JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous)
ANANTHAPURAMU – 515 002 (A.P) INDIA

Academic Regulations 2013 (R13) for B. Tech (Regular Full time)

(Effective for the students admitted into I year from the Academic Year 2013-2014 onwards)

1. Award of B.Tech. Degree

A student will be declared eligible for the award of the B.Tech. Degree if he/she fulfils the following academic regulations:

i. Pursue a course of study for not less than four academic years and in not more than eight academic years.

ii. Register for 180 credits and secure all 180 credits.

2. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled.

3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. course for non-autonomous, constituent & affiliated colleges from 2013-14

S.No.	Name of the Branch	Branch Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Chemical Engineering	08
7.	Electronics and Instrumentation Engineering	10
8.	Information Technology	12
9.	Electronics and Control Engineering	13
10.	Mechanical (Mechatronics) Engineering	14
11.	Computer Science & Systems Engineering	15
12.	Electronics and Computer Engineering	19
13.	Aeronautical Engineering	21

and any other course as approved by the authorities of the University from time to time.

4. Credits

	I Year		Semester	
	Periods / Week	Credits	Periods / Week	Credits
Theory	02	03	04	03
	03+01	05	--	--
Practical	03	04	03	02
Drawing	01+05	05	01+03	03
Seminar & Comprehensive viva-voce	--	--	--	03
Project	--	--	15	10

5. Distribution and Weightage of Marks

5.1 The performance of a student in each semester / I year shall be evaluated subject – wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, 'Seminar & Comprehensive Viva-Voce' and Project work shall be evaluated for 75 and 200 marks respectively whereas audit courses shall be evaluated for a maximum of 30 internal marks.

i. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii. For practical subjects the distribution shall be 25 marks for Internal Evaluation and 50 marks for the End- Examination.

5.2 Internal Examinations:

i. For theory subjects, during the semester, there shall be two midterm examinations and for first year there shall be three midterm examinations. Each midterm examination consists of objective paper for 10 marks and subjective paper for 20 marks with duration of 1hour 50 minutes (20 minutes for objective and 90 minutes for subjective paper).

Objective paper shall be for 10 marks. Subjective paper shall contain 5 questions of which student has to answer 3 questions evaluated* for 20 marks.

***Note 1:** The subjective paper shall contain 5 questions of equal weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 20 marks, any fraction(0.5 & above) shall be rounded off to the next higher mark.

***Note 2:** The midterm examination shall be conducted first by distribution of the Objective paper simultaneously marking the attendance, after 20 minutes the answered objective paper is collected back. The student is not allowed to leave the examination hall. Then the descriptive question paper and the answer booklet shall be distributed. After 90minutes the answered booklets are collected back.

If the student is absent for the internal examination, no re-exam shall be conducted and internal marks for that examination shall be considered as zero.

In semester pattern, first midterm examination shall be conducted for I,II units of syllabus and second midterm examination shall be conducted for III,IV & V units.

Final Internal marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage to the better mid exam and 20% to the other. For Ex:

Marks obtained in first mid: 25 Marks
obtained in Second mid: 20
Final Internal Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Ex:

Marks obtained in first mid: Absent
Marks obtained in Second mid: 25
Final Internal Marks: (25x0.8)+ (0x0.2) =20

v. For first year, first midterm examination, shall be from unit – I, second midterm examination shall be from II & III units, and third midterm examination shall be from IV & V units.

Final Internal marks shall be arrived at by considering the marks secured by the student in all the three mid examinations with 80% weightage to the average marks of the best two midterm examinations and 20% to the other. For Ex:

Marks obtained in First mid : 25
Marks obtained in Second mid: 20
Marks obtained in Third mid: 15
Average of Better mid exams: (25+20)/2 = 22.5 Final
Internal Marks: (22.5x0.8) + (15x0.2) = 21

If the student is absent for any one mid examination, final internal marks shall be arrived at by considering 80% weightage to the average marks secured by the student in the appeared midterm examinations and zero to the other. For Ex:

Marks obtained in First mid: Absent
Marks obtained in Second mid: 25
Marks obtained in Third mid: 20
Average of Better mid exams: (25+20)/2 = 22.5 Final
Internal Marks: (22.5x0.8) + (0x0.2) = 18

If the student is absent for two mid examinations, final internal marks shall be arrived as below:
Marks obtained in First mid: Absent Marks obtained in Second mid: Absent Marks obtained in Third mid: 25

Average of Better mid exams: (25+0.0)/2 = 12.5 Final
Internal Marks: (12.5x0.8) + (0x0.2) = 10

5.3 End Examinations:

i. End examination of theory subjects shall have the following pattern:
   a. There shall be 6 questions and all questions are compulsory.
   b. Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.
   c. In each of the questions from 2 to 6, there shall be either-or type questions of 10 marks each. Student shall answer any one of them.
   d. Each of these questions from 2 to 6 shall cover one unit of the syllabus.

ii. End examination of theory subjects consisting of two parts of different subjects, for ex: Electrical & Mechanical Technology, shall have the following pattern:
   a. Question paper shall be in two parts viz., Part A and Part B with equal weightage.
   b. In each part, there shall be 3 either-or type questions for 12, 12 and 11 marks.

Note: The answers for Part A & Part B shall be written in two separate answer books.

5.4 For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and end examination shall be for 50 marks. Day-to-day work in the laboratory shall be evaluated for 25 marks by the concerned laboratory teacher based on the regularity/record/ viva. The end examination shall be conducted by the concerned laboratory teacher and senior expert in the same subject of the department.

In a practical subject consisting of two parts (ex: Electrical & Mechanical Lab), the end examination shall be conducted for 25 marks in each part.

5.5 There shall be an audit pass course in Human values & Professional ethics and Advanced Communication skills lab with no credits. There shall be no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course only when he/she secures 40% or more in the internal examinations.

5.6 For the subject having design and/or drawing, such as Engineering Drawing, Machine Drawing and Estimation, the distribution shall be 30 marks for internal evaluation and 70 marks for end examination. Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2hrs each for 15 marks with weightage of 80% to better mid marks and 20% for the other. However, when offered in the I year as 5 credit course, there shall be three midterm exams with weightage of 80% to average marks of the best two midterm examinations and 20% for the other. The sum of day to day evaluation and the internal test marks will be final sessional marks for the subject.

5.7 There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his/her understanding over the topic, and submit to the department before presentation. The report and the presentation shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar shall be evaluated for 25 marks. The seminar shall be conducted throughout the semester as per the convenience of the department committee and students. There shall be no external examination for seminar.

There shall be a Comprehensive Viva – Voce in IV year II Semester. The Comprehensive viva- voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the department. The Comprehensive Viva – voce is aimed to assess the students' understanding in various subjects he/she studies during the B.Tech. course of study. The Comprehensive Viva- Voce shall be evaluated for 50 marks by the committee. There are no internal marks for the Comprehensive Viva-Voce.

A student shall acquire 3 credits assigned to the seminar & comprehensive viva-voce only when he/she secures 40% or more marks for the combined total of 75 marks.

5.8 Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination (Viva-voce). The Viva-Voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the University**.** Project work shall start in IV- I and shall continue in the semester break. The evaluation of project work shall be conducted at the end of the IV year – II semester. The Internal Evaluation shall be made by the departmental committee, on the basis of two seminars given by each student on the topic of his/her project.

5.9 Laboratory marks and the sessional marks awarded by the college are not final. They are subject to scrutiny and scaling by the University wherever necessary. In such cases, the sessional and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding.

5.10 The laboratory records and internal test papers shall be preserved for minimum of 2 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

6 Attendance Requirements:

i. A student shall be eligible to appear for University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester/ I year.

ii. Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

iii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or I year may be granted by the College Academic Committee.

iv. Students whose shortage of attendance is not condoned in any semester / I year are not eligible to take their end examination of that class and their registration shall stand cancelled.

v. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester / I year, as applicable. They may seek readmission for that semester / I year when offered next.

vi. A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

7 Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together. In case of audit courses and the seminar & comprehensive viva – voce he/she should secure 40% of the total marks.

ii. A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 26 credits of the subjects that have been studied up to II year I semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

   a. One regular and one supplementary examinations of I year.
   b. One regular examination of II year I semester

iii. A student shall be promoted from third year to fourth year only if he/she fulfils the academic requirements of securing 44 credits of the subjects that have been studied upto III year I semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

   a. Two regular and two supplementary examinations of I year.
   b. Two regular and one supplementary examinations of II year I semester.
   c. One regular and one supplementary examinations of II year II semester.
   d. One regular examination of III year I semester.

And in case if student is detained for want of credits for particular academic year by sections 7.2 and 7.3 above, the student may make up the credits through supplementary exams of the above exams before the commencement of third or fourth year I semester class work respectively of next year.

iv. A student shall register and put up minimum attendance in all 180 credits and earn all the 180 credits. Marks obtained in all 180 credits and audit courses shall be considered for the calculation of aggregate percentage of marks obtained.

v. Students who fail to earn 180 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

8. Course pattern:

i. The entire course of study is for four academic years. The first year shall be on yearly pattern and the second, third and fourth years shall be on semester pattern.

ii. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

iii. When a student is detained due to lack of credits/shortage of attendance he may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which the student is presently readmitted.

9. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will be in the academic regulations into which the candidate is presently readmitted.

10. With–holding of results:

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

11. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured from 180 credits and audit courses.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

However while awarding the degree, rounding of percentages is permitted to the extent of 0.5% to effect change of class from pass class to Second class, Second class to First class, First class to First class with Distinction for all the courses being offered or to be offered by the University without adding any marks to the original marks secured by the students.

12. Minimum Instruction Days:

The minimum instruction days including exams for each semester / I year shall be 90/180 days respectively.

13. Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

14. General:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices rules- nature and punishments is appended.
iii. Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
v. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous), ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

I YEAR - I SEMESTER

Sl.No.	Course Code	Subject	L	T	P	Credits
1	HS	English-I	3	1	0	3
2	BS	Mathematics- I	3	1	0	3
3	BS	Applied Physics	3	1	0	3
4	ES	Engineering Graphics	2	0	2	3
5	HS	Environmental Studies	3	1	0	3
6	HS	English Language Communication Skills Lab	0	0	3	2
7	BS	Applied Physics Lab	0	0	3	2
8	ES	Engineering & IT Workshop	0	0	3	2
		NSS / NCC				
		Total	**14**	**4**	**11**	**21**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous),
ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

I YEAR - II SEMESTER

Sl.No.	Course Code	Subject	L	T	P	Credits
1	HS	English-II	3	1	0	3
2	BS	Mathematics – II	3	1	0	3
3	BS	Engineering Chemistry	3	1	0	3
4	ES	Electrical Circuits – I	3	1	0	3
5	PC	Electronic Devices & Circuits	3	1	0	3
6	ES	Computer Programming	3	1	0	3
7	BS	Engineering Chemistry Lab	0	0	3	2
8	ES	Computer Programming Lab	0	0	3	2
		NSS/NCC				
		Total	**18**	**6**	**6**	**22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous),
ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

II B. Tech (EEE) – I Sem

Sl.No	Course Code	Subject	L	T	P	Credits
1	BS	Mathematics - III	**3**	**1**	**0**	3
2	PC	Electrical Circuits - II	3	1	0	3
3	PC	Electrical Machines - I	3	1	0	3
4	PC	Control Systems Engineering	3	1	0	3
5	HS	Managerial Economics and Financial Analysis	3	1	0	3
6	ES	Applied Engineering	3	1	0	3
7	PC	Electric Circuits and Simulation Lab	0	0	3	2
8	ES	Electronic Devices & Circuits Lab	0	0	3	2
		Total	18	6	6	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous), ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

II B. Tech (EEE) – II Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	BS	Complex Variables and Special Functions	3	1	0	3
2	PC	Electrical Machines - II	3	1	0	3
3	PC	Electric Power Generating Systems	3	1	0	3
4	PC	Electromagnetic Fields	3	1	0	3
5	PC	Switching Theory and Logic Design	3	1	0	3
6	PC	Analog Electronic Circuits	3	1	0	3
7		Human Values and Professional Ethics (Audit Course)	2	-	-	-
8	PC	Electrical Machines Lab – I	0	0	3	2
9	PC	Control Systems & Simulation Lab	0	0	3	2
		Total	20	6	6	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous), ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

III B. Tech (EEE) – I Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	PC	Transmission of Electric Power	3	1	0	3
2	PC	Electrical Machines – III	3	1	0	3
3	PC	Power Electronics	3	1	0	3
4	PC	Electrical and Electronic Measurements	3	1	0	3
5	ES	Linear & Digital Integrated Circuits	3	1	0	3
6	HS	Management Science	3	1	0	3
7	PC	Electrical Machines Lab – II	0	0	3	2
8	PC	Electrical and Electronic Measurements Lab	0	0	3	2
		Total	20	6	6	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous),
ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

III B. Tech (EEE) – II Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	PC	Switch Gear & Protection	3	1	0	3
2	PC	Digital Signal Processing	3	1	0	3
3	PC	Computer Aided Power System Analysis	3	1	0	3
4	PC	Microprocessors & Microcontrollers	3	1	0	3
5	PC	Power Semiconductor Controlled Drives	3	1	0	3
6	PC	Neural Networks & Fuzzy Logic Applications	3	1	0	3
7		Advanced English Communication Skills Lab (Audit Course)	2	-	-	-
8	PC	Microprocessors & Microcontrollers Lab	0	0	3	2
9	PC	Power Electronics & Simulation Lab	0	0	3	2
		Total	20	6	6	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous),
ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

IV B. Tech (EEE) – I Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	PC	Electric Power Distribution Systems	3	1	0	3
2	PC	Instrumentation	3	1	0	3
3	PC	Introduction to HVDC Transmission & FACTS	3	1	0	3
4	PC	Power System Operation and Control	3	1	0	3
5	OE	Open Elective 1) PLC & Its Applications 2) Renewable Energy Sources 3) Linear & Nonlinear Optimization Techniques 4) Reliability and Safety Engineering	3	1	0	3
6		**MOOC (Elective – I)**	3	1	0	3
7	PC	Digital Signal Processing Lab	0	0	3	2
8	PC	Power Systems & Simulation Lab	0	0	3	2
9		Project Part-A - Seminar	-	-	-	4
		Total	18	6	6	26

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous), ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

IV B. Tech (EEE)– II Sem

Sl.No	Course Code	Subject	L	T	P	Credits
1	PC	Introduction to Power Quality	**3**	**1**	**0**	3
2	HS	Utilization of Electrical Energy	3	1	0	3
3	PE	Elective-II 1) Modern Control Theory 2) Reliability Engineering and its Application to Power Systems 3) Power System Deregulation 4) Switched Mode Power Converters	3	1	0	3
4	PE	Elective-III 1) Electricity Act and Costing of Electrical Systems 2) High Voltage Engineering 3) Introduction to Distributed Generation & Smart Grid 4) Energy Auditing & Demand Side Management	3	1	0	3
5		Seminar - Comprehensive Viva-Voce	-	-	-	3
6		Project Part-B	-	-	-	10
		Total	12	4	0	25

*BS – Basic Sciences
*ES – Engineering Science
*HS – Humanities and Social Science
*PC – Professional Subject -Core
*PE – Professional Subject –Elective
*MC- Mandatory Course
*OE- Open Elective

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR COLLEGE OF ENGINEERING (Autonomous),
ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

I YEAR - I SEMESTER

Sl.No.	Course Code	Subject	L	T	P	Credits
1	HS	English-I	3	1	0	3
2	BS	Mathematics- I	3	1	0	3
3	BS	Applied Physics	3	1	0	3
4	ES	Engineering Graphics	2	0	2	3
5	HS	Environmental Studies	3	1	0	3
6	HS	English Language Communication Skills Lab	0	0	3	2
7	BS	Applied Physics Lab	0	0	3	2
8	ES	Engineering & IT Workshop	0	0	3	2
		NSS / NCC				
		Total	**14**	**4**	**11**	**21**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

COLLEGE OF ENGINEERING: ANANTAPUR

I Year B.Tech (Common to all Branches) - I Semester	**T**	**L**	**C**
	3+1*	**0**	**3**

ENGLISH

1. INTRODUCTION:

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

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

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

2. OBJECTIVES:

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

3. SYLLABUS:

UNIT –I

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

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**

2013-2014

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR,
College of Engineering (Autonomous) Anantapur.

I Year B.Tech-I semester	T	P	C
	3+1	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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING: ANANTAPUR

I Year B.Tech (Common to all Branches) I Semester	**T**	**L**	**C**
	3+1*	**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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I Year B.Tech I Semester

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APPLIED PHYSICS

(Common to EEE, ECE, CSE)

UNIT 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

Physical Optics: Introduction - Interference in thin films by reflection – Newton's Rings – Fraunhofer diffraction due to single slit, double slit and 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.

Fibre optics: Introduction– Construction and working principle of optical fiber –Numerical aperture and acceptance angle – Types of optical fibers –Optical fiber communication system – Applications of optical fibers.

UNIT 2: CRYSTALLOGRAPHY AND QUANTUM MECHANICS

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

Quantum Mechanics: Introduction to matter waves – de'Broglie hypothesis - Schrodinger's time independent wave equation – Significance of wave function - Particle in a one dimensional infinite potential well.

UNIT 3: FREE ELECTRON THEORY AND SEMICONDUCTORS

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

Semiconductor physics: Introduction – Intrinsic and extrinsic semiconductors – Drift & diffusion currents and Einstein's equation – Continuity equation -Hall Effect.

UNIT 4: DIELECTRICS AND MAGNETIC MATERIALS

Dielectrics: Introduction – Dielectric Polarization – Types of Polarization – Lorentz field – Clausius-
Mosotti equation – Dielectric strength, loss, breakdown.
Magnetic materials: Introduction and 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 5: **SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS**

Superconductivity: Introduction - Properties of superconductors – Meissner effect– Type I and type II superconductors – Flux quantization – London penetration depth – ac and dc Josephson effects – BCS theory(qualitative) - Applications of superconductors.

Physics of Nanomaterials: Introduction - Significance of nanoscale - Surface area and quantum confinement – Physical properties, optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials: ball milling, chemical vapour deposition, sol-gel – Carbon nanotubes & its properties.

Prescribed Text books:

1. Engineering physics – S. ManiNaidu, Pearson Education
2. Engineering Physics – P.K.Palanisamy, Scitech Publications

Reference Books:

1. Engineering Physics – V. Rajendran, K.Thyagarajan Tata MacGraw Hill Publishers
2. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish University Press
4. Engineering Physics – M. Arumugam, Anuradha Publications
5. Engineering physics – M.N. Avadhanulu and P.G. KrshiSagar, Chand and Co
6. Nanomaterials – A.K.Bandopadhyaya, New Age Publishers
7. Carbon nanotubes and Graphene Device Physics – H.S. Philip Wong, Deji Akinwande, Cambridge University Press

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I- Year B.Tech. I-Sem	**3**	**0**	**3**

ENGINEERING GRAPHICS
(CIVIL, EEE, ECE, CSE & CHEMICAL)

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

Principles of orthographic projection, I and III angle projections –Conventions –Projections of points.

Unit –II

Projection of lines inclined to both planes –traces, Projection of plane figures inclined to both planes.

Unit –III

Projection of simple solids inclined to both planes.

Unit –IV

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

Unit –V

Isometric projections: Principles of pictorial representations-Isometric projection- Isometric scale-Isometric views- conventions- Isometric views of plane figures, solids-Isometric projection of objects with non isometric lines-Isometric projection of spherical parts.

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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I- Year B.Tech. I-Sem	**T**	**P**	**C**
	0	**3**	**2**

APPLIED PHYSICS LABORATORY

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 the 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. Determination of thermistor coefficients (α, β)
14. Hall effect : Determination of mobility of charge carriers in semiconductor
15. B-H curve
16. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
17. Determination of lattice constant using X-ray spectrum.

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I Year B.Tech - I Semester	**T**	**L**	**C**
	0	**3**	**2**

ENGLISH LANGUAGE 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 - I Semester	**T**	**L**	**C**
	0	**3**	**2**

Engineering & IT Workshop
(Common to All Branches)

Part – A: 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

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

PART – B: IT Workshop

Course Objectives

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- Disassemble and Assemble a Personal Computer and prepare the computer ready to use
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Install single or dual operating systems on computer

Preparing your Computer (4 weeks)

Task 1: Identify the internal parts of a computer of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram.

Task 2: 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. Students should record the process of assembling and trouble shooting a computer.

Task 3: 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: Students should record the various features that are supported by the operating system installed and submit it.

Productivity tools (3 weeks)

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ANANTAPURAMU

Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

I YEAR - II SEMESTER

Sl.No.	Course Code	Subject	L	T	P	Credits
1	HS	English-II	3	1	0	3
2	BS	Mathematics – II	3	1	0	3
3	BS	Engineering Chemistry	3	1	0	3
4	ES	Electrical Circuits – I	3	1	0	3
5	PC	Electronic Devices & Circuits	3	1	0	3
6	ES	Computer Programming	3	1	0	3
7	BS	Engineering Chemistry Lab	0	0	3	2
8	ES	Computer Programming Lab	0	0	3	2
		NSS/NCC				
		Total	**18**	**6**	**6**	**22**

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

TECHNICAL COMMUNICATION & PRESENTATION SKILLS (Theory)

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

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APPLIED CHEMISTRY

(Common to EEE,ECE,CSE)

Knowledge in chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering depends 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 (CO):

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

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

UNIT.2: POLYMERS

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

Elastomers (rubbers), Natural Rubber; Compounding of Rubber

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

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

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

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.

iv). Nuclear Fuels: Controlled and uncontrolled reactions. Breeder reactor and Power reactors.

UNIT.4: CHEMISTRY OF ENGINEERING MATERIALS

i).Electrical Insulators or Dielectric materials: Definition and classification, Characteristics of electrical insulators. Applications of electrical insulating materials (Gaseous, liquid and solid insulators)

iii).Semiconducting and Super Conducting materials-Principles and some examples

iii).Magnetic materials – Principles and some examples

UNIT.5: PHOTOCHEMISTRY & COMPOSITE MATERIALS

i). Photochemical Reactions, Difference between Photochemical reactions and thermo chemical reactions. Absorption of light: Beer-Lambert's law . Photo-physical Processes: a) Fluorescence, (b) Phosphorescence and (c) Chemi-luminiscence and their applications

ii). Composite Materials: Classification of Composites materials, Constituents of Composite materials. Disperse Phase composite materials Ex. a) Glass fibre reinforced polymer composite and b) Carbon fibre reinforced polymer composite materials. Advantages and applications of Composites.

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

- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.
- Differentiation and uses of different kinds of Photochemical reactions.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU

I YEAR B. Tech EEE II SEM	**T**	**P**	**C**
	3+1	**0**	**3**

ELECTRICAL CIRCUITS - I

Course objective:
This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes Circuit concepts, magnetic circuits, Single and Three Phase Circuits etc.

UNIT- 1 INTRODUCTION TO ELECTRICAL & MAGNETIC CIRCUITS
Electrical Circuits: Circuit Concept–R-L-C Parameters-Voltage and Current Sources-Independent and Dependent Sources-Source Transformation-Voltage - Current Relationship for Passive Elements (For Different Input Signals-Square, Ramp, Saw Tooth, Triangular). Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples
Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations

UNIT- II SINGLE PHASE A.C CIRCUITS
R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms Of Representations, J-Notation, Steady State Analysis of R, L And C (In Series, Parallel and Series Parallel Combinations) With Sinusoidal Excitation- Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Real and Reactive Power, Complex Power. Examples.

UNIT- III THREE PHASE A.C CIRCUITS
Phase Sequence- Star and Delta Connection-Relation Between Line and Phase Voltages and Currents in Balanced Systems-Analysis of Balanced Three Phase Circuits- Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits-Loop Method- Application of Millman's Theorem- Star Delta Transformation Technique – Two Wattmeter Method of Measurement of Three Phase Power.

UNIT- IV LOCUS DIAGRAMS & NETWORK TOPOLOGY
Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Concept of Band Width and Q Factor.

UNIT- V NETWORK TOPOLOGY

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks with Dependent & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis, Super Node and Super Mesh for D.C Excitations.

OUTCOME:

After going through this course the student gets a thorough knowledge on basics of circuit concepts, electrical parameters, single phase AC circuits, magnetic circuits , resonance, locus diagrams, network topology with which he/she can able to apply the above conceptual things to real-world problems and applications.

TEXT BOOKS:

1. Network Analysis by M.E Van Valkenberg, Prentice Hall (India), 3rd Edition.
2. Circuit Theory (Analysis & Synthesis) by A. Chakrabarti, Dhanpat Rai & Sons
3. Electric Circuits- Schuam Series

REFERENCE BOOKS:

1. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill
2. Electric Circuits by N.Sreenivasulu, REEM Publications
3. Engineering circuit analysis by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.
4. Electrical Circuit Theory and Technology by John Bird, Routledge, Taylor & Fransis

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I YEAR B. Tech EEE II SEM	T	P	C
	3+1	0	3

ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:
To give understanding on semiconductor physics of the intrinsic, p and n materials, characteristics of the p-n junction diode, diode's application in electronic circuits, Characteristics of BJT,FET,MOSFET, characteristics of special purpose electronic devices. To familiarize students with dc biasing circuits of BJT, FET and analyzing basic transistor amplifier circuits.

Course Outcomes:
Upon completion of the course, students will:

- Analyze the operating principles of major electronic devices, its characteristics and applications.
- Design and analyze the DC bias circuitry of BJT and FET.
- Design and analyze basic transistor amplifier circuits using BJT and FET.

