and uses.

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.