UNIT- I

Junction Diode Characteristics : Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

Special Semiconductor Diodes: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, LCD, Photo diode, Varactor diode, Tunnel Diode, DIAC, TRIAC, SCR, UJT. Construction, operation and characteristics of all the diodes is required to be considered.

UNIT- II

Rectifiers and Filters: Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, L- section filter, Π- section filter, Multiple L-section and Multiple Π section filter ,comparison of various filter circuits in terms of ripple factors.

UNIT- III

Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV

Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability.

FET Biasing- methods and stabilization.

UNIT- V

Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

TEXT BOOKS:

J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition,2010.

1. David A.Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2009.
2. Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition

REFERENCES:

1. Jacob Millman, C. Halkies, C.D.Parikh, "Integrated Electronics", Tata Mc-Graw Hill, 2009.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", Pearson Publications,,9thEdition,2006.
3. BV Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, "Electronic Devices and Circuits", Pearson, 2nd edition.

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I- Year 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

Programming with C, R.S.Bickar, Universities Press.

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COLLEGE OF ENGINEERING: ANANTAPUR

I Year B.Tech II Semester	**T**	**P**	**C**
	0	**3**	**2**

COMPUTER PROGRAMMING LAB
(Common to Civil, EEE, ME, CSE, Chemical)

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

Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING: ANANTAPUR

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

ENGINEERING CHEMISTRY LAB

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.

Programme Objective:

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

LIST OF EXPERIMENTS

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of 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:

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

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.

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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

II B. Tech (EEE) – I Sem

Sl.No	Course Code	Subject	L	T	P	Credits
1	BS	Mathematics - III	**3**	**1**	**0**	3
2	PC	Electrical Circuits - II	3	1	0	3
3	PC	Electrical Machines - I	3	1	0	3
4	PC	Control Systems Engineering	3	1	0	3
5	HS	Managerial Economics and Financial Analysis	3	1	0	3
6	ES	Applied Engineering	3	1	0	3
7	PC	Electric Circuits and Simulation Lab	0	0	3	2
8	ES	Electronic Devices & Circuits Lab	0	0	3	2
		Total	18	6	6	22

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

MATHEMATICAL METHODS
(Common to All Branches)

Objectives:

- 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. 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.
5.

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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	T	P	C
II YEAR B. Tech EEE I SEM	**3+1**	**0**	**3**

ELECTRICAL CIRCUITS- II

Course objective:
This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes theorems, Transient analysis and Fourier analysis etc.

UNIT- I NETWORK THEOREMS

Thevenin's, Norton's, Maximum Power Transfer and Millman's Theorems for D.C and Sinusoidal Excitations. Tellegen's, Superposition, Reciprocity and Compensation Theorems for D.C And Sinusoidal Excitations.

UNIT- II TWO PORT NETWORKS

Two Port Network Parameters – Impedance, Admittance, Transmission and Hybrid Parameters and Their Relations. Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

UNIT- III TRANSIENT ANALYSIS

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equation and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.
A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms

UNIT- IV FOURIER TRANSFORMS

Fourier Theorem- Trigonometric Form and Exponential Form of Fourier Series – Conditions of Symmetry- Line Spectra and Phase Angle Spectra- Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

UNIT V: FILTERS & PSPICE FOR CIRCUITS

Filters – Low Pass – High Pass and Band Pass – RC, RL filters – Constant K and M – derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type, T type and Bridged – T and Lattice Equalizers.
SPICE for Circuit Analysis – Description of Circuit elements, nodes and sources, Input and Output variables – Modelling of the above elements – Types of DC analysis.

OUTCOME:

After going through this course the student gets a thorough knowledge on basics of Network theorems, Two port networks, Transient analysis, Fourier transforms and Filters with which he/she can able to apply the above conceptual things to real-world problems and applications.

TEXT BOOKS:

1. Network Analysis by M.E Van Valkenberg, Prentice Hall (India), 3rd Edition.
2. Circuit Theory (Analysis & Synthesis) by A. Chakrabarti, Dhanpat Rai & Sons
3. Electric Circuits- Schuam Series

REFERENCE BOOKS:

1. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill
2. Electric Circuits by N.Sreenivasulu, REEM Publications
3. Engineering circuit analysis by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.
4. Electrical Circuit Theory and Technology by John Bird, Routledge, Taylor & Fransis

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II YEAR I SEM B. Tech EEE	T	P	C
	3+1	0	3

ELECTRICAL MACHINES - I

Objective:

Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and Motors which are widely used in industry are covered and their performance aspects will be studied.

UNIT – I PRINCIPLES OF ELECTROMECHANICAL ENERGY CONVERSION

Electromechanical Energy Conversion – Forces and Torque In Magnetic Field Systems – Energy Balance – Energy and Force in A Singly Excited Magnetic Field System, Determination of Magnetic Force - Co-Energy – Multi Excited Magnetic Field Systems.

UNIT – II D.C. GENERATORS -I

D.C. Generators – Principle of Operation – Constructional Features – Armature Windings – Lap and Wave Windings – Simplex and Multiplex Windings – Use of Laminated Armature – E. M.F Equation– Numerical Problems – Parallel Paths-Armature Reaction – Cross Magnetizing and De-Magnetizing AT/Pole – Compensating Winding – Commutation – Reactance Voltage – Methods of Improving Commutation.

UNIT–III D.C GENERATORS – II

Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Causes for Failure to Self Excite and Remedial Measures-Load Characteristics of Shunt, Series and Compound Generators – Parallel Operation of D.C Series Generators – Use of Equalizer Bar and Cross Connection of Field Windings – Load Sharing.

UNIT – IV D.C. MOTORS

D.C Motors – Principle of Operation – Back E.M.F. – Circuit Model – Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors – Armature Reaction and Commutation.

Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Ward-Leonard System–Braking of D.C Motors – Permanent Magnet D.C Motor (PMDC).

Motor Starters (3 Point and 4 Point Starters) – Protective Devices-Calculation of Starters Steps for D.C Shunt Motors.

UNIT – V TESTING OF DC MACHINES

Losses – Constant & Variable Losses – Calculation of Efficiency – Condition for Maximum Efficiency.
Methods of Testing – Direct, Indirect – Brake Test – Swinburne's Test – Hopkinson's Test – Field's Test – Retardation Test in a D.C. Motor Test

OUTCOME:

After going through this course the student gets a thorough knowledge on electromechanical energy conversion, construction operation characteristics, construction and operation of different types of DC Generators and motors, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

TEXT BOOKS:

1. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
2. Electrical Machinery Fundamentals by Stephen J Chapman, Mc Graw Hills, 2005.

REFERENCE BOOKS:

1. Performance and Design of D.C Machines – by Clayton & Hancock, BPB Publishers, 2004.
2. Electrical Machines -S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.
3. Electric Machinary – A. E. Fritzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th Editon, 2003.
4. Electrical Machines – M.V Deshpande, Wheeler Publishing, 2004.
5. Electrical Machines – P.S. Bimbhra., Khanna Publishers, 2011.
6. Electromechanics – I - Kamakshaiah S., Overseas Publishers Pvt. Ltd, 3rd Edition, 2004.

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II YEAR I SEM B. Tech EEE

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CONTROL SYSTEMS ENGINEERING

Objective:

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

UNIT – I CONTROL SYSTEMS CONCEPTS

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver

UNIT-II TIME RESPONSE ANALYSIS

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional, integral, derivative Controllers, Design of P, PD, PI, PID Controllers.

UNIT – III STABILITY ANALYSIS IN FREQUENCY DOMAIN

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT – IV FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.

Compensation techniques – Lag, Lead, Lead-Lag Compensators design in frequency Domain.

UNIT – V STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from Schematic models, differential equations, Transfer function, block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models.

OUTCOME:

After going through this course the student gets a thorough knowledge on open loop and closed loop control systems , concept of feedback in control systems, mathematical modeling and transfer function derivations of translational and rotational systems, Transfer functions of Synchros, AC and DC servo motors, Transfer function representation through block diagram algebra and signal flow graphs, time response analysis of different ordered systems through their characteristic equation and time-domain specifications , stability analysis of control systems in S-domain through R-H criteria and root-locus techniques, frequency response analysis through bode diagrams and State space analysis with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

TEXT BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.

REFERENCE BOOKS:

1. Control Systems Engineering - by NISE 5th Edition – John wiley & sons, 2010.
2. Control Systems – by – A. Nagoor Kani- First Edition RBA Publications, 2006.
3. Automatic Control Systems– by B. C. Kuo and Farid Golnaraghi – John wiley and son's, 8th edition, 2003.

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MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Course Objective: The objectives of this course are to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to enrich analytical skills in helping them take sound financial decisions for achieving higher productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics - Definition, nature and scope – contemporary importance of Managerial Economics - Demand Analysis: Determinants- Law of Demand - Elasticity of Demand. Significance – types – 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 – Short-run and long- run production - Isoquants and Isocosts, MRTS, least cost combination of inputs - Cobb-Douglas production function - laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts - Break-Even Analysis (BEA) - Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems)

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

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

UNIT IV 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 – Techniques – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT V: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Under capitalization – Remedial measures - Sources of Shot term and Long term capital - Estimating Working Capital requirement – Capital budgeting – Features of Capital budgeting proposals – Methods and Evaluation of Capital budgeting – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems).

Learning Outcome: The thorough understanding of Managerial Economics and Analysis of Financial Statements facilitates the Technocrats – cum – Entrepreneurs to take-up decisions effectively and efficiently in the challenging Business Environment.

TEXT BOOKS:

1. VijayaKumar.P. and Apparao. N. Managerial Economics and Financial Analysis,Cengage,2012
2. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2009.

REFERENCES

1. Subhash Sharma & Vithal .M.P.Financial Accounting for Management, Macmillan,2010.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
3. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2009.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2009.
5. Shailaja & Usha: Managerial Economics and Financial Analysis, University Press, 2012.

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ELECTRIC CIRCUITS AND SIMULATION LAB

PART-A: ELECTRICAL CIRCUITS

1) Verification of Thevenin's and Norton's Theorems
2) Verification of Superposition Theorem and Maximum Power Transfer Theorem
3) Verification of Compensation Theorem
4) Verification of Reciprocity , Millmann's Theorems
5) Locus Diagrams of RL and RC Series Circuits
6) Series and Parallel Resonance
7) Determination of Self, Mutual Inductances and Coefficient of Coupling
8) Z and Y Parameters
9) Transmission and Hybrid Parameters
10) Measurement of Active Power for Star and Delta Connected Balanced Loads
11) Measurement of Reactive Power for Star and Delta Connected Balanced Loads
12) Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

PART-B: PSPICE SIMULATION

1) Simulation of DC Circuits
2) DC Transient Response
3) Mesh Analysis
4) Nodal Analysis

NOTE:

- PSPICE Software Package is Necessary.
- Eight Experiments are to be Conducted from PART-A and any two from PART-B

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ELECTRONIC DEVICES AND CIRCUITS LABORATORY

OBJECTIVES:

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

OUTCOMES:

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

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

.

PART B: List of Experiments
(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias& Reverse bias)

Part B: Silicon Diode (Forward bias only)

2. Zener Diode Characteristics

Part A: V-I Characteristics

Part B: Zener Diode act as a Voltage Regulator

3. Rectifiers (without and with c-filter)

Part A: Half-wave Rectifier

Part B: Full-wave Rectifier

4. BJT Characteristics(CE Configuration)

Part A: Input Characteristics

Part B: Output Characteristics

5. FET Characteristics(CS Configuration)

Part A: Drain (Output) Characteristics

Part B: Transfer Characteristics

6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

PART C: Equipment required for Laboratory

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. Bread Boards
11. Connecting Wires
12. CRO Probes etc.

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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

II B. Tech (EEE) – II Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	BS	Complex Variables and Special Functions	3	1	0	3
2	PC	Electrical Machines - II	3	1	0	3
3	PC	Electric Power Generating Systems	3	1	0	3
4	PC	Electromagnetic Fields	3	1	0	3
5	PC	Switching Theory and Logic Design	3	1	0	3
6	PC	Analog Electronic Circuits	3	1	0	3
7		Human Values and Professional Ethics (Audit Course)	2	-	-	-
8	PC	Electrical Machines Lab – I	0	0	3	2
9	PC	Control Systems & Simulation Lab	0	0	3	2
		Total	20	6	6	22

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II YEAR II SEM

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COMPLEX VARIABLES AND SPECIAL FUNCTIONS
(Common for ECE, EEE)

Objectives: To enable the students to understand the mathematical concepts of special functions & complex variables and their applications in science and engineering.

UNIT – I

Special Functions: Gamma and Beta Functions – their properties – Evaluation of improper integrals. Series Solutions of ordinary differential equations (Power series and Frobenius Method).

UNIT – II

Bessel functions – Properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

UNIT – III

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

Conformal mapping: Transformation of e^z, Inz, z^2, Sin z, cos z, Bilinear transformation - Translation, rotation, magnification and inversion – Fixed point – Cross ratio – Determination of bilinear transformation.

UNIT – IV

Complex integration: Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point – Isolated singular point – Pole of order m – Essential singularity.

UNIT – V

Residue – Evaluation of residue by formula and by Laurent series – Residue theorem.

Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, Peter V.O'Neil, CENGAGE publisher.

REFERENCES:

1. Mathematics III by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
3. Complex variables by Raisinghania
4. Advanced Engineering Mathematics by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel, Oxford.

Outcomes:

The student achieves the knowledge to analyse the problems using the methods of special functions and complex variables.

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ELECTRICAL MACHINES – II

Objective:
As an extension of Electrical machines I course this subject facilitates to study of the performance of different types of Transformers, Induction Motors and its characteristics which are the major part of industrial drives and agricultural pump sets.

UNIT-I SINGLE PHASE TRANSFORMERS
Single Phase Transformers- Constructional Details- Hystersis and Eddy Current Losses-Emf Equation - Operation on No Load and on Load - Phasor Diagrams
Equivalent Circuit - Losses and Efficiency-Regulation. All Day Efficiency - Effect of Variations of Frequency & Supply Voltage on Iron Losses.

UNIT-II PERFORMANCE OF SINGLE PHASE TRANSFORMERS
OC and SC Tests - Sumpner's Test - Predetermination of Efficiency and Regulation-Separation of Losses Test-Parallel Operation with Equal and Unequal Voltage Ratios - Auto Transformers-Equivalent Circuit - Comparison with Two Winding Transformers.

UNIT-III THREE PHASE TRANSFORMERS AND INDUCTION MOTORS

Three Phase Transformers - Connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and Open Δ, Third Harmonics in Phase Voltages-Three Winding Transformers-Tertiary Windings- Scott Connection.

Polyphase Induction Motors-Construction Details of Cage and Wound Rotor Machines-Production of a Rotating Magnetic Field - Principle of Operation - Rotor Emf and Rotor Frequency - Rotor Reactance, Rotor Current and Pf at Standstill and During Operation.

UNIT-IV 3-PHASE INDUCTION MOTOR CHARACTERISTICS

Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and Their Inter Relation-Torque Equation-Deduction From Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristic –Generator Operation - Double Cage and Deep Bar Rotors - Equivalent Circuit - Phasor Diagram - Crawling and Cogging -Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance

UNIT-V STARTING AND SPEED CONTROL OF INDUCTION MOTORS
Starting Methods and Starting Current and Torque Calculations, Speed Control-Change of Frequency; Pole Changing and Methods of Consequent Poles; Cascade Connection. Injection of an Emf.

OUTCOME:

After going through this course the student gets a thorough knowledge on construction operation characteristics and testing of different types of Transformers and Induction Motors with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

TEXT BOOKS:

1. Electrical Machinery & Transformers by Irving Kosow –Pearson Publishers, Second Edition, 2012
2. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7^{th} Edition.,2005

REFERENCE BOOKS:

1. Performance and Design of AC Machines by MG.Say, BPB Publishers, 2002.
2. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2^{nd} edition, 2008.
3. Electromechanics-II (transformers and induction motors) S. Kamakshaiah, Hitech publishers, 2005.
4. Electric Machinery - A.E. Fitzgerald, C.Kingsley and S.Humans, Mcgraw Hill Companies, 6^{th} edition, 2003.

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ELECTRICAL POWER GENERATING SYSTEMS

OBJECTIVE :

Electrical Power plays significant role in day-to-day life of entire mankind. This course concerns the generation of conventional and non-conventional sources of energy along with the economic aspects.

UNIT-I THERMAL POWER GENERATING SYSTEMS

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers.

UNIT-II HYDRO & NUCLEAR POWER GENERATING SYSTEMS

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.

Nuclear Power: Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT -III SOLAR & WIND POWER GENERATING SYSTEMS

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics- Pitch & Yaw Controls – Power Electronics Application – Economic Aspects.

UNIT-IV BIOGAS & GEOTHERMAL POWER GENERATING SYSTEMS

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

Geothermal and Ocean Power Generation: Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

UNIT-V ECONOMIC ASPECTS OF POWER GENERATION

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs Of Generation and their Division Into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method.- Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

OUTCOME:

After going through this course the student gets a thorough knowledge on thermal gas and nuclear power plants operation, AC and DC distribution systems operation, AIR insulated and GAS insulated indoor/outdoor substations operation, voltage control and power factor improvement techniques, economic aspects of power generation and different types of TARIFF methods with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

REFERENCE BOOKS:

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013.

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ELECTROMAGNETIC FIELDS

Course objective:

The objective of this course is to introduce the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

UNIT-I ELECTROSTATICS

Electrostatic Fields - Coulomb's Law - Electric Field Intensity(EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Properties of Potential Functions-Potential Gradient - Gauss's Law-Application of Gauss's Law-Maxwell's First Law, Laplace's Equation and Poisson's Equations - Solution of Laplace's Equation in one Variable.

Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field - Capacitance-Capacitance of Parallel Plate and Spherical Capacitors**.**

UNIT- II CONDUCTORS AND DIELECTRICS

Behavior of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection – Current Densities – Ohm's Law in Point Form – Equation of Continuity**.**

UNIT-III MAGNETO STATICS

Static Magnetic Fields – Biot-Savart Law – Magnetic Field Intensity(MFI) due to a Straight Current Carrying Filament – MFI due to Circular, Square Filament – Solenoid Current Carrying Wire – Relation Between Magnetic Flux ,Magnetic Flux Density and MFI – Maxwell's Second Equation.

Ampere's Circuital Law and Its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation.

Magnetic Force – Moving Charges in Magnetic Fields – Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductor in a Magnetic Field – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field.

UNIT – IV MAGNETIC POTENTIAL

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field.

UNIT-V TIME VARYING FIELDS

Time Varying Fields – Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.

Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance**.**

OUTCOME:

After going through this course the student gets a thorough knowledge on vector algebra, 3-dimensional co-ordinate systems, electrostatics, behavior of conductors insulators semiconductors dielectrics and capacitance, magneto statics, time-varying fields, interaction between electricity and magnetism, different laws, Maxwell's equations, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

TEXT BOOKS:

1. Engineering Electromagnetics by William.H.Hayt, Mc.Graw – Hill, 2010.
2. Electromagnetics by J.D.Kraus,Mc.Graw – Hill Inc,5th edition,1999.
3. Field Theory – Gangadhar, Khanna Publications, 2003.

REFERENCE BOOKS:

1. Electrodynamics by Griffith, PHI, 3rd Edition, 1999.
2. Electromagnetic Fields by Sadiku – Oxford University Press, 5th Edition, 2010.
3. Electromagnetics by Joseph Edminister, Tata Mc Graw Hill, 2006.

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SWITCHING THEORY AND LOGIC DESIGN

Course Objectives:

- To provide fundamental concepts used in the design of digital systems and learn the methods for the design of digital circuits.

Course Outcomes:

- To introduce basic postulates of Boolean algebra and the methods for simplifying Boolean expressions
- To illustrate the concepts and study the procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concepts of programmable logic devices.

UNIT I

Number System & Boolean Algebra:

Digital Systems, Binary Numbers, Number base conversions, Complements of numbers, Signed binary numbers, Binary codes.

Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, other logic operations & Logic gates.

UNIT II

Gate Level Minimization:

The map method, four variable & Five variable K-map, POS & SOP Simplification, Don't care conditions, NAND & NOR Implementation, Other two level Implementation, Ex-or Function, Tabular Method- Simplification of Boolean function using tabulation Method.

UNIT III

Combinational Logic Circuits:

Combinational circuits, Analysis & Design procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers.

UNIT IV

Sequential Logic Circuits:

Sequential Circuits, Latches, Flips-Flops - RS, JK, Master-Slave JK, D & T flip flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Registers & Counters – Registers, Shift Registers, Ripple Counters, Synchronous counters, asynchronous counters.

Asynchronous sequential circuits - Introduction, Analysis Procedure, Design Procedure, Reduction of State flow tables, Race-free State Assignment, Hazards.

UNIT V

Programmable Memories:

Memory organization, classification of semi conductor memories, ROM, PROM, DROM, EPROM, EEPROM, RAM, expansion of memory, CCD memories, content addressable memory, programmable logic devices, PROM at PLD, programmable logic array (PLA) programmable array logic (PAL), field programmable gate array (FPGA).

Text Books:

1. M.Morris Mano & Michel D. Ciletti, “Digital Design”, 5th Edition Pearson.
2. Zvi KOhavi and Nirah K.Jha, “Switching theory and Finite Automata Theory”, 3rd Edition Cambridge.

References:

1. Subratha Goshal, “Digital Electronics”, Cambridge
2. Comer, “Digital & State Machine Design”, Third Indian edition, OXFORD

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ELECTRICAL MACHINES LAB – I

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

1. Magnetization Characteristics of DC Shunt Generator. Determination of Critical Field Resistance and Critical Speed.
2. Load Test on DC Shunt Generator. Determination of Characteristics.
3. Brake Test on DC Shunt Motor. Determination of Performance Curves.
4. Load Test on DC Compound Generator. Determination of Characteristics.
5. Hopkinson's Test on DC Shunt Machines. Predetermination of Efficiency.
6. Fields Test on DC Series Machines. Determination of Efficiency.
7. Swinburne's Test and Speed Control of DC Shunt Motor. Predetermination of Efficiencies.
8. Brake Test on DC Compound Motor. Determination of Performance Curves.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Load Test on DC Series Generator. Determination of Characteristics.
10. Retardation Test on DC Shunt Motor. Determination of Losses at Rated Speed.
11. Separation of Losses In DC Shunt Motor.

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CONTROL SYSTEMS AND SIMULATION LAB

Any Eight of the following experiments are to be conducted:

1. Time Response of Second Order System
2. Characteristics of Synchros
3. Programmable Logic Controller – Study and Verification of Truth Tables of Logic Gates, Simple Boolean Expressions and Application of Speed Control of Motor.
4. Effect of Feedback on DC Servo Motor
5. Transfer Function of DC Machine
6. Effect of P, PD, PI, PID Controller on a Second Order Systems
7. Lag and Lead Compensation – Magnitude and Phase Plot
8. Temperature Controller Using PID
9. Characteristics of Magnetic Amplifiers
10. Characteristics of AC Servo Motor

Any two simulation experiments are to be conducted:

1. PSPICE Simulation of Op-Amp Based Integrator and Differentiator Circuits.
2. Linear System Analysis (Time Domain Analysis, Error Analysis) Using MATLAB.
3. Stability Analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant System Using MATLAB
4. State Space Model for Classical Transfer Function Using MATLAB – Verification.

REFERENCE BOOKS:

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

III B. Tech (EEE) – I Sem

Sl.No.	Course Code	Subject	L	T	P	Credits
1	PC	Transmission of Electric Power	3	1	0	3
2	PC	Electrical Machines – III	3	1	0	3
3	PC	Power Electronics	3	1	0	3
4	PC	Electrical and Electronic Measurements	3	1	0	3
5	ES	Linear & Digital Integrated Circuits	3	1	0	3
6	HS	Management Science	3	1	0	3
7	PC	Electrical Machines Lab – II	0	0	3	2
8	PC	Electrical and Electronic Measurements Lab	0	0	3	2
		Total	20	6	6	22

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	3	1	3

TRANSMISSION OF ELECTRIC POWER

Objective:

The student should learn:

- How to compute the parameters of a Transmission line
- How to represent a Transmission line using Interconnecting circuit parameters
- About the various factors that affect the performance of Transmission lines
- About the study of Travelling waves
- Design of Underground cables

UNIT-I Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II Modeling of Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current.

UNIT-III Performance of Transmission Lines

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT – IV Power System Transients

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT-V Underground Cables

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.

REFERENCE BOOKS:

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition..
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 2nd Edition.
5. Transmission of Electric Power by S. Sivanagaraju.

Course Outcomes:

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

- Compute the transmission line parameters.
- Model a given transmission line.
- Understand the design of transmission line and Insulators.
- Estimate the performance of a given transmission line.
- Analyze the effect of over voltage on transmission line.
- Design underground cables and analyze cable performance.

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ELECTRICAL MACHINES - III

Objective:

This subject should enable the students to

i. Deals with the detailed analysis of synchronous machines and motors
ii. Understand the construction and principle of working of synchronous machines
iii. Understand different methods of predetermining the regulation of alternators
iv. Understands the concepts of load sharing among alternators
v. Study the performance characteristics of synchronous motors and their use as synchronous condensers.
vi. Also, it deals with different types of single phase & special motors which have significant applications in house hold appliances and control systems.

UNIT – I SYNCHRONOUS MACHINES & CHARACTERISTICS OF SYNCHRONOUS GENERATORS

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation - Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT – II REGULATION OF ALTERNATORS

Predetermination of Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods –two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation.

UNIT – III PARALLEL OPERATION OF ALTERNATORS

Synchronization of alternators with infinite bus bar – synchronizing power, synchronizing torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

UNIT – IV SYNCHRONOUS MOTORS

Principle of operation – phasor diagram – Variation of current and power factor with excitation – V and Inverted V Curves - Power developed – Synchronous Condensers - Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT – V SINGLE PHASE MOTORS AND SPECIAL MOTORS

Single Phase Motors: Single phase induction motor – Constructional features - Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.
Special Motors: Construction, working principle, performance of- Stepper Motors, Reluctance motors, A.C. Series motors, Universal motors, BLDC motor.

TEXT BOOKS

1. Electric Machines – by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 4th Edition, 2010.
2. Electrical Machines – by P.S. Bimbra, Khanna Publishers.

REFERENCE BOOKS:

1. The Performance and Design of A.C.Machines – by M.G.Say, ELBS and Ptiman & Sons.
2. Electric Machinery – by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 5th edition, 1990.
3. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd edition.
4. Electromachanics-III (Synchronous and single phase machines), S.Kamakashiah, Overseas publishers Pvt Ltd.
5. Electric Machines - by M. S. Sarma and M. K. Pathak, CENGAGE Learning.
6. Special Electrical Machines by K. Venkataratnam, Universities Press, 2013.

Outcomes:

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

i. Understand the basic construction and working principle of synchronous machines
ii. Estimate the regulation of synchronous generator using different methods
iii. Determine the load sharing among alternators
iv. Analyze the performance characteristics of synchronous motors and their ability to operate at various power factors
v. Use specific 1-phase motor and special motors to a given application.

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POWER ELECTRONICS

Course objectives:

- The objective of this course is to study the high efficient and high reliable Power conversion systems.
- To study the basic power semiconductor switching devices and their principles of operation.
- To study the various power conversion methods, controlling and designing of power converters.
- To study the applications of Power electronic conversion to domestic, industrial, aerospace, commercial and utility systems etc.

UNIT – I POWER SEMI CONDUCTOR DEVICES AND COMMUTATION CIRCUITS

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn-on and Turn-off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points –– Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems - Two transistor analogy – SCR – R and RC Triggering - UJT firing circuit – Line Commutation and Forced Commutation circuits.

UNIT – II PHASE CONTROLLED RECTIFIERS

Phase control technique – Single phase Line commutated converters – Midpoint and Bridge connections – Half controlled converters with Resistive, RL and Fully controlled converters with Resistive, RL and RLE load– Derivation of average load voltage & current -Active & Reactive power inputs to the converters without and with Freewheeling Diode, Effect of source inductance –Numerical problems

Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage with R, RL and RLE loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

UNIT – III CHOPPERS

Principle of chopper operation– Time ratio and Current limit control strategies – Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression, Types of chopper circuits (A, B, C, D & E) – Basic principle operation – waveforms, Morgan's chopper – Jones chopper and Oscillation chopper (Principle of operation only) Waveforms –– AC Chopper – Numerical Problems.

UNIT – IV INVERTERS

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

UNIT – V AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCR's in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor - wave forms – Numerical problems.

Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

TEXT BOOKS:

1. Power Electronics – by Dr P.S.Bimbhra, Khanna Publishers, Fourth Edition, 2010.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
2. Power Electronics - by V.R.Murthy , 1st edition -2005, OXFORD University Press
3. Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.

Outcome: The student can be able to:

- After going through this course the student gets knowledge about basic operating principles of various power semiconductor switching devices.
- Also he/she can understand high efficient and high reliable power conversion methods.
- Understand the operation of various power electronic converters and their control.
- Apply the above principles and methods to practical applications.

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ELECTRICAL & ELECTRONIC MEASUREMENTS

OBJECTIVE:

- This course introduces the basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
- It also explains the measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements are also explained.
- The principle of working of CRO and its applications are explained.
- Digital meters are also introduced.

UNIT- I MEASURING INSTRUMENTS

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range.

UNIT – II MEASUREMENT OF POWER, POWER FACTOR AND ENERGY

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter.

UNIT – III INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations.
DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages.

A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples.

UNIT – IV D.C & A.C BRIDGES

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge.

UNIT – V CRO AND DIGITAL METERS

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase , Frequency, Current and Voltage-Lissajous Patterns

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.

REFERENCE BOOKS:

1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall, 3rd Edition, 1970.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
4. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.

OUTCOMES:

The student should have learnt how to

- Use wattmeters, pf meters, and energy meters in a given circuit.
- Extend the range of ammeters and voltmeters
- Measure active power, reactive power , reactive power , power factor, and energy in both 1-phase and 3-phase circuits
- Determine the resistance values of various ranges, L and C values using appropriate a.c bridges
- Measure the different characteristics of periodic and aperiodic signals using CRO.

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LINEAR & DIGITAL IC APPLICATIONS

Learning Outcomes:

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

- Understand the basic building blocks of linear integrated circuits and its characteristics.
- Analyze the linear, non-linear and specialized applications of operational amplifiers.
- Understand the theory of ADC and DAC.
- Able to use computer-aided design tools for development of complex digital logic circuits.
- Able to model, simulate, verify, analyze, and synthesize with hardware description languages.
- Able to design and prototype with standard cell technology and programmable logic.
- Able to design tests for digital logic circuits, and design for testability.

UNIT-I OP-AMP CHARECTERISTICS:
Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics - DC and AC characteristics, 741 Op-amp and its features, modes of operation-inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, sample & Hold circuits, multiplier and divider, Differentiator and Integrator, Comparators, Schmitt trigger, Multivibrators, Introduction to voltage regulators, features of 723 General purpose regulator.

UNIT-II TIMERS, PHASE LOCKED LOOPS&D-A AND A-D CONVERTERS:
Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger, PLL – Introduction, block schematic, principles and description of individual blocks of 565.Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications.

UNIT-III ACTIVE FILTERS & OSCILLATORS:
Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadraturetype, waveform generators-triangular, sawtooth, square wave and VCO.

UNIT – IV INTIGRATED CIRCUITS:
Classification, Chip size and circuit complexity,Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector o/ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.

UNIT – V COMBINATIONAL & SEQUENTIAL CIRCUITS
COMBINATIONAL: Code converters, Decoders, Demultiplexers, decoders & drives for LED & LCD display. Encoder, priority Encoder, Multiplexers & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's Complement system. Digital comparator circuits.
SEQUENTIAL: Latches, Flip-flops & their conversions. Design of synchronous counters, Decade counter, shift registers & applications, familiarities with commonly available 74XX and CMOS 40XX series of IC counters.

TEXT BOOKS:
1. Linear Integrated Circuits – D.RoyChowdhury, New Age International (p) Ltd, 2nd Edition., 2003.
2. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.

REFERENCES:
1. Operational Amplifiers & Linear Integrated Circuits – R.F.Coughlin& Fredric F.Driscoll, PHI.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications –Denton J.Daibey, TMH.
3. Design with Operational amplifiers & Analog Integrated circuits-Sergio Franco, Mc Graw Hill, 3rd Edition , 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition 2005.
5. A VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
6. Op-amps & Linear ICs – RamakanthA.Gayakwad, PHI, 1987.

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MANAGEMENT SCIENCE

Course Objective: The objective of the course, is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management**.**

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-Weber's Ideal Bureaucracy-Eltan Mayo's Human relations-Systems theory- Situational or Contingency theory-Social responsibilities of management.**Organizational structure and design**: Features of organizational structure-work specialization-Departmentation-Span of control-Centralization and Decentralization. **Organisational designs**-Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of organization.

UNIT II OPERATIONS MANAGEMENT

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study- Statistical Quality Control**:** *C* chart, *P* chart, (simple Problems) Deming's contribution to quality. **Material Management:** Objectives-Inventory-Functions,types, inventory classification 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.

UNIT III HUMAN RESOURCES MANAGEMENT (HRM)

HRM- Definition and meaning – nature-Managerial and Operative functions-Evolution of HRM-Human Resource Planning(HRP)-Employee Recruitment-sources of recruitment-employee selection- process and tests in employee selection- Employee training and development-On- the-job and Off- the- job training methods-Performance Appraisal systems-Concept-Methods of Performance Appraisal-Placement-Employee Induction-Wage and Salary Administration-Objectives-Essentials of Wage and Salary Administration-Job Analysis-Process -Job Evaluation-Employee Grievances-techniques of handling Grievances.

UNIT IV   STRATEGIC MANAGEMENT

Definition& meaning-Setting of Vision- Mission- Goals- Corporate Planning Process- Environmental Scanning-Steps in Strategy Formulation and Implementation-SWOT Analysis. **Project Management (PERT/CPM):**Network Analysis- Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying Critical Path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

UNIT V   CONTEMPORARY ISSUES IN MANAGEMENT

The concept of MIS- Materials Requirement Planning (MRP)- Just-In-Time (JIT) System- Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management- Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO), Business Process Re-engineering and Bench Marking -Balanced Score Card-Knowledge Management.

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.

TEXT BOOKS:

1. A.R Aryasri: Management Science, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.

REFERENCE BOOKS:

1. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
2. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
3. Thomas N.Duening & John M.Ivancevich ManagementPrinciples and Guidelines,Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
6. Samuel C.Certo: Modern Management, 9/e, PHI, 2005
7. Schermerhorn, Capling, Poole & Wiesner: Management, Wiley, 2002.
8. Parnell: Strategic Management, Biztantra, 2003.
9. Lawrence R Jauch, R.Gupta &William F.Glueck: Business Policy and Strategic Management, Frank Bros., 2005.
10. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

Learning Outcome:

After completion of this course, the prospective engineering technocrats will be able to understand various fundamentals of functional areas such general management, plant and materials management, marketing management, human resource management, statistical quality control techniques, strategic management and also aware of the latest and contemporary issues of management science.

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ELECTRICAL MACHINES LAB - II

Objective:

- Transformers, Induction Motors, Alternators and synchronous motors are experimented in detail and their performance characteristics are evaluated.

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

1. O.C. & S.C. Tests for predetermination of regulation and efficiency of single phase transformers.
2. Sumpner's test on a pair of single phase transformers.
3. Scott connection of transformers.
4. No-load & Blocked-rotor tests for construction of circle diagram and predetermination of performance characteristics of three-phase Induction motor.
5. Regulation of a three phase alternator by synchronous impedance & m.m.f methods.
6. V and inverted V curves of a 3-phase synchronous motor.
7. Determination of Equivalent circuit of a single phase induction motor.
8. Determination of X_d and X_q of a salient pole synchronous machine.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted.

9. Parallel operation of single phase transformers.
10. Separation of core losses of a single phase transformer.
11. Load test on three phase Induction motor.
12. Regulation of three-phase alternator by Z.P.F. and A.S.A. methods.

OUTCOME:

- After going through this laboratory course, the student acquires sufficiently good practical knowledge about the operation, testing, and characteristics of important A.C equipment like transformers, Induction Motors, Alternators and synchronous motors.
- The student should also have acquired the knowledge about the fixation of the rating of transformers, induction motors and synchronous machines.

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ELECTRICAL AND ELECTRONIC MEASUREMENT LAB

Objective: This laboratory deals with the practical exercises for

- Calibration of various electrical measuring instruments.
- Accurate determination of inductance and capacitance using D.C and A.C Bridges.
- Measurement of coefficient of coupling between two coupled coils.

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

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance.
5. Determination of Coefficient of coupling between two mutually coupled coils.
6. Schering Bridge & Anderson bridge.
7. Measurement of 3-phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:

9. Maxwell's bridge and DeSauty bridge.
10. Calibration of LPF wattmeter – by Phantom loading.
11. Measurement of 3-phase power with Two-watt meter method (Balanced & Un balanced).
12. Wheatstone bridge – measurement of medium resistances.
13. LVDT and capacitance pickup – characteristics and Calibration
14. Resistance strain gauge – strain measurement and Calibration
15. Transformer turns ratio measurement using A.C Bridge.
16. A.C. Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil.

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

- Calibrate various electrical measuring instruments.
- Accurately determine the values of inductance and capacitance using a.c bridges
- Compute the coefficient of coupling between two coupled coils.
- Accurately determine the values of very low resistances.

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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

III B. Tech (EEE) – II Sem

S.No	Course Code	Subject	L	T	P	Credits
1	PC	Switch Gear & Protection	3	1	0	3
2	PC	Digital Signal Processing	3	1	0	3
3	PC	Computer Aided Power System Analysis	3	1	0	3
4	PC	Microprocessors & Microcontrollers	3	1	0	3
5	PC	Power Semiconductor Controlled Drives	3	1	0	3
6	PC	Neural Networks & Fuzzy Logic Applications	3	1	0	3
7		Advanced English Communication Skills Lab (Audit Course)	2	-	-	-
8	PC	Microprocessors & Microcontrollers Lab	0	0	3	2
9	PC	Power Electronics & Simulation Lab	0	0	3	2
		Total	20	6	6	22

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ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B. Tech EEE II-Sem	**L**	**T**	**C**
	3	**1**	**3**

SWITCH GEAR AND PROTECTION

Objective: the student can be able to learn about

- The study of different Circuit Breakers and Relays
- The protection of Generators and Transformers
- The protection of various feeder bus bars from abnormal conditions and over voltages
- It importance on Neutral grounding for overall protection.

UNIT – I Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT – II Electromagnetic and static relays

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT) and Distance Relays and their Flow Charts.

UNIT – III Protection of Generators and Transformers

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

UNIT –IV Protection of Feeders and Transmission Lines

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars.

UNIT – V Protection against over voltages

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

TEXT BOOKS:

1. Switchgear and Protection – by Sunil S Rao, Khanna Publlishers
2. Power System Protection and Switchgear by Badari Ram , D.N Viswakarma, TMH Publications
3. Principles of power systems - by V.K. Mehta, Rohit Mehta. S.Chand publications.

REFERENCE BOOKS:

1. Transmission network Protection by Y.G. Paithankar ,Taylor and Francis,2009.
2. Power system protection and switch gear by Bhuvanesh Oza, TMH, 2010.
3. Electrical Power Systems – by C.L.Wadhwa, New Age international (P) Limited, Publishers, 3rd editon

OUTCOME:

After completing this course the candidate will be able to:

- Understand the operation of different circuit breakers.
- Get thorough knowledge on different relays which are used in real time power system operation.
- Understand the protection of different power system components such as generators, transformers, lines and feeders against over voltages.
- Apply the above conceptual things in practical applications of power system operation and planning.

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III B. Tech -II Sem. (E.E.E)	L	T	C
	3	1	3

DIGITAL SIGNAL PROCESSING

Objective:

The student will be able to learn about:

- Basic concepts of signal processing and representation of discrete time signals and systems
- Realization of FIR and IIR digital filters
- Processing of signals in different engineering fields

UNIT-I INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems.

UNIT-II DISCRETE FOURIER SERIES AND FAST FOURIER TRANSFORMS

Properties of Discrete Fourier Series, DFS Representation of Periodic Sequences, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences Using DFT, Computation of DFT. Relation between Z-Transform and DFS, Fast Fourier Transforms (FFT)-Radix2 Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT and FFT for Composite N.

UNIT-III REALIZATION OF DIGITAL FILTERS

Z-Transforms: Concept, Properties, Region of Convergence, and Applications; Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant-Coefficient Difference Equations, Basic Structures of IIR Systems, Transposed Forms, Basic Structures of FIR Systems, System Function.

UNIT-IV IIR AND FIR DIGITAL FILTERS

Analog Filter Approximations-Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations, Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR Filters, Illustrative Problems.

UNIT-V MULTIRATE DIGITAL SIGNAL PROCESSING

Basic Sample Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Polyphase Decomposition, Nyquist Filters. Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Signal Compression, Transmultiplexers, Discrete Multitone Transmission of Digital Data.

TEXT BOOKS:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 2007.
2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd edition, 2009.

REFERENCES:

1. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
2. A Text book on Digital Signal processing – R S Kaler, M Kulkarni, Umesh Gupta, I K International Publishing House Pvt. Ltd., 2009.
3. Digital signal processing: M H Hayes, Schaum’s outlines, TATA Mc-Graw Hill, 2007.

OUTCOMES:

The student can be able to

- Design signal processer
- Realize various filters and finding solution for various filter designs
- Apply design procedures in various processing applications
- Understanding of different transformation techniques

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech II-Sem (EEE)	**L**	**T**	**C**
	3	**1**	**3**

COMPUTER AIDED POWER SYSTEM ANALYSIS

Objective:

The student will be able to

- Study about the Y bus and Z bus of a Power System, power flow studies by various methods.
- It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

UNIT -I Power System Network Matrices-I

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System Essential characteristics of a good Algorithm, Steps involved in solving a problem using Digital computer - Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} *formation by Direct and Singular Transformation Methods, Numerical Problems.*

UNIT -II Power System Network Matrices-II

Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Z_{Bus} for the changes in network (Problems)

UNIT –III Power flow Studies

Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods .

UNIT – IV Short Circuit Analysis

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory:, Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems

UNIT –V Power System Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

TEXT BOOKS:

1. Computer Methods in Power Systems, Stagg El – Abiad & Stags.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing Company, 2nd edition.

REFERENCE BOOKS:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by Hadi Saadat – TMH Edition.
4. Power System Analysis by B.R.Gupta, Wheeler Publications.

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

- Understand the mathematical models of power system components.
- Analyze and pick the best algorithm for a selected power system problem.
- Generate input data suitable for load flow.
- Understand the methods for load flow studies.
- Understand the fault calculations for various types of faults.
- Understand the power system stability concepts.

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III B. Tech -II Sem. (E.E.E)	L	T	C
	3	1	3

MICROPROCESSORS AND MICROCONTROLLERS

Objectives: The student can be able to learn about

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understands the 8051 Microcontroller concepts, architecture, programming, and various applications.

UNIT-I: INTRODUCTIO 8086 ARCHITECTURE

Historical background- 8-Bit Microprocessor - 8085 architecture and memory interfacing (RAM& ROM - Evolution of microprocessors. Architecture of 8086 microprocessor - special function of general purpose registers - 8086 flag registers and functions of 8086 flags.

UNIT-II: 8086 HARDWARE

Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation. Timing diagrams.

UNIT III: ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation and interfacing to 8086 - interfacing keyboard - display - stepper motor interfacing - A/D - D/A converter interfacing.

UNIT-IV: INTERFACING WITH ADVANCED DEVICES AND COMMUNICATION INTERFACE

Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – introduction to DOS and BIOS interrupts – interfacing interrupt controller 8259 - Need of DMA – DMA controller 8257 to 8086 – serial communication standards – serial data transfer schemes.

UNIT V: 8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises skey board and display interface – Closed loop control of servo motor – stepper motor control.

OUTCOMES:

The student should have learnt about:

- Understand the basic architecture & pin diagram of 8086 microprocessor.
- Assembly language programming to perform a given task.
- Interrupt service routines for all interrupt types.
- Microcontroller and its applications
- Microprocessor and Microcontroller designing in various applications.

TEXT BOOKS

1. Advanced Microprocessor and Peripherals – A. K. Ray and K. M. Bhurchandi- TMH,2000
2. The 8051 Micro Controller Architecture, Programming and Applications – Kenneth J Ayala, Pearson International publishing (India).

REFERENCE BOOKS

1. Microprocessor and Interfacing - Douglas V Hall 2nd Edition , Tata McGrawhill-1992
2. Microprocessor – NILESH B BAHADURE – PHI, 2010.

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	3	**1**	**3**

POWER SEMICONDUCTOR CONTROLLED DRIVES

Objective: The student should learn about

- Operation of electric motor drives those are controlled from power electronic converters.
- Analyze the stable steady-state operation and transient dynamics of a motor-load system
- Analyze the operation of the chopper fed DC drive
- Gives the differences between synchronous motor drives and induction motor drives.

UNIT-I: Introduction

Electrical Drives, Parts of electrical Drives –Electrical motors, Power modulators, sources and control unit -dynamics of electrical drives -torque equation -equivalent values of drive parameters-components of load torques, types of load Torques–steady state stability –Load equalization.

UNIT-II: Control of Electrical Drives

Modes of operation- speed control and drive classifications- Closed loop control of Drives-current limit control, closed loop torque control, closed loop speed control, closed loop speed control of multi-motor drives- speed sensing-current sensing.

UNIT-III: DC motor drives

DC motors & their performance (shunt, series, compound, permanent magnet motor, universal motor, dc servomotor) –Braking –regenerative braking, dynamic braking, plugging –Transient analysis of separately excited motor –converter control of dc motors –analysis of separately excited & series motor with 1-phase and 3-phase converters –dual converter –analysis of chopper controlled dc drives –converter ratings and closed loop control.

UNIT-IV: Induction motor drives

Three-phase Induction Motors- Analysis and Performance- stator voltage control of induction motor –torque-slip characteristics –control by ac voltage controllers and soft start–stator frequency control –variable frequency operation –V/F control- Voltage Source Inverter Control-Current Source Inverter Control - Cycloconverter Control- rotor resistance control –slip torque characteristic- slip power recovery – Static scherbius drive- Static Kramer drive.

UNIT-V: Synchronous motor drives

Separate and self control of synchronous motors- operation of self controlled By VSI, CSI and Cycloconverters. Load commutated CSI fed synchronous motors- operation- waveforms- speed torque characteristics- Applications- Advantages and Numerical problems- Closed loop control operation of Synchronous motor drives.

Outcomes: The student should have learned about

- The choice of their electric drives system based on their applications.
- The operation of single and multi quadrant operation of electric drives.
- The type of an electric drive whether it is 1-Φ or 3-Φ rectifiers fed to DC motors as well as chopper fed to DC motors.
- The speed control methods for AC-AC & DC-AC converters fed to Induction motors and synchronous motors with their closed loop, and open loop operations.

Text Books:

1. Fundamentals of Electric Drives –by G K Dubey, alpha science Publications-2001.
2. Power Electronics –MD Singh and K B K hanchandani, Tata –McGraw-Hill Publishing Company, 1998.
3. Power Electronics- by Dr. P.S.Bhimbhra, kanna publications, 5th Edition.

Reference Books:

1. Modern Power Electronics and AC Drives by B.K.Bose, PHI Publications. Prentice Hall PTR- 2002.
2. Thyristor Control of Electric drives –Vedam Subramanyam Tata McGraw Hill Publilcations-2008.

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III B. Tech -II Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

NEURAL NETWORKS & FUZZY LOGIC APPLICATIONS

Objective:

The student will be able to understand:

- Importance of AI techniques in engineering applications
- Artificial Neural network and Biological Neural Network concepts
- ANN approach in various Electrical Engineering problems
- Fuzzy Logic and Its use in various Electrical Engineering Applications

UNIT – I: INTRODUCTION TO ARTIFICIAL INTILLEGENCE

Introduction and motivation – Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems.

UNIT – II: ARTIFICIAL NEURAL NETWORKS

Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories.

UNIT – III: ANN APPLICATIONS TO ELECTRICAL SYSTEMS

ANN approach to: Electrical Load Forecasting Problem – System Identification – Control Systems – Pattern Recognition.

UNIT – IV: FUZZY LOGIC

Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT – V: FUZZY LOGIC APPLICATIONS TO ELECTRICAL SYSTEMS

Fuzzy Logic Implementation for Induction Motor Control – Switched Reluctance Motor Control –Fuzzy Excitation Control Systems in Automatic Voltage Regulator - Fuzzy Logic Controller in an 18 Bus Bar System.

Text Books:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Neural Networks using MATLAB”, McGraw Hill Edition, 2006.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Third Edition, WILEY India Edition, 2012.

References:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, “Intelligent System – Modeling, Optimization & Control, CRC Press, 2009.

Outcomes: The students acquire knowledge about:

- Artificial Intelligence techniques
- ANN Techniques and their concepts
- Role of ANN in various Applications
- Fuzzy Logic concepts and its role in various applications

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III B. Tech -II Sem. (E.E.E)	**L**	**P**	**C**
	0	**2**	**0**

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(Audit Course)

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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III B. Tech -II Sem. (E.E.E)	**L**	**P**	**C**
	0	**3**	**2**

MICROPROCESSORS AND MICROCONTROLLERS LAB

Objectives: The student will perform:

- Assembly language programming on 8086 Microprocessors
- Interfacing of various devices with 8086
- MASAM Programming
- Interfacing 8051 Microcontroller with its peripheral devices

I . Microprocessor 8086:

Introduction to MASM/TASM.

Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

Modular Program: Procedure, Near and Far implementation, Recursion.

Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

II. Interfacing

8259 – Interrrupt Controller.

8279 – Keyboard Disply.

8255 – PPI.

8251 – USART.

III. Mcrocontroller 8051:

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.
4. Understanding three memory areas of 00 – FF (Programs using above areas).
5. Using external interrupts
6. Programs using special instructions like swap, bit/byte, set/reset etc.
7. Programs based on short, page, absolute addressing.

Outcomes: The student able to perform:

- Assembly language programming on 8086 Microprocessors
- Interfacing of various devices with 8086
- MASAM Programming
- Interfacing 8051 Microcontroller with its peripheral devices

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III B. Tech -II Sem. (E.E.E)	**T**	**P**	**C**
	0	**3**	**2**

POWER ELECTRONICS AND SIMULATION LAB

Objectives: The student will understand about

- Various characteristics of power electronic devices with gate firing circuits
- Various forced commutation techniques
- The operation of single-phase half & fully-controlled converters, and inverters with different types of loads
- The operation of single-phase AC Voltage controllers with different loads
- Experimentation and also by the PSPICE/PSIM

Any Eight of the Experiments in Power Electronics Lab

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

Any two simulation experiments with PSPICE/PSIM

PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.

PSPICE simulation of resonant pulse commutation circuit and Buck chopper.

PSPICE simulation of single phase Inverter with PWM control.

Outcomes:

The student should have learned about

- The study of various power electronic devices and their commutation circuits
- The voltage and current characteristics of various converters and inverters at different firing angles
- The study of different types converters and inverters with different types of loads
- The PSPICE/PSIM programming for various power electronic devices.

REFERENCE BOOKS:

1. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

IV B. Tech (EEE) – I Sem

S.No	Course Code	Subject	L	T	P	Credits
1	PC	Electric Power Distribution Systems	3	1	0	3
2	PC	Instrumentation	3	1	0	3
3	PC	Introduction to HVDC Transmission & FACTS	3	1	0	3
4	PC	Power System Operation and Control	3	1	0	3
5	OE	Open Elective 1) PLC & Its Applications 2) Renewable Energy Sources 3) Linear & Nonlinear Optimization Techniques 4) Reliability and Safety Engineering	3	1	0	3
6		**MOOC (Elective – I)**	3	1	0	3
7	PC	Digital Signal Processing Lab	0	0	3	2
8	PC	Power Systems & Simulation Lab	0	0	3	2
9		Project Part-A - Seminar	-	-	-	4
		Total	18	6	6	26

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COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV - B.Tech -I-Sem (EEE)	**L**	**T**	**C**
	3	**1**	**3**

ELECTRIC POWER DISTRIBUTION SYSTEMS

Objectives: The student acquires knowledge about:

- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as, location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve dependence of voltage on reactor power flow and methods of voltage control

UNIT – I GENERAL CONCEPTS

Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT – II GENERAL ASPECTS OF D.C. DISTRIBUTION SYSTEMS

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design features of Distribution Systems.
Voltage Drop and power loss derivations in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at both ends (equal/unequal Voltages) and Ring Main Distributor, LVDC Distribution Network

A.C. DISTRIBUTION SYSTEMS

Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of secondary distribution systems.
Voltage Drop and power loss derivations in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT – III SUBSTATIONS

Location of Substations: Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.
Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment.
Bus bar arrangements in Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar, Double breaker – One and half breaker system with relevant diagrams, Lightening arrestors, Grounding practices

UNIT – IV POWER FACTOR IMPROVEMENT and VOLTAGE CONTROL

Causes of low P.F -Methods of Improving P.F -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical P.F. for constant KW load and constant KVA type loads- Capacitive compensation for power-factor control - effect of shunt capacitors (Fixed and switched) and other compensating devices, Power factor correction- Economic justification - Procedure to determine the best capacitor location-Numerical Problems.

Dependence of Voltage on Reactive Power flow.- Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers

UNIT – V PROTECTION AND COORDINATION OF DISTRIBUTION SYSTEMS

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizer, and circuit breakers. Coordination of Protective Devices: General coordination procedure.

Outcomes: Student should have learnt about:

- Design aspects and computational procedures for DC and AC Distribution systems
- Important phenomena regarding substations such as, ratings, optimal location, layout of equipment, various types of busbar arrangements
- Dependence of voltage on reactive power flow and methods of voltage control

TEXT BOOK:

1.“Electric Power Distribution system, Engineering” – by Turan Gonen, Mc Graw-hill Book Company.

2. Electric Power Distribution – by A.S. Pabla, Tata Mc Graw-hill Publishing company, 4th edition, 1997.

REFERENCE BOOK:

1. Electrical Power Distribution and Automation by S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2006

2. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

3.Principles of Power Systems by V.K.Mehta

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IV B.Tech -I Sem. (E.E.E)	L	T	C
	3	1	3

INSTRUMENTATION

Objectives: The student able to learn about:

- Measuring system, Common errors, test signals and modulation phenomenon
- Data acquisition system
- Measuring meters and analyzers
- Basic transducers and their usage in various measurements

UNIT-I: INSTRUMENT ERRORS, SIGNALS AND THEIR REPRESENTATION

Measuring Systems, Performance Characteristics, - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signal and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

UNIT-II: DATA TRANSMISSION, TELEMETRY AND DAS

Methods of Data Transmission – General Telemetry System . Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

UNIT-III: SIGNAL ANALYZERS

Wave Analysers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

UNIT-IV: TRANSDUCERS

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor, LVDT and Capacitor Transducers; LVDT Applications, Strain Gauge and Its Principle of Operation, Guage Factor, Thermistors, Thermocouples, Synchros, Piezo Electric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

UNIT-V: MEASUREMENT OF NON-ELECTRICAL QUANTITIES

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

TEXT BOOKS:

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India, 2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co., 2012.

REFERENCE BOOKS:

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e., 2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India., 1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3rd re print, 2009.

Outcomes: The student should have learnt about:

- Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques
- Basic operation of DAS
- Various measuring meters and signal analyzers
- Transducers and their measurements

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IV Year B. Tech EEE I-Sem	**L**	**T**	**C**
	3	**1**	**3**

INTRODUCTION TO HVDC TRANSMISSION & FACTS

Objectives:

The objectives of this course include:

- To learn about the comparison of AC and DC transmission systems and operation of different HVDC converters.
- To know about harmonics and filters.
- To know about sources of reactive power and its control.
- To learn about operation of different FACTS devices and their applications.
-

UNIT-I INTRODUCTION

Comparison of AC and DC Transmission systems, Application of D.C. Transmission, Types of DC links, Typical layout of a HVDC converter station. HVDC converters, pulse number, Analysis of 6 - pulse Bridge circuit with and without overlap, converter Bridge characteristics, equivalent circuits of Rectifier and inverter configurations 12- pulse converters, Principles of DC links control, converter control characteristics, system control Hierarchy, Firing angle control, current and extinction Angle control starting and stopping of DC link.

UNIT -II HARMONICS, FILTERS AND REACTIVE POWER CONTROL

Introduction, generation of Harmonics, AC and DC Filters, Reactive power requirements at steady state, sources of Reactive power, static Var systems.

UNIT - III TYPES OF FACT DEVICES

Objectives of shunt compensation, Methods of controllable VAR generation, Static VAR compensators, SVC and STATCOM, Comparison

UNIT - IV STATIC SERIES COMPENSATORS

Objectives of series compensation, variable impedance type-thyristor switched series capacitors (TCSC), switching converter type series compensators – static synchronous series compensator (SSSC) – power angle characteristics – Basic operating control Schemes.

UNIT - V COMBINED COMPENSATORS

Introduction, unified power flow controller (UPFC), Basic operating principle, Independent real and reactive power flow controller, control structure.

Outcomes:

After completion of the course the student will able to;

- Understand the operation of HVDC converters.
- Know the effect of harmonics and filters as a remedy.
- Understand about FACTS devices and their applications.

TEXT BOOKS:

1. HVDC power Transmission systems by K.R. Padiyar, Wiley Eastern Limited
2. Understanding of FACTS by N.G. Hingorani & L. Gyugyi, IEEE Press.
3. Flexible AC Transmission Systems (FACTS) Young Huasong & Alian T. hons, The Institution of Electrical Engineers, IEE Power and Energy Series 30.
4. An Introduction to: Reactive Power Control and Voltage Stability in Power Transmission Systems by Abhijit Chakrabarti, D. P. Kothari, A. K. Mukhopadhyay and Abhinandan De, Eastern Economy Edition, 2010.

REFERENCE BOOKS:

1. **EHVAC, HVDC Transmission & Distribution Engineering,** S.Rao,Khanna publishers, 3rd edition 2003.
2. **Power Electronic Control in Electrical Systems-** E Acha. VG Agelidis & O Anaya-Lara. THE Miller – Elsevier, 2009.

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IV B. Tech -I Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

POWER SYSTEM OPERATION AND CONTROL

Objectives:

The objectives of this course include:

- To learn about economic operations of Power Systems.
- To know about hydrothermal scheduling and modeling of turbines, generators and automatic controllers.
- To know about single area and two area load frequency control and reactive power control.
- To learn about introduction and key issues of power system deregulation.

UNIT – I Economic Operation of Power Systems

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected, Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

UNIT – II Hydrothermal Scheduling and Governing

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, Scheduling problems-Short term Hydrothermal scheduling problem, Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function – Block Diagram.

UNIT – III Load Frequency Control

Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control, Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

UNIT – IV Reactive Power Control

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

UNIT – V Power System Restructuring

Introduction – Need for Regulation – Motivation for Power System Restructuring – Structure of Deregulated system.

Outcomes:

After completion of the course, the student will able to;

- Understand the economic operations of Power Systems.
- Get the knowledge on hydrothermal scheduling and modeling of turbines, generators and automatic controllers.
- Understand single area and two area load frequency control and reactive power control.
- Get knowledge on introduction and key issues of power system deregulation.

TEXT BOOKS:

1. Power Systems Operation and Control – Chakravarthi, Halder
2. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd, 2nd edition.
3. Electric Energy Systems by O I Elgerd.

REFERENCE BOOKS:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., THOMPSON, 3rd Edition.
2. Electric Power Generation, Transmission and Distribution, S N Sing, PHI, 2008.

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IV B. Tech -I Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

PLC & ITS APPLICATIONS
(OPEN ELECTIVE)

Objectives: The student will be able to learn about:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Designing of control circuits for various applications
- PLC logical and arithmetic operations

UNIT-I

PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules.

PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

UNIT-II

Digital Logic Gates, Programming in the Boolean Algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flowchart for Spray Process System.

UNIT-III

PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

UNIT-IV

Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.

UNIT-V

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintanance.

Text Books:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI, 2011.

Outcomes: The student should have learnt about:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Designing of control circuits for various applications
- PLC logical and arithmetic operations

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IV B. Tech -I Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

RENEWABLE ENERGY SOURCES
(OPEN ELECTIVE)

OBJECTIVES: The student will be able to learn about:

- Basic renewable energy sources.
- The development of solar energy by solar radiation.
- The development of wind energy
- The applications of solar & wind energy systems
- The study of bio-mass, geothermal and ocean energy technology.

UNIT - I:
Introduction, problems associated with fossil fuel based energy options, need for alternate sources of energy, present energy scenario, Role and potential of new and renewable energy sources.

UNIT - II:
Basic characteristics of sunlight – Solar energy resource - Flat plate and concentrating collectors – advanced collectors - Photovoltaic cell - characteristics – Equivalent circuit – Photo voltaic for battery charging - Solar Applications- solar heating/cooling technique, solar distillation and drying.

UNIT - III:
Wind source – Wind statistics - Energy in the wind – Aerodynamics - Rotor types – Forces developed by blades - Aerodynamic models – Braking systems – Tower - Control and monitoring system – Power performance. Horizontal and vertical axis windmills, performance characteristics Wind driven induction generators - Power circle diagram - Steady state performance – Modeling - Integration issues – Impact on central generation - Transmission and distribution systems – Wind farm electrical design.

UNIT - IV:
Wind - Diesel systems - Fuel savings - Permanent magnet alternators – Modeling – Steady state equivalent circuit - Self-excited induction generators – Integrated wind - Solar systems.

UNIT - V:
Micro-hydel electric systems – Power potential – Scheme layout – Generation efficiency and turbine part flow - Isolated and parallel operation of generators – Geothermal - tidal and OTEC systems - Hydrogen energy concept, production and storage of hydrogen, utilization of hydrogen, safety measures - Introduction to sources of energy from nuclear power biomass, ocean and geothermal energy.

TEXT BOOKS:

1. S.P. Sukhatme, Solar Energy – Thermal Collection and Storage, Tata-Mc Graw Hill New Delhi, 1984.
2. G.D.Rai, Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
3. El Wakil, Power Plant Technology, Tata Mc Graw Hill, New York, 1999.

REFERENCE BOOKS:

1. Arora and S.Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Sons, New Delhi 1998.
2. Ed Nejat Vezirog, Alternate Energy Sources, Mc Graw Hill, New York.
3. John F.Walker & Jenkins. N , Wind Energy Technology, John Wiley and sons, Chichester , U.K , 1997.
4. Van Overstraeton and Mertens R.P, Physics, Technology and Use of Photovoltaics, Adam Hilger, Bristol,1996.
5. Freries LL , Wind Energy Conversion Systems, Prentice Hall, U.K., 1990.

OUTCOMES: The student should have learned about:

- Understands the principles of wind power and solar photovoltaic power generation, fuel cells.
- Evaluate the cost of generation for conventional and renewable energy plants.
- Design suitable power controllers for wind and solar applications.
- Study of Ocean & Geo-thermal power plants

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IV B. Tech -I Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

LINEAR AND NONLINEAR OPTIMIZATION TECHNIQUES
(OPEN ELECTIVE)

Objectives:

The student will be able to learn:

- The basic concepts of Optimization
- The emphasis of this course is laid different classical Optimization techniques, linear programming, Constrained and unconstrained Nonlinear programming.

UNIT – I Introduction and Classical Optimization Techniques:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II Linear Programming

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT – III Transportation Problem

Formulation, methods of solution: Finding initial basic feasible solution by north – west (NW) corner rule, least cost and Vogel's approximation methods – testing for optimality of balanced transportation problems.

UNIT – IV Unconstrained & Constrained Nonlinear Programming:

One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method. Unconstrained Optimization Techniques: Univariate method, Powell's method and steepest descent method. Constrained optimization Technique: Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods.

UNIT – V Constrained Nonlinear & Dynamic Programming:
Introduction to convex Programming Problem. Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

OUTCOMES:

The student gets thorough knowledge on:

- Basic theoretical principles in optimization, formulation of optimization models, solution methods in optimization
- Methods of linear and non-linear (constrained and unconstrained) programming
- Applications to a wide range of engineering problems.

TEXT BOOKS:

1. “Engineering optimization: Theory and practice”-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. “Introductory Operations Research” by H.S. Kasene & K.D. Kumar, Springer(India), Pvt .LTd.

REFERENCE BOOKS:

1 “Optimization Methods in Operations Research and systems Analysis” – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma.
3. “Operations Research: An Introduction” – by H.A. Taha, PHI Pvt. Ltd., 6th edition
4. Linear Programming – by G. Hadley

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IV B. Tech -I Sem. (E.E.E)	L	T	C
	3	1	3

RELIABILITY AND SAFETY ENGINEERING
(OPEN ELECTIVE)

Objectives:

The objectives of this course include:

- To introduce the concepts of system reliability and safety.
- To learn about reliability block diagram, markov models, fault tree analysis, monte carlo simulation and dynamic reliability analysis.
- To know about probabilistic safety assessment procedure, identification of hazards and initiating events.
- To learn about event tree analysis, importance measures, common-cause failure analysis and human reliability analysis.
- To learn about various applications of probabilistic safety analysis.
- To learn about uncertainty management in reliability assessment.

UNIT I: BASIC RELIABILITY CONCEPTS

Introduction, Need for Reliability and Safety Engineering, Definitions and Terms, Basic Reliability Mathematics - Classical Set Theory and Boolean Algebra, Concepts of Probability Theory, Reliability and Hazard Functions, Distributions Used in Reliability and Safety Studies, Failure Data Analysis, Numerical Problems.

UNIT II: SYSTEM RELIABILITY MODELING

Reliability Block Diagram, Markov Models, Fault Tree Analysis, Monte Carlo Simulation, Dynamic Reliability Analysis, Numerical Problems.

UNIT III: PROBABILISTIC SAFETY ASSESSMENT

Introduction, Concept of Risk and Safety, Probabilistic Safety Assessment Procedure, Identification of Hazards and Initiating Events, Event Tree Analysis, Importance Measures, Common-cause Failure Analysis, Human Reliability Analysis.

UNIT IV: APPLICATIONS OF PROBABILISTIC SAFETY ASSESSMENT

Objectives of Probabilistic Safety Assessment, Probabilistic Safety Assessment of Nuclear Power Plants, Technical Specification Optimization, Risk Monitor, Risk-informed In-service Inspection.

UNIT V: UNCERTAINTY MANAGEMENT IN RELIABILITY/SAFETY ASSESSMENT

Mathematical Models and Uncertainties, Uncertainty Analysis: an Important Task of Probabilistic Risk/Safety Assessment, Methods of Characterizing Uncertainties, Uncertainty Propagation, Uncertainty Importance Measures, Treatment of Aleatory and Epistemic Uncertainties, Dempster – Shafer Theory, Probability Bounds Approach, Bayesian Approach, Expert Elicitation Methods, Case Study to Compare Uncertainty Analysis Methods, Numerical Problems.

TEXT BOOK:

1. Reliability and Safety Engineering – by Ajit Kumar Verma, Srividya Ajit, Durga Rao Karanki, Springer Publications, 2010.

REFERENCE BOOKS:

1. Roy Billinton and Ronald N. Allan, Reliability Evaluation of Engineering Systems, Pitman Advanced Publishing Program, 2nd Edition 1998.
2. Charles E. Ebeling , Reliability and Maintainability Engineering, Tata McGraw Hill, 2000
3. E. Balagurusamy, Reliability Engineering, Tata McGraw Hill, 2003.
4. A. K. Gupta, Reliability, Maintenance & Safety Engineering, University Science Press, 2013.

Outcomes:

After completion of the course the student will able to;

- Understand the concepts of system reliability and safety.
- Get knowledge on reliability block diagram, markov models, fault tree analysis, monte carlo simulation and dynamic reliability analysis.
- Understand the probabilistic safety assessment procedure, identification of hazards and initiating events.
- Familiar with event tree analysis, importance measures, common-cause failure analysis and human reliability analysis.
- Get knowledge on various applications of probabilistic safety analysis.
- Understand about uncertainty management in reliability assessment.

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	L	P	C
IV B. Tech -I Sem. (E.E.E)	**0**	**3**	**2**

DIGITAL SIGNAL PROCESSING LAB

OBJECTIVES:

- To implement the processing techniques using the instructions of DSP Processor
- To implement various filters using MATLAB Programming.

SIMULATION IN MATLAB

1. Generation of Signals
2. Linear and circular convolution of two sequences
3. Sampling and effect of aliasing
4. Design of FIR filters
5. Design of IIR filters
6. Calculation of FFT of a signal
7. Decimation by polyphase decomposition.

USING PROCESSOR

8. Study of various addressing modes of DSP using simple programming examples.
9. Implementation of Linear and Circular Convolution.
10. Sampling of input signal and display.
11. Waveform generation.
12. Implementation of FIR filter

OUTCOMES: The student can be able to perform:

- Programming concepts to implement various digital filters
- Generation of signals and their processing
- Interfacing of DSP processor with other peripherals

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	0	3	2

POWER SYSTEMS & SIMULATION LAB

Objectives:

The objectives of this course include:

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactances.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses.
- To develop the MATLAB programs for gauss-seidel and fast decouples load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.
2. Fault Analysis – I
   LG Fault
   LL Fault
3. Fault Analysis – II
   LLG Fault
   LLLG Fault
4. Determination of Sub transient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer.
6. Y bus formation using MATLAB
7. Z Bus formation using MATLAB
8. Gauss-Seidel load flow analysis using MATLAB
9. Fast decoupled load flow analysis using MATLAB
10. Develop a Simulink model for a single area load frequency problem and
    Simulate the same.

Outcomes:

After completion of the course the student will able to;

- Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactances.
- Get the practical knowledge on how to draw the equivalent circuit of three winding transformer.
- Get the practical knowledge on development of MATLAB program for formation of Y and Z buses.
- Get the practical knowledge on development of MATLAB programs for gauss-seidel and fast decouples load flow studies.

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Course Structure for B. Tech (Electrical and Electronics Engineering) (2013-14)

IV B. Tech (EEE)– II Sem

S.No	Course Code	Subject	L	T	P	Credits
1	PC	Introduction to Power Quality	**3**	**1**	**0**	3
2	HS	Utilization of Electrical Energy	3	1	0	3
3	PE	Elective-II 1) Modern Control Theory 2) Reliability Engineering and its Application to Power Systems 3) Power System Deregulation 4) Switched Mode Power Converters	3	1	0	3
4	PE	Elective-III 1) Electricity Act and Costing of Electrical Systems 2) High Voltage Engineering 3) Introduction to Distributed Generation & Smart Grid 4) Energy Auditing & Demand Side Management	3	1	0	3
5		Seminar - Comprehensive Viva-Voce	-	-	-	3
6		Project Part-B	-	-	-	10
		Total	12	4	0	25

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IV B. Tech -II Sem. (E.E.E)	**L**	**T**	**C**
	3	**1**	**3**

INTRODUCTION TO POWER QUALITY

Objectives

The objectives of this course include:

- To know about introduction on power quality issues.
- To learn about voltage disturbances and power transients that are occurring in power systems.
- To know the concept of harmonics in the system and their effect on different power system equipment.
- To know about different power quality measuring and monitoring concepts.

UNIT-I INTRODUCTION

What is power quality? Power quality – voltage quality, why are we concerned about power quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

UNIT-II VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES

Sources of sagas and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags, utility system fault-clearing issues. Sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

UNIT-III FUNDAMENTALS OF HARMONICS

Harmonic Distortion, Voltage versus current distortion, Harmonics versus Transients, power system qualities under non sinusoidal conditions, Harmonic indices, Harmonic sources from commercial loads, Harmonic sources from Industrial loads, Effects of Harmonics, Harmonic distortion evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion

UNIT-IV LONG-DURATION VOLTAGE VARIATIONS

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation flicker.

UNIT-V POWER QUALITY BENCH MARKING AND MONITORING

Benchmarking process, RMS Voltage variation Indices, Harmonics indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards

Outcomes:

After completion of the course the student will able to;

- Understand the different power quality problems in the power system.
- Know about voltage variations and over voltage transients in the system and also know about the protection of over voltages.
- Understand the effect of harmonics in the system and about the equipment that are effected from the harmonics.
- Know the concepts on measuring and monitoring issues of power quality.

TEXT BOOKS:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ptd.

2. Power quality by C. Sankaran, CRC Press

REFERENCE BOOKS:

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons

2. Understanding Power quality problems by Math H. J. Bollen IEEE Press

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UTILIZATION OF ELECTRICAL ENERGY

Objectives:

- To make the students aware about the importance of maximizing the energy efficiency by optimum utilization of electrical energy.
- To ensure that the knowledge acquired can be applied in various fields such as electric heating, illumination, chemical processes and electric traction.
- To develop ability amongst the students to analyze the performance of arc furnaces, electric traction, different sources of light, illumination schemes, electric traction
- To provide knowledge about above processes and applications of these in practical world.

UNIT – I ILLUMINATION

Definition – Laws of illumination – Polar curves – Calculation of MHCP and MSCP. Lamps: Incandescent lamp, Sodium Vapour lamp, Fluorescent lamp. Requirement of good lighting scheme – Types, Design and Calculation of illumination. Street lighting and Factory lighting – Numerical Problems.

UNIT – II ELECTRICAL HEATING & ELECTRIC WELDING

Advantages. Methods of Electric heating – Resistance, arc, Induction and dielectric heating. Types of electric welding – Resistance, Electric arc, gas welding and Ultrasonic welding, Welding electrodes of various metals, Defects in welding.

UNIT – III ELECTROLYTIC PROCESS

Basic principle of Electrolysis, Faradays laws of Electrolysis – **Numerical problems**, Applications of Electrolysis – **Electro deposition-manufacturing of chemicals – anodizing – electro polishing – electro cleaning – electro parting – electro metallurgy**, Power supply for Electrolysis.

UNIT – IV ELECTRIC TRACTION

Introduction –Traction Systems, Systems of Electric Traction- Advantages of Electric Traction, **Systems of Track Electrification**, Desirable features of Traction Motors – **Suitability of D.C. series motor, A.C. series motor, 3 phase induction motor and linear induction motor for traction**. Electric Braking in traction– Plugging, Rheostatic and Regenarative types – Suitability of different motors for braking, Temperature Rise and Load Equalization.

UNIT – V TRACTION MECHANICS

Types of services – urban – sub-urban and main line services, Speed-time curves of different services – trapezoidal and quadrilateral speed-time curves – Numerical Problems, Tractive effort, Power, Specific Energy Consumption- factors affecting Specific Energy Consumption, Mechanics of train movement - Adhesive weight and coefficient of adhesion – Problems.

Outcomes:

- Students will be able to understand the importance of maximizing the energy efficiency by its optimum utilization and mould their practical work in professional world accordingly.
- Students will be able to understand the performance of simple resistance furnaces, modern welding techniques, illumination schemes and electric traction.
- Students will get technical knowledge of various control devices and their use, in practical world.
- Students will be able to design above systems and apply them to real world usage.

TEXT BOOKS:

1. Utilization of Electrical Energy’ by E. O. Taylor – Revised in S.I. Units by V.V.L.Rao, Orient Longman
2. Generation, Distribution and Utilization of Electrical Energy’ by C. L. Wadhwa, Eastern Wiley Ltd.
3. ‘Utilization of Electric Power and Electric Traction’ by J.B. Gupta, S.K. Kataria and sons,Delhi.

REFERENCE BOOKS:

1. Art & Science of Utilization of electrical Energy – by H. Partab, Dhanpat Rai & Sons.
2. A text book on Power System Engineering’ by A. Chakraborti, M. L. Soni, P. V. Gupta, U.S.Bhatnagar, Dhanpat Rai and Co.(P) Ltd – Delhi
3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited Publishers, 1996.
4. Utilization of Electrical Power – by R.K. Rajput, Laxmi publications.

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MODERN CONTROL THEORY

(**ELECTIVE – II**)

Objective: This course introduces

- To give an overview of system analysis and design based on state space.
- Stability analysis for linear and nonlinear systems.
- Design of state feedback control and observer.
- Design of adaptive control and optimal control problem.

UNIT – I STATE VARIABLE DISCRIPTION

State space representation of systems – State diagrams for continuous time state models – Solution of state equations – State transmission matrix. controllability and observability for continuous time systems, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms.

UNIT – II POLE PLACEMENT OBSERVER

Fundamental theorem of feedback control - - Pole assignment by state feedback using Ackermann's formula – Eigen structure assignment problem-Design of full order observer using Ackermann's formula. - Full order Observer based controller design. Reduced order observer design.

UNIT – III DESCRIBING FUNCTION AND PHASE-PLANE ANALYSIS

Introduction to nonlinear systems, Types of nonlinearities, Concepts of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

UNIT-IV STABILITY ANALYSIS

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems.problems.

UNIT –V OPTIMAL AND ADAPTIVE CONTROL

Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Infinite time Regulator, Output regulator problem. Tracking problem, Parameter Optimization. Basic block diagram of adaptive system, Classification of adaptive control systems- MRAC systems- different configuration-classification-Mathematical description.

Course Outcomes: At the end of the course the student will be able to

- Obtain the transfer functions for linear and non-linear systems.
- Obtain the State Space Modeling for linear time-invariant systems.
- Solve system state equations.
- Analyze the system stability.
- Apply optimal control to statement of the optimal control problems.
- Design an adaptive control

TEXT BOOKS:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
3. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.

REFERENCE BOOKS:

1. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw-Hill Companies, 1997.
2. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003
3. T. Kailath, T., Linear Systems, Perntice Hall, Englewood Cliffs, NJ, 1980.
4. N. K. Sinha , Control Systems, New Age International, 3rd edition, 2005**.**
5. K.J.Astrom and Bjorn Wittenmark, Adaptive control, Pearson Edu., 2nd Edn
6. Sankar Sastry, Adaptive control.

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RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS (ELECTIVE-II)

Objectives:

The objectives of this course include:

- To learn about the basic reliability concepts like probability theory, distribution function and network modelling.
- To know about different reliability functions and time dependent reliability evaluation of different networks.
- To know about Markov modelling and component repairable models for frequency and duration.
- To study about the reliability applications to power systems.

UNIT–I BASICS OF PROBABILITY THEORY, DISTRIBUTION & NETWORK MODELLING

Basic Probability Theory – Rules for Combining Probabilities of Events – Bernoulli's Trials – Probability Density and Distribution Functions – Binomial Distribution – Expected Value and Standard Deviation of Binomial Distribution. Analysis of Series, Parallel, Series-Parallel Networks – Complex Networks – Decomposition Method.

UNIT–II RELIABILITY FUNCTIONS

Reliability Functions F(T), F(T), R(T), H(T) and Their Relationships – Exponential Distribution – Expected Value and Standard Deviation of Exponential Distribution – Bath Tub Curve – Reliability Analysis of Series Parallel Networks Using Exponential Distribution – Reliability Measures MTTF, MTTR, MTBF.

UNIT–III MARKOV MODELLING AND FREQUENCY & DURATION TECHNIQUES

Markov Chains – Concept of Stochastic Transitional Probability Matrix, Evaluation of Limiting State Probabilities – Markov Processes One Component Repairable System – Time Dependent Probability Evaluation Using Laplace Transform Approach – Evaluation of Limiting State Probabilities Using Stpm – Two Component Repairable Models.

Frequency and Duration Concept – Evaluation of Frequency of Encountering State, Mean Cycletime, For One , Two Component Repairable Models – Evaluation of Cumulative Probability and Cumulative Frequency of Encountering of Merged States.

UNIT–IV APPLICATIONS TO GENERATING SYSTEMS

Generation System Reliability Analysis: Reliability Model of a Generation System– Recursive Relation for Unit Addition and Removal – Load Modeling - Merging of Generation Load Model – Evaluation of Transition Rates for Merged State Model – Cumulative Probability, Cumulative Frequency of Failure Evaluation – LOLP, LOLE, LOEE.

UNIT–V APPLICATIONS TO NETWORK

Transmission & Distribution System Reliability Analysis: System and Load Point Reliability Indices – Weather Effects on Transmission Lines, Weighted Average Rate and Markov Model. Basic Techniques - Radial Networks – Evaluation of Basic Reliability Indices, Performance Indices – Load Point and System Reliability Indices – Customer Oriented, Loss and Energy Oriented Indices -Examples.

Outcomes:

After completion of the course the student will able to;

- Understand the basic reliability concepts like probability theory, distribution function and network modeling.
- Know about different reliability functions and time dependent reliability evaluation of different networks.
- Understand concept of Markov modeling and component repairable models for frequency and duration.
- Know about the reliability applications to power systems.

TEXT BOOKS:

1. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.
2. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
3. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York, reprinted in India by B.S.Publications, 2007.

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POWER SYSTEM DEREGULATION
(ELECTIVE – II)

Objectives:

The objectives of this course include:

- To learn about key issues of restructured power systems and its financial matters.
- To get knowledge on cost analysis, information on system operator and its duties.
- To know about ATC, TTC and different ancillary services.
- To learn about different cost allocation method in the power systems.

UNIT-I: KEY ISSUES IN ELECTRIC UTILITIES

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT-II: OPEN ACCESS SAME-TIME INFORMATION SYSTEM (OASIS) & MARKET POWER

Structure of OASIS - Posting of Information – Transfer capability on OASIS. Market Power: Introduction - Different types of market Power – exercising of Market Power - Examples.

UNIT-III: AVAILABLE TRANSFER CAPABILITY (ATC) & ELECTRICITY PRICING

Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow. Electricity Pricing: Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

UNIT-IV: POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT

Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets – Operational Planning Activities of a GENCO.

UNIT-V: TRANSMISSION COST ALLOCATION METHODS & ANCILLARY SERVICES MANAGEMENT

Introduction - Transmission Cost Allocation Methods : Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods. Ancillary Services Management: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

Outcomes:

After completion of the course the student will able to;

- Understand the key issues of restructured power systems and its financial matters.
- Know about cost analysis, information on system operator and its duties.
- Know about ATC, TTC and different ancillary services.
- Understand about different cost allocation method in the power systems.

TEXT BOOKS :

1. Kankar Bhattacharya, Math H.J. Boller and Jaap E.Daalder, Operation of Restructured Power System, Kulwer Academic Publishers, 2001.
2. Mohammad Shahidehpour and Muwaffaq alomoush, Restructured Electrical Power Systems, Marcel Dekker, Inc., 2001.

REFERENCE BOOKS:

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England.

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SWITCHED MODE POWER CONVERTERS
(ELECTIVE – II)

Objectives:

- To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.
- To make the student to analyze and control the various power converter circuits

UNIT I DC-DC CONVERTERS
Principles of stepdown and stepup converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHING MODE POWER CONVERTERS
Analysis and state space modeling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS
Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control .

UNIT IV DC-AC CONVERTERS
Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS
Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Text Book:

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
2. Kjeld Thorborg, “Power Electronics – In theory and Practice”, Overseas Press, First Indian Edition
2005.

REFERENCES:

1. Philip T Krein, “ Elements of Power Electronics”, Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design- Third Edition- John Wiley and Sons- 2006
3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.

Outcomes:

Upon completion of this course,

- The student learns the fundamental concepts of DC - DC Converters
- The student can analyze and control the various power converter circuits.

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ELECTICITY ACT AND COSTING OF ELECTRICAL SYSTEMS
(ELECTIVE – III)

Objective:

The student will be able to learn about:

- Domestic and Industrial wiring estimation
- Coasting and Contracting types
- Estimate the Transmission line, Overhead distribution and underground distribution based on IE Rules.

Unit-I Electrical Wiring

Types of wires Different types of wiring system and wiring procedure Merits, demerits and comparison of different types of wiring, Different types and specifications of wiring materials, Accessories and wiring tools Domestic and industrial panel wiring I.E. rules for wiring, including Electricity supply act-1948 Different types of wiring circuits.

Unit– II Estimating, Costing and Contracting

Estimation and estimation tools. Electrical Schedule of rates, catalogues, Survey and source selection, Recording estimates, Quantity and cost of material required. Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Types of contract system. Tendering procedure and preparation of simple tender, Earnest Money Deposit, Security Deposit Schedule of rates (S.O.R.)

Unit– III Estimating and Costing of Domestic and Industrial wiring

Layout for domestic Wiring, Load calculation , Cable selection Earthing Selection of switchgear. Overall Estimating and costing, Layout for industrial Wiring, Load calculation, Cable selection, Earthing Selection of switchgear. Overall Estimating and costing.

Unit-IV Estimation of Overhead Transmission line

Transmission lines, Line supports, Factors governing height of pole, Conductor materials, size of conductor for overhead, Transmission line: cross arms, pole brackets and clamps, guys and stays, conductors configuration spacing and clearances, span lengths, overhead line insulators, insulator materials lightning arrestors, erection of supports, setting of stays, Earthling of lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between supports conductors, I.E. rules pertaining to LV transmission line

Unit- V Estimation of Distribution line Underground Distribution System

Describe Method of installation of service connection (1-phase and 3-phase), observing I.E. rules, Overhead distribution system. Materials and accessories required for the overhead distribution system. Estimate for 440 V, 3-phase, 4 wires or 3 wires overhead distribution system. Types of service connections, Method of installation of service connection(1-phase and 3-phase), I.E. rules pertaining to overhead lines and service connection

Underground distribution system. Materials and accessories required for underground distribution system. Estimate for 440 V, 3-phase, 4 wires or 3 wires underground distribution system. I.E. rules pertaining to underground system and service

Outcomes:

The student should able to:

1. Prepare an estimate of quantity and cost of the material for a electrical project
2. Prepare detail estimate and costing of Residential and commercial Electrical Installations
3. Test Residential, commercial and Industrial Electrical Installation
4. Prepare detail estimate and costing of a transmission line/Overhead and underground distribution project
5. Prepare estimates for repairs and maintenance of electrical devices and equipment.

TEXT BOOKS:

1. Electrical Design, estimating & Costing aina, K. B. and Bhattacharya,S.K New Age International (p) Limited, New Delhi
2. Electrical Estimating & costing Uppal, S L New Age International (p) New Delhi

REFERENCE BOOKS:

1. Electrical Installation Estimating & Costing Gupta, J.B. S. K. Kataria & Sons, New Delhi
2. Relevant IS Code for-service line connection, laying of cable, wiring installation NBC National Building Code- Vol-IV
3. E. rules for wiring, Electricity supply act-1948. Bureau of Indian Standards Electricity supply act-1948

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HIGH VOLTAGE ENGINEERING
(ELECTIVE – III)

Objectives:

The objectives of this course include:

- To learn about detailed analysis of breakdown occur in gaseous, liquids and solid dielectrics.
- To study about generation and measurement of high voltage and current.
- In addition to learn about high voltage testing methods.

UNIT-I BREAK DOWN IN GASEOUS, LIQUID & SOLID DIELECTRICS

Introduction to HV Technology, Need for Generating High Voltages in Laboratory. Industrial Applications of High Voltage, Electrostatic Precipitation, Separation.

Gases As Insulating Media, Collision Process, Ionization Process, Townsend’s Criteria Of Breakdown in Gases, Paschen’s Law, Liquid As Insulator, Pure and Commercial Liquids, Breakdown in Pure and Commercial Liquids.

Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Breakdown of Solid Dielectrics in Practice, Breakdown in Composite Dielectrics, Solid Dielectrics Used in Practice.

UNIT–II GENERATION OF HV AC AND DC VOLTAGES

HV AC-HV Transformer: Need for Cascade Connection and Working of Transformers Units Connected in Cascade. Series Resonant Circuit- Principle of Operation and Advantages - Tesla Coil - HV DC- Voltage Doubler Circuit, Cockroft- Walton Type High Voltage DC Set - Calculation of High Voltage Regulation, Ripple and Optimum Number of Stages for Minimum Voltage Drop.

UNIT–III GENERATION OF IMPULSE VOLTAGES

Introduction to Standard Lightning and Switching Impulse Voltages - Analysis of Single Stage Impulse Generator-Expression for Output Impulse Voltage - Multistage Impulse Generator Working of Marx Impulse Generator, Rating of Impulse Generator - Components of Multistage Impulse Generator - Triggering of Impulse Generator By Three Electrode Gap Arrangement - Trigatron Gap and Oscillograph Time Sweep Circuits, Generation of Switching Impulse Voltage - Generation of High Impulse Current.

UNIT–IV MEASUREMENT OF HIGH VOLTAGES:

Electrostatic Voltmeter-Principle, Construction and Limitation - Chubb and Fortescue Method for HV AC Measurement - Generating Voltmeter- Principle, Construction - Series Resistance Micro Ammeter for HV DC Measurements - Standard Sphere Gap Measurements of HVAC, HVDC And Impulse Voltages - Factors Affecting The Measurements - Potential Dividers-Resistance Dividers Capacitance Dividers Mixed RC Potential Dividers. Measurement of High Impulse Currents-Rogowsky Coil.

UNIT–V HIGH VOLTAGE TESTING TECHNIQUES

Dielectric Loss and Loss Angle Measurements Using Schering Bridge - Transformer Ratio Arms Bridge. Need for Discharge Detection and PD Measurements Aspects - Factors Affecting The Discharge Detection, Discharge Detection Methods-Straight and Balanced Methods. Tests on Isolators, Circuit Breakers, Cables, Insulators and Transformers.

TEXT BOOKS:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 4th Edition, 2004.
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.

REFERENCE BOOKS:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition, 2000.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Technology by L. L. Alston, OXFORD University Press, Second Edition, 2009.
4. High Voltage Engineering Problems & Solutions, R. D. Begamudre, New Age International Publishers, First Edt., 2010

Outcomes:

After completion of the course, the student will able to;

- Understand the detailed analysis of breakdown occur in gaseous, liquids and solid dielectrics.
- Know about generation and measurement of high voltage and current.
- Understand about high voltage testing methods.

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INTRODUCTION TO DISTRIBUTED GENERATION AND SMART GRID
(ELECTIVE – III)

Objectives:

The objectives of this course include:

- To study about various types of power generation resources to be connected in distributed generation system.
- To know the architecture of smart grid with integrated distribution generation with various plants.
- To get the knowledge on smart grid and how will gain the efficient power to the distributed end.

UNIT-I Introduction to Distributed Generation and Smart Grid

The development of the electrical power system - Value of distributed generation and network pricing – Smart Grids - Reasons for distributed generation - The future development of distributed generation - Distributed generation and the distribution system - Technical impacts of generation on the distribution system - Economic impact of distributed generation on the distribution system - Impact of distributed generation on the transmission system - Impact of distributed generation on central generation.

UNIT-II Distributed generation plant

Combined heat and power plants - Renewable energy generation - Small-scale hydro generation - Wind power plants - Offshore wind energy - Solar photovoltaic generation

UNIT-III Distributed generators and their connection to the system

Distributed generators - Synchronous generators - Induction generators - Doubly fed induction generator - Full power converter (FPC) connected generators - System studies - Load flow studies in a simple radial system - Load flow studies in meshed systems - Symmetrical fault studies - Unbalanced (asymmetrical) fault studies - Case studies - Steady-state voltages under peak and minimum loading - Electromagnetic transient studies

INTELLIGRID ARCHITECTURE FOR THE SMARTGRID:
Introduction- Launching intelligrid - Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT-IV DC DISTRIBUTION
AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

UNIT-V SMART GRID TO EVOLVE A PERFECT POWER SYSTEM

Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.
Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

Outcomes: After completion of the course the student will able to;

- Understand about the distribution generation system connected with various power generation plants.
- Gain the knowledge on smart grid by various techniques for better efficiency in transmitting the power.
- Know about the integration of distribution generation with various plants to the smart grid.

TEXT BOOKS:

1. "Distributed Generation" by N.Jenkins, J.B. Ekanayake & G. Strbac
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Janaka Ekanayake, Kithsiri Liyanage,Jianzhong.Wu, Akihik Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

REFERENCES:

1. IEEE 1547. IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems; 2003.
2. James Momoh, "Smart Grid :Fundamentals of Design and Analysis"- Wiley, IEEE Press, 2012.
3. Horlock J.H. Cogeneration: Combined Heat and Power Thermodynamics and Economics. Oxford: Pergamon Press; 1987.

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ENERGY AUDITING & DEMAND SIDE MANAGEMENT (ELECTIVE – III)

Objectives:

The objectives of this course include:

- To learn about energy consumption and situation in India
- To learn about Energy Auditing.
- To aware of Energy Measuring Instruments.
- To understand the Demand Side Management.

UNIT - I INTRODUCTION TO ENERGY AUDITING

Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation. Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

UNIT - II ENERGY EFFICIENT MOTORS & POWER FACTOR IMPROVEMENT

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance - over motoring - motor energy audit. Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f. , p.f motor controllers.

UNIT – III LIGHTING AND ENERGY MEASURING INSTRUMENTS

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Measuring Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's

UNIT – IV ENERGY ECONOMIC ANALYSIS

The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems.

UNIT – V DEMAND SIDE MANAGEMENT

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning. Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs.

TEXT BOOK:

1. Industrial Energy Management Systems, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York.

1. **Fundamentals of Energy Engineering -** Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
2. **Electrical Power distribution**, A S. Pabla, TMH, 5th edition, 2004
3. **Demand Side Management,** Jyothi Prakash, TMH Publishers.

REFERENCES:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
4. Energy management hand book by W.C.Turner, John wiley and sons
5. Energy management and good lighting practice : fuel efficiency- booklet12-EEO
6. **Recent Advances in Control and Management of Energy Systems**, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
7. **Energy Demand – Analysis, Management and Conservation,** Ashok V. Desai, Wiley Eastern, 2005.
8. **Hand book on energy auditing** - TERI (Tata Energy Research Institute)

Outcomes:

After completion of the course the student will able to;

- Understand the concepts of energy auditing
- Analyze efficiency of motors.
- Understand the concept of Demand side management

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (Chemical Engineering) 2015-16
COURSE STRUCTURE & SYLLABUS

I YEAR I SEMESTER

S.No	Code	Subject	L	P	C
1	15A55101	English	4	-	4
2	15A51101	Mathematics -I	4	-	4
3	15A53102	Physical Chemistry	4	-	4
4	15A01101	Environmental Studies	4	-	4
5	15A01103	Engineering Mechanics & Strength of Materials	4	-	4
6	15A53104	Physical Chemistry Lab	-	4	2
7	15A35101	Engineering Workshop & IT Workshop	-	4	2
8	15A55102	English Language Communication Skills Lab.	-	4	2
		Total	**20**	**12**	**26**

I YEAR II SEMESTER

S.No	Code	Subject	L	P	C
1	15A55201	Technical Communication and Presentation Skills	4	-	4
2	15A51201	Mathematics -II	4	-	4
3	15A52201	Engineering Physics	4	-	4
4	15A05201	Problem Solving & Computer Programming	4	-	4
5	15A03202	Engineering Graphics	4	-	4
6	15A08201	Introduction to Chemical Engineering	4	-	4
7	15A05202	Computer Programming Lab	-	4	2
8	15A52202	Engineering Physics Lab	-	4	2
		Total	**24**	**8**	**28**

B.Tech (Chemical Engineering)-COURSE STRUCTURE

II YEAR I SEMESTER

S.No	Code	Subject	L	P	C
1	15A51301	Mathematical Methods	4	-	4
2	15A24301	Electrical and Electronics Engineering	4	-	4
3	15A53301	Organic Chemistry	4	-	4
4	15A08301	Materials Science for Chemical Engineers	4	-	4
5	15A08302	Momentum Transfer	4	-	4
6	15A08303	Chemical Process Calculations	4	-	4
7	15A54302	Human Values & Professional Ethics (Audit)	2	-	0
8	15A08304	Momentum Transfer Lab	-	4	2
9	15A53302	Organic Chemistry Lab	-	4	2
		Total	**26**	**8**	**28**

II YEAR II SEMESTER

S.No	Code	Subject	L	P	C
1	15A51401	Probability and Statistics	4	-	4
2	15A53401	Analytical Chemistry	4	-	4
3	15A08401	Process Instrumentation	4	-	4
4	15A08402	Process Heat Transfer	4	-	4
5	15A08403	Chemical Engineering Thermodynamics	4	-	4
6	15A08404	Mechanical Operations	4	-	4
7	15A08405	Process Heat Transfer Lab	-	4	2
8	15A08406	Mechanical Operations Lab	-	4	2
		Total	**24**	**8**	**28**

B.Tech (Chemical Engineering)-COURSE STRUCTURE

III YEAR I SEMESTER

S.No	Code	Subject	L	P	C
1	15A08501	Energy Engineering	4	-	4
2	15A08502	Process Dynamics & Control	4	-	4
3	15A08503	Phase and Chemical Equilibria	4	-	4
4	15A08504	Chemical Reaction Engineering-I	4	-	4
5	15A08505	Mass Transfer Operations-I	4	-	4
6	15A08506	Chemical Technology	4	-	4
7	15A08507	Energy & Environmental Engineering Lab	-	4	2
8	15A08508	Process Dynamics & Control Lab	-	4	2
		Total	**24**	**8**	**28**

III YEAR II SEMESTER

S.No	Code	Subject	L	P	C
1	15A08601	Biochemical Engineering	4	-	4
2	15A08602	Process Modeling and Simulation	4	-	4
3	15A08603	Mass Transfer Operations – II	4	-	4
4	15A08604	Chemical Reaction Engineering-II	4	-	4
5	15A08605	Chemical Plant Design and Economics	4	-	4
6	 15A08606a 15A08606b 15A08606c 15A08606d	**(OpenElective)** Basics of Nanotechnology Green Technology Nuclear Engineering Solid Waste Management	4	-	4
7	15A08607	Chemical Reaction Engineering Lab	-	4	2
8	15A08608	Mass Transfer Operations Lab	-	4	2
9	15A55601	Advanced Communication Skills Lab (Audit)	-	4	0
		Total	**24**	**12**	**28**

B.Tech (Chemical Engineering)-COURSE STRUCTURE

IV YEAR I SEMESTER

S.No	Code	Subject	L	P	C
1	15A08701	Transport Phenomena	4	-	4
2	15A08702	Chemical Process Equipment Design	4	-	4
3	15A08703	Optimization of Chemical Processes	4	-	4
4	15A08704	Separation Techniques for Bioprocessing	4	-	4
5	15A08705	Industrial Engineering and Management	4	-	4
6	15A08706	**Elective – I (Through MOOC)**	4	-	4
7	15A08707	Process Equipment Design& Drawing Lab	-	4	2
8	15A08708	Simulation Lab	-	4	2
9	15A08709	Project work-A	-	-	-
		Total	**24**	**10**	**28**

IV YEAR II SEMESTER

S.No	Code	Subject	L	P	C
1	 15A08801a 15A08801b 15A08801c	**Elective-II** Design and analysis of Experiments Industrial Safety & Hazard Management Chemical Plant Utilities	4	0	4
2	 15A08802a 15A08802b 15A08802c	**Elective-III** Industrial Pollution Control Engineering Computational fluid dynamics Introduction to statistical thermodynamics	4	0	4
3	 15A08803a 15A08803b 15A08803c	**Elective-IV** Fluidization Engineering Interfacial Engineering Polymer Technology	4	0	4
4	 15A08804a 15A08804b 15A08804c	**Elective –V** Petroleum Refining and Petrochemicals Food Processing Technology Rheology of Polymers	4	0	4

	15A08804d	Corrosion Engineering			
5	15A08805	Seminar	0	4	2
6	15A08806	Project Work	0	20	10
		Total	**16**	**24**	**28**

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Theory P – Practical/Drawing C – Credits

College Vision:

- Committed to expanding the horizon and inspiring young minds towards academic excellence.
- Aims at scaling new heights through advanced research and innovative technologies to keep pace with the changing needs of industry and society at large.

College Mission:

- To identify and implement proven, prevention-oriented, forward-looking solutions to critical scientific and technological problems.
- To make technology a principal instrument of economic development of the country and to improve the quality of life of the people through technological education, innovation, research, training and consultancy.

Department of Chemical Engineering:

The Department of Chemical Engineering was established in 1989 with an intake of 30 students and the current intake is 60 students. The department has recently celebrated its Silver Jubilee in the year 2014. The department is accredited with NBA for three years during 2005-2008 and for two years during 2013-2015 and offers UG, PG, MS and PhD programs. The department has good infrastructural facilities for all the programs and maintains excellent academic standards. The faculty members are actively involved in research and development activities of the department. The department has research collaborations with reputed organizations like BRNS, BHEL, UCIL, etc.

Department Vision:

- To become a globally recognized Chemical Engineering program coupled with excellence in education, training, research and consultancy in Chemical Engineering and to serve as a valuable resource for industry and society.
- To inspire young minds towards academic excellence through advanced research and innovative technologies coupled with professional ethics and human values.

Department Mission:

- To provide students with broad curriculum in the basic sciences, process systems and design, unit operations and modern experimental and computing techniques to make them competent and practicing chemical engineers without compromising professional ethics and moral values.
- To develop infra-structure that promotes internationally recognized research, creativity and an entrepreneurial culture.
- To foster ethical leadership and activities those support the administration, advancements, governance and regulation of chemical engineering education and the engineering profession.
- To undertake collaborative projects/consultancy works which provide opportunities for long - term interaction with academia, industry and other research organizations.

Program Outcomes:

*The program outcomes for **Chemical Engineering** are:*

PO 1: An ability to apply the knowledge of Mathematics, Science, Engineering and fundamentals for understanding and solving of complex Engineering problems in Chemical Engineering

PO 2: Be capable of designing and conducting experiments and be able to analyze and interpret data

PO 3: An ability to design systems, components, and processes to meet desired needs applicable to Chemical Engineering within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability and sustainability

.PO 4: An ability to function effectively as individual, as a member or leader in diversified teams and multidisciplinary areas.

PO 5: Ability to identify, formulate, and solve Chemical Engineering related problems.

PO 6: An understanding of professional and ethical responsibility to the chemical engineering profession and to society at large

PO 7: An ability to communicate effectively by conveying technical material through both formal written medium and through oral presentations.

PO 8: To attain broad education necessary to understand the impact of chemical engineering related solutions in a global, economic, environmental and societal context.

PO 9: An ability to recognize the need for continuous professional development through lifelong learning

PO 10: Ability to possess knowledge of contemporary chemical engineering related issues

PO 11: An ability to use the techniques, skills, and modern engineering tools necessary for chemical engineering practice.

PO 12: Ability to design, analyze and control physical and chemical processes. (Project Management and Finance)

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JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester	L	P	C
	4	0	4

ENGLISH (15A55101)
(Common to all Branches)

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

SYLLABUS:

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

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**

JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester	L	P	C
	4	0	4

MATHEMATICS – I (15A51101)

(Common to All Branches)

Objectives

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

UNIT – I

Exact, linear and Bernoulli equations, Applications to first order equations.

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.

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.

Outcomes:

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

JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester	L	P	C
	4	0	4

PHYSICAL CHEMISTRY (15A53102)

Course Objectives:

- To acquire basic knowledge of basic types of reactions
- To acquire knowledge about the mechanisms through which the chemical reactions proceed.
- To understand the impact of nature on metals.

Unit-I: Kinetics

Introduction to chemical kinetics-theories of reaction rates-Collision theories-Modified collision theory – Absolute reaction rate theory (Transition state theory)-reaction between ions, Chain reactions-Hydrogen and bromine, hydrogen and oxygen (Steady state treatment)-.explosion limits.

UNIT-II: Colloids

Definition of colloids, classification of colloids, solids in liquids (Sols) – properties, kinetics, optical and electrical, stability of colloids, protective action, Hardy-Schultze Law, Gold Number. Liquids in liquids (Emulsions) -Types of Emulsions, preparation, Emulsifier. Liquids in solids (Gels) – Classification, preparation & properties, Inhibition, General, applications of colloids.

UNIT-III: Catalysis

Definition-Homogeneous and heterogeneous Catalysis- Characteristics of a good catalyst-Theories of Catalysis: Intermediate compound formation theory and adsorption theory, relevant examples- Types of catalysis: Acid-base catalysis and enzymatic catalysis (10h)

Unit-IV: Surface Chemistry

Adsorption, characteristics of adsorption, physical & chemical adsorption, Langumuir adsorption isotherm, B.E.T. equation, BET plot, surface area determination of solids. Numerical calculations of surface area, Heterogenous catalysis, Mechanism of catalysis-Langmuir-Hinsel Wood mechanism of surface catalyzed reactions, Eley-Rideal mechanism surface catalysed reactions. Applications of catalysis in industry. (12h)

UNIT-V: 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: Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating. (12h)

Course Outcome:

The student may acquire enough knowledge on industrial processes and Products

BOOKS:

1. Quantitative analysis, R.A.Day & A.L. Underwood , 5th edition, Printice- Hall of India Pvt. Ltd., 2000.
2. Vogel's Text Book of Qualitative chemical analysis, J. Mendham, R.C.Denney, J. Darnes, M.J.K. Thomas, Persar education 6th edition, 2002.
3. Elements of Physical Chemistry-Peter Atkins, Oxford Uni.Press, 3rd Edition, 2010.

REFERENCES:

1. Atkin's Physical Chemistry – P. Atkins and J. De Paula, Oxford Univ.Press, 9th Edition, 2012
2 Instrumental lMethods of Chemical Analysis, Gurdeep R.Chatwal, Sham K.Ananad, Himalayha publishing House,5th Edition, 2012.
3. Advanced physical chemistry – Gurudeepraj, Goel Publishing House, 2000
4. Essentials of Physical Chemistry- Arun Bahl, B.S.Bahl and G.D.Tuli, S.Chand Publishers, New Delhi.

JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester	L	P	C
	4	0	4

ENVIRONMENTAL STUDIES (15A01101)
(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 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

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.

Outcomes:

- Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
- Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities.
- Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century
- Recognize the interconnectedness of — human dependence — on the earth's ecosystems
- Influence their society in proper utilization of goods and services.
- Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices.

JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester

L	P	C
4	0	4

ENGINEERING MECHANICS & STRENGTH OF MATERIALS (15A01103)

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 – Momentum of forces and its applications – Couples and Resultant of Force system – Equilibrium of System of Forces – Degree of Freedom – Free body diagrams – Types of Supports –Support reaction 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.

Centroid and Center of Gravity: Centroid of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia – parallel axis and perpendicular axis theorems – Moment 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 – III

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 – Resilence – Gradual, Sudden, impact and shock loadings – simple applications.

UNIT – IV

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 over changing 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 section of a beam.

UNIT – V

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 Hallow), 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.

TEXT BOOKS:

(1) Engineering Mechanics by Shames & Rao – Pearson Education
(2) Engineering Mechanics by Dr. R.K Bansal, Lakshmi Publications

(3) Strength of Materials by Ghosh & Datta, New Age Publishers
(4) Strength of Materials by B.C Punmia – laxmi publications

REFERENCES:

(1) Engineering Mechanics by Fedrinand L.Singer – Harper Collings publishers
(2) Engineering Mechanics by Shesigiri Rao, Universities Press, Hyderabad
(3) Engineering Mechanics by B.Bhattacharya, Oxford University Publications
(4) Engineering Mechanics by Rjasekharan , Vikas Publications
(5) Engineering Mechanics by S.Timoshenko, D.H Young and J.V Rao, Tata McGraw-Hill Company
(6) A Text book of strength of materials by R.K Bansal – Laxmi publications (p) Ltd, New Delhi
(7) Strength of Materials by R.Subramanian, Oxford University Press

JNTUA College of Engineering (Autonomous), Ananthapuramu

I Year B.Tech - I Semester	L	P	C
	0	4	2

PHYSICAL CHEMISTRY LAB (15A53104)

Course Objectives:
To confirm the formation and nature of the product in a chemical processes, the knowledge of some physical, chemical and instrumental methods is essential for a chemical engineer.

I. PHYSICAL CHEMISTRY LAB:
1. Determination of Specific rotation of substance by Polarimeter.
2. Study of inversion of Sucrose by Polarimetry.
3. Conductometric titration of Strong acid Vs Strong base.
4. Conductometric titration of Weak acid Vs Strong base.
5. Potentiometric titration between Potassium Dichromate and Ferrous iron.
6. Potentiometric Titration of Strong acid Vs Strong base
7. a)Determination of the specific rate (first order kinetics) of the hydrolysis of Methyl acetate by volumetric method.
   b) Study of first order kinetics(hydrolysis of methyl acetate by raising 10^{o}C
8. Study of Adsorption characteristics of acetic acid on Charcoal.
9. Estimation of critical solution temperature of Phenol-Water System.
10. Determination of Molecular weight of a given Polymer from Viscosity measurements.

(Any 10 experiments from the above list)

Course Outcomes

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

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.

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

Engineering & IT Workshop (15A35101)
(Common to All Branches)

Part – A: Engineering Workshop Lab

Objectives:

- Make the students correctly use measuring and marking tools
- Practice the correct use of hand tools
- Apply safe workshop practices when performing basic fitting, carpentry, tin smithy and electrical wiring skills
- Develop the fabrication skills among the students
- Read and interpret the component drawings
- Gain practical skills to apply student's knowledge of theory concepts in real time practice

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

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

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

Outcomes:

- Expected to improve practical skills
- Able to develop and fabricate the experimental setups for academic and research purposes.
- Able to assemble components for making various systems

PART – B: IT Workshop

Objectives:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- Disassemble and Assemble a Personal Computer and prepare the computer ready to use
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Install single or dual operating systems on computer

Preparing your Computer (4 weeks)

Task 1: Identify the internal parts of a computer of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram.

Task 2: 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. Students should record the process of assembling and trouble shooting a computer.

Task 3: 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: Students should record the various features that are supported by the operating system installed and submit it.

Productivity tools (3 weeks)

Task 5: 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 etc, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages etc at the end of the task. Students should submit a user manual of the word processor considered.

Task 6: 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 7: 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.

References:

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

Outcomes:

- Students attain complete knowledge of a computer i.e. hardware as well as operating systems.
- Students will be technically strong in using Word processors, Spreadsheets.
- Prepare Slide presentations that helps them in their career

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I Year B.Tech - I Semester	**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.

OBJECTIVES:

1. 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
2. To expose the students to a varied blend of self-instructional learner-friendly modes of language learning through computer-aided multi-media instruction.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence
5. 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

OUTCOMES :

- Develop linguistic and communicative competence through the development of the language skills.
- 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. 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.

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

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.

Outcomes:

- Turning out the students with a clear concept of communication like speaking convincingly, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation
- Getting them ready for placements and equipping them with readiness to implement their communication and Presentation skills at work place.

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

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

Objectives: Our emphasis will be more on conceptual understanding and application of Fourier series, Fourier, Z and Laplace transforms and solution of partial differential equations.

UNIT – I

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of 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.s

UNIT – V

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

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. 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.

Outcomes: The student gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and partial differential equations.

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I- Year B.Tech. II-Sem

L	P	C
4	0	4

ENGINEERING PHYSICS (15A52201)

(Common to Civil, Mechanical & Chemical Engg.)

Objectives:

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To understand and employ the concepts of waves & oscillations and acoustics to engineering applications.
- To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications.
- 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.
- 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.

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

Outcomes:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fiber optics.
- The concepts of types of waves and oscillations ,acoustics are highlighted
- The dielectric and magnetic response of materials are focussed.
- The importance of superconducting materials, nano and smart materials along with their engineering applications are well elucidated.
- 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.

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I Year B.Tech. II-Sem

L	P	C
4	0	4

PROBLEM SOLVING & COMPUTER PROGRAMMING (15A05201)

Course Objectives:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs
- To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- 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.

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.

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

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

ENGINEERING GRAPHICS (15A03202)

(Civil, EEE, ECE, CSE & Chemical)

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

Principles of orthographic projection, I and III angle projections –Conventions –Projections of points.

Unit –II

Projection of lines inclined to both planes –traces, Projection of plane figures inclined to both planes.

Unit –III

Projection of simple solids inclined to both planes.

Unit –IV

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

Unit –V

Isometric projections: Principles of pictorial representations-Isometric projection- Isometric scale-Isometric views- conventions- Isometric views of plane figures, solids-Isometric projection of objects with non isometric lines-Isometric projection of spherical parts.

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

INTRODUCTION TO CHEMICAL ENGINEERING (15A08201)

Unit-I

Introduction, Chemical Engineering in everyday life, Scaling up or down, Engineering applications of portable devices, challenges in petroleum sector, versatility of a Chemical Engineer, role of Chemical Engineers in Biomediacal Engineering, similarities in dissimilar applications.

Batch Processing, paint manufacture, transition from batch to continuous processing, Case study: Manufacture of Sulphuric acid, role of basic sciences in Chemical Engineering (Introduction) (Text Book 1)

Unit-II

Introduction, Unit operations, basic laws, units and dimensions, partial pressure, vapor pressure. Solutions, concentration measurements,humidityand saturation. Material and Energy balances.

Flow of fluids: Introduction, nature of fluid, viscosity, velocity profile, flow field, types of fluid motion, laminarand turbulent flow, flow of a fluid past a solid surface, Reciprocating, rotary, and centrifugal pumps(Text Book 2)

Unit-III

Heat transfer: Conduction, convection (omit correlations for calculation of heat transfer coefficients, heattransfer with change in phase) and radiation. Flow arrangement in heat exchangers, variation of fluidtemperatures in heat exchangers, heat transfer equipment (double pipe & Shell and tube heat exchanger),evaporation, long tube vertical type and forced circulation type evaporators, multiple effect evaporation,methods of feeding(Text Book 2)

Unit-IV

Mass transfer: Introduction - Diffusion, mass transfer operation, equipment for gas-liquid operations, contact patterns, classification of separation processes and applications, basic definitions of separation processes, VLE, LLE, boiling point diagram.(Text Book 2)

Unit-V:

Introduction to mechanical operations: Size reduction, filtration, basic differences between agitation and mixing.

Types of reactions and reactors.

Introduction to environmental pollution: types and their effect.

Safety in chemical process industries (case study on DDT, environmental hazards of a green project)(Text Book 1&2)

TEXT BOOK:

1. Introduction to chemical engineering by S. Pushpavanam, PHI, 2012.
2. Introduction to chemical engineering by S. K. Ghosal, S. K. Sanyal and S. Dutta, TMH publications, 1993.

REFERENCE:

1. Unit operations in chemical engineering by W.L. McCabe and J.C. Smith and Peter Harriott, McGraw Hill5th ed. 1993.

Objectives:

1. To impart the role of Chemical Engineers in everyday life and the importance of Chemical Engineering.
2. To learn the role of various Unit Operations and Unit Processes in Chemical industries.
3. To learn the role of Chemical Engineers in environmental and safety aspects in process industries.

Outcomes:

The student will be able to explain:

1. The role of Chemical Engineers in everyday life and the importance of Chemical Engineering.
2. The role of various Unit Operations and Unit Processes in Chemical industries.
3. The role of Chemical Engineers in environmental and safety aspects in process industries.

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I Year B.Tech II Semester	L	P	C
	0	4	2

COMPUTER PROGRAMMING LAB (15A05202)

(Common to Civil, EEE, ME, CSE, Chemical)

Objectives:

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

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 with C, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

Outcomes:

- Able to have fundamental concept.
- Able to write, compile and debug programs in C language.
- Able to formulate problems and implement algorithms in C.
- Able to effectively choose programming components that efficiently solve computing problems in real-world.
- Able to use different data types in a computer program.
- Able to design programs involving decision structures, loops and functions.

JNTUA College of Engineering (Autonomous), Ananthapuramu

I- Year B.Tech. II-Sem

L	P	C
4	0	4

ENGINEERING PHYSICS LABORATORY (15A52202)

Objectives:

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To understand and employ the concepts of waves & oscillations and acoustics to engineering applications.
- To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications.
- 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.
- To enlighten the characterization of materials by different techniques, the periodic arrangement of atoms in crystals, Bragg's law and X-Ray diffraction technique

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

Outcomes:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fiber optics.
- The concepts of types of waves and oscillations ,acoustics are highlighted
- The dielectric and magnetic response of materials are focussed.
- The importance of superconducting materials, nano and smart materials along with their engineering applications are well elucidated.
- 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.

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. I-Sem

L	P	C
4	0	4

MATHEMATICAL METHODS (15A51301)

Objectives:

- 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.

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.

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

JNTUA College of Engineering (Autonomous), Ananthapuramu

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

ELECTRICAL AND ELECTRONICS ENGINEERING (15A24301)

(Common to Mech. Engg. & Chemical)

PART – A

ELECTRICAL ENGINEERING

OBJECTIVES:

- To understand the basic concepts of different types of electrical machines and their performance.
- To understand the basic types of Circuits, DC generators & motors, Transformers, Induction motors and their performance aspects.
- To understand the concepts of semiconductors, various types of semiconductors, diodes rectifiers, transistors, amplifiers and number systems for digital electronics

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.

PART-B

ELECTRONICS ENGINEERING

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 and Operations of Transistors, Input-Output Characteristics of BJT Configurations, Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier 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,

Text Books:

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

Outcomes:

1: Students shall gain knowledge on basics of Electrical Circuits, DC Machines, Transformers, Induction motors, Alternators.

2: Students shall gain knowledge on various types of semiconductor devices, transistors, amplifier and digital electronics.

3: Students shall be able to apply the knowledge of Electrical and Electronic systems real-world Chemical Engineering problems and applications.

JNTUA College of Engineering (Autonomous), Ananthapuramu

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

ORGANIC CHEMISTRY (15A53301)

Objectives:

- The Mechanism of organic chemical reaction is essential to synthesis new organic compounds in drug and pharmaceutical industries. In order to study their kinetics of reactions to regulate the process for optimization of production of drugs and pharmaceutical, the principles of organic chemistry are essential.
- For chemical engineer to carry out a processes industrially for the manufacture of drgus and pharmaceuticals, Comprehension on basic reactions, reagents and their applications is needed.
- He/She should know the electronic behavior of organic molecules, their special and geometrical arrangement of functional groups.
- He/She should have insight of reaction mechanisms for different types of reactions.
- He/She must have knowledge to conduct the most common reactions like addition, substitution, oxidation, reduction etc., on large scale.

UNIT I:

Polar effects – Inductive effect, electromeric effect, resonance, hyper conjugation, steric hindrens, and aromaticity – examples.

UNIT II:

Electrophilic reactions: a) Friedel-Craft reaction b) Riemer- Teimenn Reaction c) Backmann rearrangement.

Nucleophillic reactions : a) Aldol condensation b) Perkin Reaction c) Benzoin condensation.

UNIT – III:

Stereo isomerism; Optical isomerism; Symmetry and chirality; Optical isomerism in lactic acid and tartaric acid; Sequence rules; Enantiomers, diastereomers; Geometrical Isomerism; E-Z system of nomenclature, conformational analysis of ethane and Cyclohexane.

UNIT.IV

Some Reagents of Synthetic importance:

Preparation and applications of Aluminum Chloride, N-Bromosuccnamide (NBS), Diazomethane, Dicyclohexylcarbodiimide(DCC), Potassiumtertiarybutoxide and Grignard reagent

UNIT.V:

Some Useful Reactions in Organic Synthesis:

i). Protection of functional groups: Hydroxyl, Carbonyl and amino groups

ii). Oxidation: Oxidation of alcohols and carbonyl compounds with suitable examples

iii). Reduction: Reduction of double and triple bonds and carbonyl compounds with suitable examples.

TEXTBOOKS:

1. Text book of Organic Chemistry – Morrsion and Boyd.
2. Organic Reaction Mechanisms by VK Ahulwalia and RK Parashar

REFERENCES:

1. Reaction mechanism – Peter Skyes.
2. Text book of Organic Chemistry – P.L. Soni.
3. Organic Chemistry Vol- I-IL. Finar.
4. Reactions and Reagents – O.P. Agrawal.
5.A Text Books of Organic Chemistry- Bahl and Arun Bahl, S. Chand company, New Delhi
6. Polymer Science and Technology- Hema Singh, Acme Learning, New Delhi

Outcomes:

1. Will be able to understand the essentiality of organic chemical reaction to synthesis new organic compounds in drug and pharmaceutical industries.
2. To gain knowledge on basic reactions, reagents and their applications.
3. To gain knowledge on electronic behavior of organic molecules, their special and geometrical arrangement of functional groups.
4. To gain necessary knowledge to conduct the most common reactions like addition, substitution, oxidation, reduction etc., on large scale.

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. I-Sem

L	P	C
4	0	4

MATERIALS SCIENCE FOR CHEMICAL ENGINEERS (15A08301)

UNIT- I

Introduction:Engineering Materials – Classification – levels of structure.

Crystal Geometry and Structure Determination: Space lattice and Unit cell. Bravais lattices, crystal systems with examples. Lattice coordinates, Miller indices, Bravais indices for directions and places: crystalline and non crystalline solids; ionic, covalent and metallic solids; packing efficiency, coordination number; structure determination by Bragg's X-ray diffraction and powder methods.

UNIT -II

Crystal Imperfection: Point defects, line defects-edge and screw dislocation, Berger's circuit and Berger's vectors, dislocation reaction, dislocation motion, multiplication of dislocations during deformation , role of dislocation on crystal properties; surface defects, dislocation density and stress required to move dislocations.

UNIT -III

Basic thermodynamic functions: phase diagrams and phase transformation: Primary and binary systems-general types with examples; tie line& lever rule, non equilibrium cooling: phase diagrams of Fe-Fe_3-C, Pb-Sn, Cu-Ni systems.

Phase transformations in Fe-Fe_3-C steels, Time-Temperature-Transformation (TTT) curves for eutectoid steels and plain carbon steels; effect of alloying elements on properties of steels; types of steels, alloys and other metals used in chemical industry.

UNIT -IV

Elastic, an elastic and plastic deformations in solid materials; rubber like elasticity, visco elastic behavior (models); shear strength of real and perfect crystals, work hardening mechanisms, cold working, hot working; dynamic recovery, recrystallization, grain growth, grain size and yield stress, Brief description of heat treatment in steels.

Magnetic materials: Terminology and classification, magnetic moments due to electron spin, ferro-magnetism and related phenomena, domain structure, hysteresis loop, soft and hard magnetic materials.

UNIT- V

Fracture in ductile and brittle materials, creep: mechanism of creep and methods to reduce creeping in materials, creep rates and relations. Fatigue-mechanisms and methods to improve fatigue resistance in materials. Composite materials: types; stress-strain relations in composite materials, applications.

Oxidation and Corrosion: Mechanisms of oxidation, oxidation resistant materials, principles and types of corrosion, protection against corrosion.

TEXT BOOK:

1. Materials Science and Engineering, 5thed. V. Raghavan, PHI Learning Pvt. Ltd., New Delhi, 2009.

REFERENCES:

1. Elements of Materials Science, L.R. Van Vlack,
2. Science of Engineering Materials, vols. 1&2, ManasChanda, McMillan Company of India Ltd.

Objective: This course will help students to learn about the relationship between structure and properties of materials, application of various classes of materials including metals, ceramics, polymers.

Outcome: This course will enable the student to learn about proper selection of materials for designing various equipment in a chemical industry.

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. I-Sem

L	P	C
4	0	4

MOMENTUM TRANSFER (15A08302)

UNIT- I

Unit operations and unit processes, unit systems, basic concepts, nature of fluids, hydrostatic equilibrium, applications of fluid statics.

Fluid flow phenomena-Laminar flow, Shear rate, Shear stress, Rheological properties of fluids, Turbulence, Boundary layers.

UNIT- II

Basic equation of fluid flow –Mass balance in a flowing fluid; continuity equation, differential momentum balance; equations of motion, Macroscopic momentum balances, Bernoulli equation.

Incompressible Flow in pipes and channels- shear stress and skin friction in pipes, laminar flow in pipes and channels, turbulent flow in pipes and channels, friction from changes in velocity or direction.

UNIT- III

Dimensional analysis: Buckingham π Theorem and Rayleigh's method.

Flow of compressible fluids- Definitions and basic equations, Processes of compressible flow, Isentropic flow through nozzles, adiabatic frictional flow, and isothermal frictional flow.

UNIT -IV

Flow past immersed bodies, Drag and Drag coefficient, friction in flow through beds of solids, Kozeny-Carman, Blake-Plummer and Ergun equations, and motion of particles through fluids.

Fluidization: Conditions for fluidization, Minimum fluidization velocity, Types of fluidization, Expansion of fluidized beds, Applications of fluidization, Continuous fluidization:Slurry and pneumatic transport.

UNIT- V

Transportation and Metering of fluids: Pipes, fittings and valves, Fluid- moving machinery, Fans, blowers, and compressors.

Measurement of flowing fluids:Variable head meters- Orifice meter, Venturi meter, Pitot tube; Area meter- Rota meter.

TEXTBOOKS

1. Unit Operations of Chemical Engineering by W.L.McCabe, J.C.Smith& Peter Harriot, McGraw-Hill, 7thed, 2007

REFERENCES:

1. Transport processes and unit operations by Christie J. Geankoplis, PHI
2. Unit operations, Vol-1 –Chattopadhya, Khanna publishers
3. Principles of Unit Operations, Foust *et al*, 2nd ed., John Wiley, 1999
4. Chemical Engineering, Vol-I, Coulson and Richardson, Pergamon Press.

OBJECTIVE: The behavior of fluids is important to process Engineering and constitutes foundations for the study of unit operations. An understanding of fluids is essential to students not only for accurately treating problems on the moment of fluids through pipes, pumps, but for dealing with all kinds of process equipment.

OUTCOME: To apply the concept of hydrostatic equilibrium and to have knowledge on fluid flow phenomena and to determine engineering design quantities for laminar and turbulent flow.

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. I-Sem

L	P	C
4	0	4

CHEMICAL PROCESS CALCULATIONS (15A08303)

UNIT- I

Stoichiometric & Composition relations: Stoichiometric relation, basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales.

(For Assignments only: Use of Log-Log and Semi-Log graphs; Graph plotting using plotters like MS-Excel, Polymath, Minitab, Origin, etc..)

Behavior of Ideal gases: Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions.

UNIT -II

Vapor pressure: Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, Antoine equation, vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law, Non volatile solutes.

Humidity and Saturation: Partial saturation, Humidity- Absolute Humidity, Vaporization process, Molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts, adiabatic vaporization.

UNIT- III

Material balances: Tie substance, Yield, conversion, limiting reactant, excess reactant, processes involving reactions, Material balances with the help of Stoichiometric equations, Material balances involving drying, dissolution, & crystallization. Material balance calculations for processes involving recycle, bypass and purge.

UNIT -IV

Thermo physics: Energy, energy balances, heat capacity of gases, liquid and mixture solutions. Kopp's rule, latent heats, heat of fusion and heat of vaporization, Trouton's rule, Kistyakowsky equation for non polar liquids enthalpy and its evaluation.

Thermo chemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchoff's equation, enthalpy concentration change,

UNIT- V

Flame Temperature Calculations: Calculation of theoretical and actual flame temperatures.

Combustion Calculations: Introduction, fuels, calorific value of fuels, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations, incomplete combustion, material and energy balances, thermal efficiency calculations.

TEXTBOOKS

1. Chemical process principles, Part -I, Material and Energy Balance, Hougen O A, Watson K.M. and Ragatz R.A. 2nd Edition,John Wiley and Sons, New York, 1963.

REFERENCES:

1. Basic principles and calculations in chemical engineering by D.H. Himmelblau, 7th Ed. PHI, 2013

2. Stoichiometry by B.I. Bhatt and S.M. Vora (3rd Ed.) Tata McGraw Hill publishing company, Ltd. New Delhi (1996)

Data Tables: Use of Humidity Chart is permitted in the Examination hall

OBJECTIVE: To develop the basic knowledge in material and energy balance industry recycle streams.

OUTCOME: This course will enable students to evaluate the effeciency of a process in terms of yield, energy and provide guidance to improve upon them.

JNTUA College of Engineering (Autonomous), Ananthapuramu

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

HUMAN VALUES AND PROFESSIONAL ETHICS (15A54302)
(AUDIT COURSE)

Objectives:

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

Students will be able to:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
- Identify the multiple ethical interests at stake in a real-world situation or practice
- Articulate what makes a particular course of action ethically defensible
- Assess their own ethical values and the social context of problems
- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research

Unit I: HUMAN VALUES

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

Unit II: ENGINEERING ETHICS

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

Unit III :ENGINEERING AS SOCIAL EXPERIMENTATION

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

UNIT IV: ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

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

UINIT V: GLOBAL ISSUES

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

Text Books:

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

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. I-Sem

L	P	C
0	4	0

MOMENTUM TRANSFER LAB (15A08304)

1. Identification of laminar and turbulent flows
   Major equipment - Reynolds apparatus
2. Measurement of point velocities
   Major equipment - Pitot tube setup
3. Verification of Bernoulli's equation
   Major equipment – Bernoulli's Apparatus
4. Calibration of Rotameter
   Major equipment – Rotameter Assembly
5. Variation of Orifice coefficient with Reynolds Number
   Major equipment - Orifice meter Assembly
6. Determination of Venturi coefficient
   Major equipment – Venturi meter Assembly
7. Friction losses in Fluid flow in pipes
   Major equipment - Pipe Assembly with provision for Pressure measurement
8. Pressure drop in a packed bed for different fluid velocities
   Major equipment - Packed bed with Pressure drop measurement
9. Pressure drop and void fraction in a fluidized bed
   Major equipment - Fluidized bed with Pressure drop measurement
10. Studying the coefficient of contraction for a given open orifice
    Major equipment - Open Orifice Assembly
11. Studying the coefficient of discharge in a V-notch
    Major equipment - V-notch Assembly
12. Studying the Characteristics of a centrifugal pump
    Major equipment - Centrifugal Pump

Objective: The lab provides knowledge on various flow patterns, flow measuring devices and pumps.

Outcome: Student will be able to understand the concept of fluid flow phenomena, different flow regimes, flow measuring devices like venturi, orifice and rotameter.

JNTUA College of Engineering (Autonomous), Ananthapuramu

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

ORGANIC CHEMISTRY LAB (15A53302)

Course Objectives:

To confirm the formation and nature of the product in a chemical processes, the knowledge of some physical, chemical and instrumental methods is essential for a chemical engineer.

ORGANIC CHEMISTRY LAB:

1. Criteria of Purity of Solid and Liquid, Determination of Melting Point & Boiling Point. Detecting Nitrogen, Sulphur, and Halogens in Organic Compounds.
2. Identification of an Unknown Substance from the following classes of Organic Compounds, Alcohols, Phenols, Aldehydes, Ketenes, Carbohydrates and Carboxylic acids.
3. Preparation of Aspririn
4. Preparation of Paracetamol
5. Preparation of Acetanilide
6. Preparation of Sulphonic acid
7. Preparation of derivatives for Aldehydes and Amines.
8. Beckman Rearrangement (Preparation of Benzanilide from Benzophenone oxime).
9. Determination of strength of a Glycine Solution.
10. Estimation of an Aldehyde.

Course Outcome:

Student will get the knowledge of methods to confirm the formation and the nature of the product.

TEXT BOOKS:

1. Vogels Text Book of Qualitative Organic Analysis.

TEXTBOOKS:

1. Text book of Organic Chemistry – Morrsion and Boyd.
2. Organic Reaction Mechanisms by VK Ahulwalia and RK Parashar

REFERENCES:

1. Reaction mechanism – Peter Skyes.
2. Text book of Organic Chemistry – P.L. Soni.
3. Organic Chemistry Vol- I-IL. Finar.
4. Reactions and Reagents – O.P. Agrawal.
5. A Text Books of Organic Chemistry- Bahl and Arun Bahl, S. Chand company, New Delhi
6. Polymer Science and Technology- Hema Singh, Acme Learning, New Delhi

JNTUA College of Engineering (Autonomous), Ananthapuramu

II- Year B.Tech. II-Sem

L	P	C
4	0	4

PROBABILITY AND STATISTICS (15A51401)

(Common for CE, ME, Chemical)

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

UNIT – I: Basic concepts of Probability – Random variables – Expectation – Discrete and continuous Distributions – Distribution functions. Binomial 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 operation of $\overline{X}$ - Chart, R-Chart, p - Chart and C-Chart.

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

TEXT BOOKS:

1. Probability & 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.

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

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

ANALYTICAL CHEMISTRY (15A53401)

Course Objectives:

- To acquire basic principles of simple instrumental methods for estimation of organic/inorganic species.
- To acquire basic knowledge of industrial separations
- To acquire Knowledge in Characterization of the Materials synthesized by chemical industry
- To understand the Preparations, properties and reactions of materials

UNIT-I: Basic Principles of Quantitative Analysis

Limitations of analytical methods, Classification of errors, Accuracy, Precision, How to reduce systematic errors, Significant figures, Calculators and Computers, Mean and Standard deviation, Distribution of Random errors, Reliability of Results, Confidence interval , Comparison of results, Comparing the means of two samples, Paired T-test, Correlation and regression, Standard deviations.

UNIT-II: Chromatographic Methods:

Column chromatography-general principles, terminology: retention time, rotation volume, separation factor, resolution of peaks. Principles of gas chromatography, block diagram of gas chromatograph - detectors (FID, ECD), stationary phases for column, mobile phases, chromatogram, qualitative analysis, special plots, quantitative analysis, HPLC: Principles of High Performance Liquid Chromatography. Block diagram of HPLC Systems, function of each component, stationary phases, eluting solvents, pumps, detectors, quantitative applications of HPLC. Ion chromatography-seperation of anions and cations. Suppressed & non-suppressed ion chromatography. Numerical calculations.

Unit-III: Thermal methods of Analysis:

Introduction to Thermal methods, Thermogravimetric Analysis (TGA)-principles, and applications (determination of drying temperatures, kinetic methods, automatic thermo gravimetric Analysis) DTA: Differential thermal analysis-Principles and applications (exothermic and endothermic peaks, heat of reaction, catalysis, decompositions etc.,)

DSC: Differential scanning calorimettry, principles & applications (exothermic & endothermic peaks, compound purity determination, percentage crystallinity, glass transition temperature).

Unit-IV: Electro-Analytical Techniques

i). Polarography: Definition, advantage of dropping mercury electrode, factors affecting on limiting current, Half wave potentials and significance, Applications of Polarography

ii), Amperometric Titrations: Basic principle involved in the Amperometry, Amperometric Titrations and applications, Advantages and disadvantages of Amperometric Titrations.

Unit-V: Spectrophotometric Methods:

Introduction to Analysis: Qualitative & Quantitative Analysis; Conventional & Instrumental methods of analysis. Molecular spectrophotormetry-Beer's law Block diagram of UV-Visible Spectrophotometer – quantitative analysis direct method for the determination metal ions: Chromium, Manganese, Iron, etc in alloys. Infrared spectrophotormetry-principle, instrumentation and Functional group analysis of organic compounds using infrared spectra.

Quantitative analysis of organic molecules. Atomic absorption spectrophotormetry(AAS) and flame photometry: principles, instrumentation and applications (Determination of Sodium, Potassium and Calcium.) (12h)

Course Outcome:

The student may acquire enough knowledge on industrial processes and Identification of Products using different analytical and instrumental techniques.

BOOKS:

1. Quantitative analysis, R.A.Day & A.L. Underwood , 5th edition, Printice- Hall of India Pvt. Ltd., 2000.
2. Vogel's Text Book of Qualitative chemical analysis, J. Mendham, R.C.Denney, J. Darnes, M.J.K. Thomas, Persar education 6th edition, 2002.
3. Elements of Physical Chemistry-Peter Atkins, Oxford Uni.Press, 3rd Edition, 2010.

REFERENCES:

1. Atkin's Physical Chemistry – P. Atkins and J. De Paula, Oxford Univ.Press, 9th Edition, 2012
2 Instrumental lMethods of Chemical Analysis, Gurdeep R.Chatwal, Sham K.Ananad, Himalayha publishing House,5th Edition, 2012.
3. Advanced physical chemistry – Gurudeepraj, Goel Publishing House, 2000
4. Essentials of Physical Chemistry- Arun Bahl, B.S.Bahl and G.D.Rulasi, S.Chand Publishers, New Delhi.

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II- Year B.Tech. II-Sem

L	P	C
4	0	4

PROCESS INSTRUMENTATION (15A08401)

UNIT I

Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers.

Unit II:

Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells and response of thermocouples. Thermal coefficient of resistance, industrial resistance thermometer bulbs and circuits, radiation receiving elements, radiation, photoelectric and optical pyrometers.

Unit III:

Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer.

Unit IV:

Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids, static accuracy and response of pressure gauges.

Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels, measurement of interface level, density measurement, and level of dry materials.

Unit V:

Head flow meters, area flow meters, open channel meters, viscosity meters, quantity meters, flow of dry materials, viscosity measurements.

Recording instruments, indicating and signaling instruments, transmission of instrument readings, control center, instrumentation diagram, process analysis.

TEXT BOOK:

1. Industrial instrumentation by Donald P.Eckman, Wiley eastern, 1950.

REFERENCE:

1. Principles of industrial instrumentation by PatraNabis, TMH.
2. Instruments for measurements and control by Holbrock W.C. Van Nostrand
East West.
3. Hand book Instrumentation, Considine, McGraw Hill,

OBJECTIVE: The course will give an idea about different instruments for measuring T, P, flow rate, level and composition of various process streams in chemical industry.

OUTCOME: This course enables the student to select and design an instrument for measurement of flow, level, temperature, pressure and composition in chemical process industries.

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II- Year B.Tech. II-Sem

L	P	C
4	0	4

PROCESS HEAT TRANSFER (15A08402)

UNIT -I

Introduction: Nature of heat flow, conduction, convection, natural and forced convection, radiation.

Heat transfer by conduction in Solids: Fourier's law, thermal conductivity, steady state conduction in plane wall & composite walls, compound resistances in series, heat flow through a cylinder, conduction in spheres.

Unsteady state heat conduction: Equation for one-dimensional conduction, Semi-infinite solid.

UNIT- II

Principles of heat flow in fluids: Typical heat exchange equipment, countercurrent and parallel current flows, energy balances, rate of heat transfer, overall heat transfer coefficient, electrical analogy, critical radius of insulation, logarithmic mean temperature difference, variable overall coefficient, multi-pass exchangers, individual heat transfer coefficients, resistance form of overall coefficient, fouling factors, classification of individual heat transfer coefficients, magnitudes of heat transfer coefficients, effective coefficients for unsteady-state heat transfer.

UNIT- III

Heat Transfer to Fluids without Phase change: Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in laminar flow, heat transfer by forced convection in turbulent flow, the transfer of heat by turbulent eddies and analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids in forced convection outside tubes.

Natural convection: Natural convection to air from vertical shapes and horizontal planes, effect of natural convection in laminar-flow heat transfer.

UNIT -IV

Heat transfer to fluids with phase change: Heat transfer from condensing vapors, heat transfer to boiling liquids.

Radiation: Introduction, properties and definitions, black body radiation, real surfaces and the gray body, absorption of radiation by opaque solids, radiation between surfaces, radiation shielding, radiation to semi transparent materials, combined heat transfer by conduction, convection and radiation.

UNIT- V

Heat exchange equipment: General design of heat exchange equipment, heat exchangers, condensers, boilers and calendrias, extended surface equipment, heat transfer in agitated vessels, scraped surface heat exchangers, heat transfer in packed beds, heat exchanger effectiveness (NTU method)

Evaporators: Evaporators, performance of tubular evaporators, capacity and economy, multiple effect evaporators, methods of feeding, vapor recompression.

TEXT BOOK:

1. Unit Operations of Chemical Engineering, 6th ed., W.L. McCabe, J.C. Smith and P. Harriot, McGraw-Hill, New York, 2001

REFERENCES:

1. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997.
2. Heat Transfer, 4th ed., J.P. Holman, McGraw-Hill, New York, 1976.
3. Chemical Engineering, Volume-I, J. Coulson and R.F. Richardson, Pergamon Press

Objective: To impart the students about knowledge on modes of heat transfer and design of heat transfer equipment evaporators etc.,

Outcome: Student will be able to use the heat transfer principles in selection and design of heat exchanger, evaporator, etc. for a chemical industry.

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II- Year B.Tech. II-Sem

L	P	C
4	0	4

CHEMICAL ENGINEERING THERMODYNAMICS (15A08403)

UNIT -I

Introduction: The scope of thermodynamics, temperature, defined quantities; volume, pressure, work, energy, heat, Joules Experiments.

The first law and other basic concepts: The first law of thermodynamics, thermodynamic state and state functions, enthalpy, the steady-state steady-flow process, equilibrium, the phase rule, the reversible process, constant-V and constant- P processes, heat capacity, isobaric, isochoric, isothermal, adiabatic and polytrophic processes.

UNIT -II

Volumetric properties of pure fluids: The PVT behavior of pure substances, virial equations, the ideal gas, the applications of the virial equations, second virial coefficients from potential functions. Cubic equations of state, generalized correlations for gases, generalized correlations for liquids, molecular theory of fluids.

UNIT- III

The second law of thermodynamics: Statements of the second law, heat engines, thermodynamic temperatures scales, thermodynamic temperature and the ideal gas scale

Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point, calculation of ideal work and lost work.

UNIT -IV

Power cycles: Carnot cycle, Rankine cycle, Otto cycle, Diesel cycle.

Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the comparison of refrigeration cycles, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes.

UNIT –V

Thermodynamic properties of fluids: Property relations for homogeneous phases, residual properties, two phase systems, thermodynamic diagrams, tables of thermodynamic properties, generalized property correlation for gases.

TEXT BOOKS

1. J.M.Smith and HC Van Ness, Introduction to Chemical Engineering Thermodynamics, 6^{th}ed, McGraw Hill,2003.

REFERENCE

1. Y.V. C. Rao, Chemical Engineering Thermodynamics, University publications.
2. K. V. Narayanan, Chemical Engineering Thermodynamics, PHI,2001

Objective: To provide the students with the terminology of thermodynamics like system, properties, processes, reversibility, equilibrium, phases, components; the relationship between heat and work by understanding the significance of the thermodynamic laws.

Outcome: This course will enable the student to understand the spontaneity and energy efficiency of a process.

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

MECHANICAL OPERATIONS (15A08404)

UNIT- I

Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.

UNIT- II

Size reduction: Principles of comminution, computer simulation of milling operations, size reduction equipment-crushers, grinders, ultra fine grinders, cutting machines, Equipment operation. Laws of crushing: Kick's law, Bond's law, Rittinger's law

Screening, Industrial screening equipments, Effectiveness of the screen, differential & cumulative analysis.

UNIT -III

Filtration, cake filters, centrifugal filters, cyclone separators, electro-static precipitators.

Principles of cake filtration, Clarifying filters, liquid clarification, gas cleaning, principles of clarification.

UNIT- IV

Separations based on motion of particles through fluids: gravity settling processes and centrifugal settling processes, float and sink method, differential settling, coagulation, Flotation-separation of ores, flotation agents

Transportation of solid particulate mass:Belt, screw, apron conveyers, bucket elevators, pneumatic conveying.

UNIT- V

Agitation and mixing of liquids: Agitation of liquids, circulation velocities, power consumption in agitated vessels. Blending and mixing of liquids, suspension of solid particles, dispersion operations.

TEXT BOOK:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, McGraw Hill 7th ed. 2001.

REFERENCES:

1. Chemical engineers hand book, J.H. Perry, 7th ed. McGraw Hill
2. Introduction to Chemical Engineering by J.T.Banchero& W.L. Badger., TMH, 1997.

Objective: This course deals with the different mechanical unit operations in chemical engineering. Specific attention is given on particle and separation techniques.

Outcome: Student will gain knowledge on various mechanical separation operations used in chemical industry.

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II- Year B.Tech. II-Sem

L	P	C
0	4	2

PROCESS HEAT TRANSFER LAB (15A08405)

1. Determination of total thermal resistance and thermal conductivity of composite wall.
   Major equipment - Composite wall Assembly
2. Determination of thermal conductivity of a metal rod.
   Major equipment - Thermal Conductivity apparatus
3. Determination of natural convective heat transfer coefficient for a vertical tube.
   Major equipment - Natural convection heat transfer apparatus
4. Determination of critical heat flux point for pool boiling of water.
   Major equipment- Pool boiling apparatus
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe
   Major equipment – Forced convection heat transfer apparatus
6. Determination of overall heat transfer coefficient in double pipe heat exchanger.
   Major equipment - Double pipe heat exchanger apparatus
7. Determination of heat transfer coefficient for a helical coil in an agitated vessel.
   Major equipment – Helical coil in a agitated vessel.
8. Study of the temperature distribution along the length of a pin-fin under natural and forced convection conditions
   Major equipment - Pin fin apparatus
9. Estimation of un-steady state film heat transfer coefficient between the medium in which the body is cooled.
   Major equipment - Heat transfer coefficient determination apparatus
10. Determination of Stefan – Boltzmann constant.
    Major equipment - Stefan Boltzmann apparatus
11. Determination of emissivity of a given plate at various temperatures.
    Major equipment - Emissivity determination apparatus

Objective: This lab will provide practical knowledge on various heat transfer process and equipment like heat exchangers and evaporators.

Outcome: The student will be able to understand the thermal conductivity measurement, heat transfer coefficient, calculation in natural and forced convection and some of the radiation aspects.

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II Year B.Tech. II-Sem

L	P	C
0	4	0

MECHANICAL OPERATIONS LAB (15A08406)

1. To determine the time of grinding in a ball mill for producing a product with 80 % passing a given screen.
Major equipment - Ball mill Apparatus, Sieve shaker, Different sizes of sieves, weighing balance.
2. To verify the laws of crushing using any size reduction equipment like crushing rolls or vibrating mills and to find out the working index of the material.
Major equipment – Jaw Crusher, Sieve shaker, Different sizes of sieves, WeighingBalance, Energy meter.
3. To find the effectiveness of hand screening and vibrating screen of a given sample.
Major equipment - Vibrating Sieve shaker, Different sizes of sieves, WeighingBalance.
4. To achieve beneficiation of a ore using froth flotation technique.
Major equipment - Froth flotation cell
5. To obtain batch sedimentation data and to calculate the minimum thickner area under given conditions.
Major equipment- Sedimentation apparatus
6. To determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.
Major equipment - Plate and frame filter press.
7. To separate a mixture of particles by Jigging.
Major equipment - Jigging apparatus
8. To calculate separation efficiency of particles in a mixture using cyclone separator.
Major equipment - Cyclone separator
9. To determine reduction ratio of a given sample in a pulverizer.
Major equipment - Pulverizer
10. To Verify Stoke's law.
Major equipment – Stoke's law apparatus
11. To determine reduction ratio of a given sample in .a grinder Major equipment - Grinder

Objective: The course will equip students with the practical knowledge of different mechanical unit operations & operational conditions of different equipments.

Outcome: Student will be able to develop knowledge on various mechanical separation operations used in a chemical industry.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. I-Sem

L	P	C
3+1*	0	4

ENERGY ENGINEERING (15A08501)

OBJECTIVES:

- To acquaint the student with the conventional energy sources and their utilization.
- To understand the importance of heat recovery and energy conservation methods and energy audit

UNIT -I

Sources of energy, types of fuels- energy and relative forms. Calorific value- gross and net value, calculation of calorific value from fuel analysis, experimental determination energy resources present and future energy demands with reference to India.

Coal: origin, occurrence, reserves, petrography, classification, ranking, analysis, testing, storage, coal carbonization and by product recovery, liquefaction of coal, gasification of coal, burning of coal and firing mechanism, burning of pulverized coal.

UNIT- II

Liquid fuels: petroleum: origin, occurrence, reserves, composition, classification, characteristics, fractionation, reforming, cracking, petroleum products, specification of petroleum products, burning of liquid fuels.

Natural gas, coke oven gas, producer gas, water gas, LPG, burning of gaseous fuels, hydrogen (from water) as future fuel, fuel cells, flue gas, analysis: orsat apparatus

UNIT -III

Steam Plant: Run time cycle, boiler plant, steam cost, steam distribution and utilization, combined heat and power systems, energy from biomass and biogas plants, gas purification, solar energy, wind energy, energy storage

UNIT -IV

Waste heat recovery, sources of waste heat and potential application, various types of heat recovery systems, regenerators, recuperators, waste heat boilers

Energy conservation: conservation methods in process industries, theoretical analysis, practical limitations.

UNIT-V

Energy auditing: short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing.

TEXT BOOKS:

1. Fuels, Furnaces and Refractories, O.P.Gupta

2. Fuels and Combustion, 3rd ed., Samir Sarkar, Universities Press, 2009.

REFERENCES:

1. Non-conventional Energy Resources, G.D.Rai, Khanna Publishers

2. Fuel and Energy, Harker and Backhurst, Academic press London 1981

3. Fuel Science- Harker and Allen, Oliver and Boyd, 1972

Outcomes:

- Students would have a good knowledge about conventional energy sources and their audit.
- Ability to apply the fundamentals of energy conversion and applications.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. I-Sem

L	T	P	C
4	0	0	4

PROCESS DYNAMICS AND CONTROL (15A08502)

Objectives:

- Develop mathematical and transfer function models for dynamic processes.
- Analyze process stability and dynamic responses.
- Empirically determine process dynamics for step response data.
- Development of block diagrams, reading block diagrams, process and instrumentation diagrams
- Familiarity with different types of PID feedback controllers..
- Ability to understand feed forward control, cascade control and Smith predictors and their applications
- Knowledge of real time applications of process control implementation.

UNIT I

Introduction to process dynamics and control: Laplace transforms, Inverse Laplace transform, Response of First Order Systems. Physical examples of first order systems- Liquid level, mixing process, R- C circuit. Linearization.

UNIT II

Response of first order systems in series- interacting and non- interacting systems, second order systems, transportation lag.

Control system: Components of a control system, Servo Vs regulator problem, development of block diagram.

Controllers and final control elements: Control valve and its construction,P, PD, PI, PID controllers.

UNIT III

Stability: Concept of Stability, Stability criterion, Routh test for stability

Root locus: concept of root locus, rules for plotting the root locus diagram.

UNIT IV

Introduction to frequency response: Substitution rule, Bode diagrams

Control systems design by frequency response: Bode stability criterion, Gain and Phase margins.

Controller tuning: Tuning of P, PD, PI, PID controllers, trial and error method, Ultimate gain and ultimate period, Ziegler- Nichols technique, Cohen and Coon rules.

UNIT V

Advanced control strategies: Cascade control, feed forward control, ratio control, Smith predictor, dead time compensation. Control valve sizing, valve characteristics.

TEXT BOOK:

1. Process Systems Analysis and Control, 2nd ed., D.R. Coughanowr, McGraw-Hill, 1991

REFERENCES:

1. Chemical Process Control, G. Stephanopoulos, PHI Learning Pvt. Ltd., New Delhi, 2010

2. Process Control, B.W. Bequette, PHI Learning Pvt. Ltd., New Delhi, 2010

OUTCOME: Ability to model the dynamic processes, to analyze the dynamic processes, to design feedback control system for chemical, mechanical & electrical engineering systems and to design advanced control system for complex and normal processes.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. I-Sem **L P C**

3+1* 0 4

PHASE AND CHEMICAL EQUILIBRIA (15A08503)

OBJECTIVES:

To introduce the concepts of chemical potential, partial properties, property relations for ideal gases, fugacity excess properties and to develop the theoretical foundation for applications of thermodynamics to gas mixtures and liquid solutions and to perform the phase equilibrium calculations using simple models for VLE, Gamma/Phi approach and equation of state approach.

UNIT I

Solution Thermodynamics: Theory, Fundamental property relation, chemical potential as a criterion for phase equilibrium, partial properties, ideal gas mixtures, fugacity and fugacity coefficient for pure species, fugacity and fugacity coefficient for species in solutions, generalized correlations for Fugacity coefficient, The ideal solutions, excess properties.

UNIT II

Solution Thermodynamics: Applications: The liquid phase properties from VLE data, models for the excess Gibbs energy, property changes of mixing

VLE at low to moderate pressures: The nature of equilibrium, the phase rule, Duhems theorem, VLE: Qualitative behavior, the gamma /Phi formulation of VLE, Dew point and bubble point calculations, flash calculations, solute (1)/solvent (2) systems

UNIT III

Thermodynamic Properties and VLE from Equations of State: properties of fluids from the virial equations of state, properties of fluids from cubic equations of state, fluid properties from correlations of the Pitzer type, VLE from cubic equations of state

Topics in Phase Equilibria: Equilibrium and stability, Liquid-Liquid Equilibrium (LLE), Vapor- Liquid–Liquid Equilibrium (VLLE), Solid-Liquid Equilibrium (SLE), Solid Vapor Equilibrium (SVE).

UNIT IV

Chemical Reaction Equilibria: The reaction coordinate, application equilibrium criterion to chemical reactions, The standard Gibb's energy change and the equilibrium constant, effect of temperature on equilibrium constants, relation of equilibrium constants to composition, equilibrium conversion for single reactions, Phase rule and Duhem's theorem for reacting systems.

UNIT V

Introduction to Molecular Thermodynamics : Molecular Theory of Fluids,Second Virial Coefficients from Potential Functions,Internal Energy of Ideal Gases: Microscopic view, Thermodynamic Properties and Statistical Mechanics ,Hydrogen Bonding and Charge-Transfer Complexing ,Behaviour of Excess Properties ,Molecular Basis for Mixture Behaviour,VLE by Molecular Simulation.

TEXT BOOK:

1. Introduction to Chemical Engineering Thermodynamics, 6th ed., J.M. Smith, H.C. Van Ness and M.M. Abbott, Tata McGraw-Hill, New Delhi, 2003.

REFERENCE:

1. Chemical Engineering Thermodynamics, Pradeep Ahuja, PHI Learning Pvt. Ltd., New Delhi, 2009
2. A Text Book of Chemical Engineering Thermodynamics, K.V. Narayanan, PHI Learning Pvt. Ltd., New Delhi, 2001.

Outcome:

1. Students will learn the concepts of chemical potential, partial properties, property relations for ideal gases, fugacity excess properties and to develop the theoretical foundation for applications of thermodynamics to gas mixtures and liquid solution.
2. Students will be able to understand the procedures for estimating the thermodynamic properties and perform thermodynamic calculations oriented to the analysis and design of chemical processes.

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III Year B.Tech. Chem. Engg. I-Sem

L	P	C
3+1*	0	4

CHEMICAL REACTION ENGINEERING – I (15A08504)

OBJECTIVES:

- The emphasis of this course is on the fundamentals of chemical reaction kinetics and chemical reactor operation.
- The overall goal of this course is to develop a critical approach toward understanding complex reaction systems and elucidating chemical reactor design.
- Integrate concepts from science & engineering to constitute a basis for the design of chemical reactor, a key element in the design of chemical process.
- Provide a foundation on deriving rate expressions for series, parallel, reversible reactions and the knowledge about product distribution in multiple reactions, recycle reactors and auto catalytic reactions

UNIT I

Overview of chemical reaction engineering-classification of reactions, variables affecting the rate of reaction definition of reaction rate, kinetics of homogenous reactions- concentration dependent term of rate equation, Temperature dependent term of rate equation, searching for a mechanism, predictability of reaction rate from theory.

Interpretation of batch reactor data- constant volume batch reactor:- Analysis of total pressure data obtained in a constant-volume system, the conversion, Integral method of analysis of data– general procedure, irreversible unimolecular type first order reactions, irreversible bimolecular type second order reactions, irreversible trimolecular type third order reactions, empirical reactions of nth order, zero-order reactions, overall order of irreversible reactions from the half-life, fractional life method, irreversible reactions in parallel, homogenous catalyzed reactions, autocatalytic reactions, irreversible reactions in series.

UNIT II

Constant volume batch reactor– first order reversible reactions, second order reversible reactions, reversible reactions in general, reactions of shifting order, Differential method of analysis of data. Varying volume batch reactor–differential method of analysis, integral method of analysis, zero order, first order, second order, nth order reactions, temperature and reaction rate, the search for a rate equation.

UNIT III

Introduction to reactor design- general discussion, symbols and relationship between C_A and X_A. Ideal reactors for a single reaction- Ideal batch reactor, Steady-state mixed flow reactor, Steady-state plug reactors.

Design for single reactions- Size comparison of single reactors, Multiple- reactor systems, Recycle reactor, Autocatalytic reactions.

UNIT IV

Design for parallel reactions- introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size.

Multiple reactions-Irreversible first order reactions in series, quantitative discussion about product distribution, quantitative treatment, plug flow or batch reactor, quantitative treatment, mixed flow reactor, first-order followed by zero-order reaction, zero order followed by first order reaction.

UNIT V

Temperature and Pressure effects- single reactions- heats of reaction from thermodynamics, heats of reaction and temperature, equilibrium constants from thermodynamics, equilibrium conversion, general graphical design procedure, optimum temperature progression, heat effects, adiabatic operations, non adiabatic operations, comments and extensions. Exothermic reactions in mixed flow reactors-A special problem, multiple reactions.

TEXT BOOK:

1. Chemical Reaction Engineering, 3rd ed., O. Levenspiel, John Wiely & Sons, 1999.

REFERENCES:

1. Elements of Chemical Reaction Engineering, 2nd ed., H.S. Fogler, PHI Learning Pvt. Ltd., New Delhi, 2010.
2. Chemical Engineering Kinetics, 3rd ed., J.M. Smith, McGraw-Hill, New York, 1981.

<u>Outcome</u>:

- This course provides necessary knowledge for selection of the chemical reactors for a particular process.
- Analyze and interpret experimental data from batch reactors and determine the order of simple chemical reactions.
- Compare ideal reactor types (batch, CSTR and PFR) and apply quantitative methods to design and size reactors for simple chemical reaction schemes.
- Determine optimal ideal reactor design for multiple reactions for yield or selectivity.
- Predict reactor performance for reactors when the temperature is not uniform within the reactor

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III Year B.Tech. Chem. Engg. I-Sem

L	P	C
3+1*	0	4

MASS TRANSFER OPERATIONS-I (15A08505)

OBJECTIVES:

- To discuss the fundamental concepts of mass transfer principles and to apply those concepts to real engineering problems.
- To impart the basic concepts of molecular diffusion, mass transfer coefficients and analysis of different mass transfer processes
- Applies the concepts of diffusion mass transfer, mass transfer coefficients, convective mass transfer, inter-phase mass transfer, equipment for gas-liquid operations.

UNIT- I

The Mass Transfer Operations: Classification of the Mass-Transfer Operations, Choice of Separation Method, Methods of Conducting the Mass-Transfer Operations, Design Principles, Unit Systems

Molecular Diffusion In Fluids: Molecular Diffusion, Equation of Continuity, binary solutions, Steady State Molecular Diffusion in Fluids at Rest and in Laminar Flow, estimation of diffusivity of gases and liquids, Momentum and Heat Transfer in Laminar flow

Diffusion:Diffusion in Solids, Fick's Diffusion, Unsteady State Diffusion, Types of Solid Diffusion, diffusion through polymers, diffusion through crystalline solids, Diffusion through porous solids & hydrodynamic flow of gases.

UNIT- II

Mass Transfer Coefficients: Mass Transfer Coefficients, Mass Transfer Coefficients in Laminar Flow (Explanation of equations only and no derivation), Mass Transfer Coefficients in Turbulent Flow, eddy diffusion, Film Theory, Penetration theory, Surface-renewal Theory, Combination Film-Surface-renewal theory, Surface-Stretch Theory, Mass, Heat and Momentum Transfer Analogies, Turbulent Flow in Circular Pipes. Mass transfer data for simple situations.

Inter Phase Mass Transfer: Concept of Equilibrium, Diffusion between Phases, Material Balances in steady state co-current and counter current stage processes, Stages, Cascades, Kremser – Brown equation.

UNIT-III

Equipment For Gas-Liquid Operations: Gas Dispersed, Sparged vessels (Bubble Columns), Mechanical agitated equipments(Brief description),Tray towers, General characteristics, Sieve design for absorption and distillation (Qualitative Treatment), Different types of Tray Efficiencies, Liquid Dispersed venturi Scrubbers, Wetted-Wall Towers, Packed Towers, Counter current flow of Liquid & Gas through packing, Mass transfer coefficients for packed towers, End effects and Axial Mixing Tray tower vs Packed towers.

UNIT-IV

Absorption And Stripping: Absorption equilibrium, ideal and non ideal solutions selection of a solvent for absorption, one component transferred: material balances. Determination of number

of Plates (Graphical), Absorption Factor, estimation of number of plates by Kremser Brown equation, Continuous contact equipment; HETP, Absorption of one component,
Determination of number of Transfer Units and Height of the Continuous Absorber, overall coefficients and transfer units, dilute solutions, overall height of transfer units.

UNIT-V

Humidification Operations: Vapor-Pressure Curve, Definitions, Psychometric Charts, Enthalpy of gas-vapor Mixtures, Humidification and Dehumidification, Operating lines and Design of Packed Humidifiers, Dehumidifiers and Cooling towers, Spray Chambers

TEXT BOOK:

1. Mass transfer operations by R.E. Treybal, 3rd ed. Mc Graw Hill, 1980.
2. Separation process C.J King, Tata Mc Graw Hill
3. Principles of Mass Transfer and Separation Processes by B K Dutta, Printice Hall of India Pvt Limited, New Delhi

REFERENCE:

1. Diffusion mass transfer in fluid system by E. L. Cussler.
2. Transport processes and unit operations by Christie J. Geankoplis
3. Separation Process Principles, J D Seader and E. J. Henley, John Wiley & Sons, Inc,. New York

Pre-requisite:---Nil---

Codes/Tables: *Psychometric Charts may be provided*

Outcome:

- Recognize the various modes of mass transfer, Determine mass transfer rates using Fick's Law.
- Fundamental knowledge on mass transfer mechanisms and operations like absorption, stripping, drying and humidification.
- Estimate diffusion coefficients, Solve unsteady state diffusion problems
- Determine convective mass transfer rates & mass transfer coefficients
- Determine the number of transfer units and height requirements for a packed column

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. I-Sem **L P C**
3+1*0 4

CHEMICAL TECHNOLOGY (15A08506)

OBJECTIVES:

- Unit operations unit processes involved in manufacture of important and widely employed organic and inorganic chemicals.
- Develop skills in preparing /presenting a neat Engineering drawing for Chemical Process Industries.
- Impart clear description of one latest process along with its Chemistry, Process parameters, Engineering Problems and Optimum Conditions.
- Demonstrate the importance of updating the latest technological developments in producing products economically and environment friendly.
- Appreciate the usage of other engineering principles such as Thermodynamics, Heat, mass and momentum transfer in operation and maintain the productivity

UNIT – I

Water and Air: Importance of water, sources, plant location factors related to water, water shortage problems, methods of treating fresh water, methods of obtaining fresh water from saline waters, waste water treatment and disposal, air as a chemical raw material.

Soda ash, caustic soda and chlorine, Glass: manufacture of special glasses

UNIT – II

Industrial gases: carbon dioxide, hydrogen and oxygen – products of water gas, producer gas. Nitrogen industries: synthetic ammonia, urea, nitric acid (ammonium nitrate), ammonium chloride, ammonium phosphate and complex fertilizers

Sulphur and sulphuric acid, manufacture of sulphuric acid, hydrochloric acid and some other chemicals –Aluminum sulphate and alum.

UNIT – III

Cement manufacture, special cements, miscellaneous calcium compounds, magnesium compounds.

Manufacture of phenols, formaldehyde, vinyl chloride and vinyl acetate, manufacture of phenol-formaldehyde resin and polyvinyl chloride polymer, SBR

UNIT – IV

Oils: Definition, constitution, extraction and expression of vegetable oils, refining and hydrogenation of oils.

Synthetic fibers: Classification, manufacture of Nylon 66, polyester fiber and viscose rayon fiber.

Soaps and detergents: Definitions, continuous process for the production of fatty acids, glycerin and soap, production of detergents.

UNIT – V

Pulp and paper industry: methods of pulping, production of sulphate and sulphite pulp, production of paper –wet process

Pharmaceutical Industries: Classification, Alkylation, Carboxylation and Acetylation, Condensation and Cyclization, Dehydration,Halogenation, Oxidation, Sulfonation, Amination, Radio isotopes in Medicine, Fermentation and Life processing for Antibiotics, Hormones, and Vitamines, Biologicals, Steroid hormones, isolates and Animals.

Text books:

1. Shreve's Chemical Process Industries edited by Austin, Mc.graw-Hill.5th ed.1985.
2. Dryden's Outlines of Chemical Technology edited by M. Gopal Rao and M. Sittig, 2nd ed. 1973.

References:

1. Industrial Chemistry by B.K. Sharma,
2. Hand book of industrial chemistry Vol 1& II K.H.Davis & F.S. Berner Edited by S.C. Bhatia, CBS publishers
3. Chemical Technology: G.N. Panday, Vol 1& Vol II.

Pre-requisite:---Nil---

Outcomes:

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

1. Make a neat and easy to understand the plant process flow sheet.
2. Keeps up the productivity while maintaining all safety norms stipulated, during their job.
3. Solve Engineering problems that are likely to come across during the operation of plants.
4. Suggest alternative manufacturing process in terms of Economic viability of the product.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. I-Sem

L	P	C
0	3	2

ENERGY AND ENVIRONMENTAL ENGINEERING LAB (15A08507)

List of Experiments:

1. Estimation of chemical and physical parameters of Ground and Surface water:
   P^H, TDS & Conductivity, Hardness, Turbidity, Fluoride, Color analysis.
   Pesticide Microbial analysis: e-coli/ total coli forms bacteria
2. Estimation of physical parameters of waste water:
   P^H, TDS, Hardness, Turbidity, Alkalinity etc.
3. Estimation of chemical parameters of waste water:
   COD, BOD, TSS
4. Water and waste water treatment:
   Small RO system for treatment of ground water.
   Same above system with UF membrane for turbidity removal and water disinfection.
5. Analysis of Air:
   Estimation of SPM, RSPM, Sox, Nox, CO and ozone in atmospheric air to study air pollution.

4. Fuel cell Test Kit [Energy]
   A small ½ watt to 1 watt fuel cell with water electrolysis kit (H_2 and O_2 Generation) plus small voltmeter and ammeter for measuring fuel cell performance.

7. Measurement of Flash point, fire point and calorific value of petroleum products.
8. Proximate Analysis of Coal – Moisture, Volatile Matter, Fixed Carbon and Ash. (Hot air Oven & Muffle Furnace)
9. Calorific value of Solid Fuels.
10. Energy auditing of your Department.

List of Equipment

P^H meter, Colorimeter, TDS meter, Aerobic /Anaerobic reactor 25L capacity, BOD incubator, High accuracy analytical balance (5 digit), Desiccators, RO system with domestic 2"x12" Membrane module, H_2S vial kit, Water analysis kit, UV-Vis spectrophotometer, High volume air sampler, Bomb calorimeter, Fuel cell test kit, Microscope.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. I-Sem

L	P	C
0	3	2

PROCESS DYNAMICS AND CONTROL LAB (15A08508)

OBJECTIVES:

- To evaluate response of fist and higher order characteristics.
- Study the installed characteristics of the valve.
- Study if there is a hysteresis in the control valve and sensor.
- Evaluate the tuning of a PID control via manual and automatic tuning.
- Evaluate the effect controller on the control system

1. Calibration and determination of time lag of various first and second order instruments
Major equipment - First order instrument like Mercury-in-Glass thermometer and Overall second order instrument like Mercury-in-Glassthermometer in a thermal well

2.Experiments with single tank system.
Single tank - Step Response
Single tank - Impulse Response

3. Experiments with two tank systems with and without interaction.
Non Interacting Tanks – Step Response
Interacting Tanks – Step Response
Non Interacting Tanks – Impulse Response
Interacting Tanks – Impulse Response

4. Level control trainer
Major equipment - Level control trainer set up with computer

5. Temperature control trainer
Major equipment - Temperature control trainer with computer

6. Experiments on proportional, reset, rate mode of control etc.
Major equipment – PID control apparatus

7. Control valve characteristics
Major equipment – Control valve set up

8. Estimation of damping coefficient for U-tube manometer
Major equipment - U-tube manometer.

Outcome:

- Estimate the dynamic behavior of the control systems

- Understand the controllability, speed of response the control systems.
- Select proper control valve to meet process needs.
- Understand direct digital control systems handling and operation.
- Tuning of a PID control via manual and automatic tuning.
- Choose PID modes that effect controllability, speed of response the control systems

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

BIOCHEMICAL ENGINEERING (15A08601)

OBJECTIVES:

- Study introduction to the application of chemical engineering principles in biochemical systems.
- Be enabled to understand the biological systems and kinetics of enzymatic reactions.
- Learn the kinetics of growth of microorganisms, hence be able to control the process.
- Be able to design equipments for handing biological processes.
- Study Operations utilized in the purification of biological products enable them to recommend, install and easily learn to operate the equipments.

UNIT I

Introduction to microbiology: Biophysics and the cell doctrine, the structure of cells, important cell types, from nucleotides to RNA and DNA, amino acids into proteins. Kinetics of enzyme catalyzed reaction: the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, other patterns of substrate concentration dependence, modulation and regulation of enzyme activity, other influences on enzyme activity.

UNIT II

Immobilized enzyme technology: enzyme immobilization, industrial processes, utilization and regeneration of cofactors.Immobilized enzyme kinetics: effect of external mass transfer resistance, analysis of intraparticle diffusion and reaction.

Kinetics of cellular growth in batch and continuous culture, models for cellular growth – unstructured, structured and cybernetic models. Thermal death kinetics of cells and spores

UNIT III

Introduction to metabolic pathways, biosynthesis, transport across cell membranes, end products of metabolism, stoichiometry of cell growth and product formation.

Design and analysis of biological reactors: batch reactors, fed-batch reactors, enzyme catalyzed reactions in CSTR, CSTR reactors with recycle and cell growth, ideal plug flow reactors, sterilization reactors, sterilization of gases, packed bed reactors using immobilized catalysts. Fermentation technology: medium formulation, design and operation of a typical aseptic, aerobic fermentation process.

UNIT IV

Transport phenomena in bioprocess systems: Gas-liquid mass transfer in cellular systems, determination of oxygen transfer rates, overall k_La’ estimates and power requirements for sparged and agitated vessels, scaling of mass transfer equipment, heat transfer.

UNIT V

Downstream processing: Strategies to recover and purify products; separation of insoluble products-filtration and centrifugation; cell disruption-mechanical and non-mechanical methods; separation of soluble products: liquid-liquid extractions, membrane separation (dialysis, ultra filtration and reverse osmosis), chromatographic separation-gel permeation chromatography, electrophoresis, final steps in purification – crystallization and drying.

TEXT BOOKS:

1. Biochemical Engineering Fundamentals, 2nd ed., J.E. Bailey and D.F. Ollis, McGraw-Hill, New York, 1987.
2. Bioprocess Engineering, 2nd ed., M. L. Shuler and F. Kargi, PHI Learning Pvt. Ltd, New Delhi, 2009.

REFERENCES:

1. Biochemical Engineering, J. M. Lee, Prentice-Hall, New Jersey 1992.
2. Bioprocess Engineering Principles, P. M. Doran, Elsevier, Gurgaon, 2005.

Outcome:

- This course will help the students to understand and apply the principles of biochemical engineering in analysis and design of industrial biochemical processes.
- Upon completion of this course, the students would develop the ability to design novel bioprocesses for their research in various areas. They will have the ability to find solutions to the problems which occur when materials and processes interact with the environment.
- Explain operations utilized in the purification of biological products are also studied by the students. This will enable them to recommend, install and easily learn to operate the equipment.

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III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

PROCESS MODELING AND SIMULATION (15A08602)

OBJECTIVES:

- Learn to develop mathematical model for problems.
- To impart knowledge on modeling of various equipment and their simulation using different numerical techniques.
- Formulate a chemical engineering problem as a mathematical model, and select an appropriate solution method.
- Understand the computational requirements of various solution options and use this understanding in the selection of the solution method
- Formulate and solve process design problems, based on fundamental analysis and using mathematical models of chemical processes

UNIT I

Introduction: Uses of mathematical models, Principles of formulation,
Fundamental laws: Continuity equation, component Continuity equation, energy equation, Equation of motion.
Classification of mathematical models- steady state Vs dynamic models, lumped Vs distributed parameter models, deterministic Vs stochastic models.

UNIT II

Examples of mathematical models of chemical engineering systems: Series of isothermal constant hold-up CSTRs, CSTRs with variable hold-ups, two heated tanks, gas phase pressurized CSTR, Non-isothermal CSTR

UNIT III

Examples of mathematical models of chemical engineering systems: Single component vaporizer, batch reactor, reactor with mass transfer, ideal binary distillation column, batch distillation with hold-up.

UNIT IV

Empirical model building- method of least squares, linear, polynomial and multiple regression, non-Linear regression.
Solution of non-linear algebraic equations-bisection, false position, Newton- Raphson methods.
Numerical solution of ordinary differential equations-Euler's method, Modified Euler's method, Runge- Kutta method.

UNIT V

Numerical solution of partial differential equations- elliptic, parabolic and hyperbolic equations. Finite difference methods, Leibman's method and Crank Nicholson method.
Process Simulation examples: VLE dew point and bubble point calculations, binary distillation column, gravity flow tank, batch reactor, Non- isothermal CSTR, countercurrent heat exchanger.

TEXTBOOKS:

1. Process modeling, Simulation and Control for Chemical Engineers, 2nd ed., W. L. Luyben, McGraw-Hill, New York, 1990.
2. Numerical Methods for Engineers, S.K. Gupta, Wiley Eastern, New Delhi, 1995.

REFERENCE:

1. Introduction to Numerical Methods in Chemical Engineering, P. Ahuja, PHI learning Pvt. Ltd., New Delhi, 2010
2. Process Modeling and Simulation, Amiya K. Jana, 2012.

Outcome:

- Understand the stages involved in the development of a process model.
- Formulate a chemical engineering problem as a mathematical model from basic engineering principles.
- Identify the appropriate numerical solutions used in solving the models
- Apply various simulation tools for solving the chemical engineering models developed.
- Understand the solution techniques for solving ODEs.

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III Year B.Tech. Chem. Engg. II-Sem **L P C**

3+1* 0 4

MASS TRANSFER OPERATIONS-II (15A08603)

OBJECTIVES:

- Study of the stage wise mass transfer operations, principles of various stage wise contact processes like distillation, extraction and leaching and drying
- Design aspects of the equipments utilized for above mentioned operations.
- Attain practical knowledge of separation processes, conduct experiments and submit the report.

UNIT-I

Distillation: Fields of applications, VLE for miscible liquids, immiscible liquids, steam distillation, Positive and negative deviations from ideality, enthalpy-concentration diagrams, flash vaporization and differential distillation for binary and multi component mixtures, Batch distillation with Reflux.

UNIT-II

Continuous rectification-binary systems, multistage tray towers –method of Mc Cabe and Thiele, enriching section, Stripping section, feed introduction, total reflux, minimum and optimum reflux ratios, use of open steam, types of condensers, partial condensers, effect of cold reflux, multiple feeds , tray efficiencies, continuous-contact equipment (packed towers)

Multistage (tray) towers –the method of Ponchon and Savarit, the enriching and stripping sections, feed tray location, total reflux, minimum and optimum reflux ratios, types of reboilers, use of open steam, condenser and reflux accumulators, Azeotropic distillation, extractive distillation, comparison of Azeotropic and extractive distillation.

UNIT- III

Liquid-Liquid operations: fields of usefulness, liquid-liquid equilibrium, equilateral triangular co-ordinates, choice of solvent, stage wise contact, multistage cross-current extraction, Multi stage counter current without reflux

Multi stage counter current with reflux, Differential (continuous contact) extractors, spray towers, packed towers, mechanically agitated counter-current extractors, centrifugal extractors, dilute solutions, super critical fluid extraction, fractional extraction.

UNIT-IV

Drying: Equilibrium, Definitions, Drying Conditions- Rate of Batch Drying under constant drying conditions, Mechanisms of batch drying, Drying time Through Circulation Drying.

Classification Of Drying Operations: Batch and Continuous Drying Equipment, Material and Energy Balances of Continuous Driers, rate of drying for continuous direct heat driers.

UNIT-V

Leaching: Fields of applications, preparation of solid for leaching, types of leaching, leaching equilibrium, single stage and multi stage leaching calculations, constant under flow conditions, equipment for leaching operation.

TEXT BOOK:

1. Mass transfer operations by R.E. Treybal, 3rd ed. Mc Graw Hill, 1980.

REFERENCE:

1. Principles of Mass Transfer and Separation Processes by B K Dutta, Printice Hall of India Pvt Limited, New Delhi
2. Transport processes and unit operations by Christie J. Geankoplis
3. Separation Process Principles, J D Seader and E. J. Henley, John Wiley & Sons, Inc,. New York

Pre-requisite:---Mass Transfer Operations-I

Outcome:

- Have complete insight of stage wise contact processes absorption; distillation, extraction and leaching that are used in separation processes in industries.
- Explain the underlying principles and apply them for related separation processes in industries.
- Suggest and design equipment for various mass transfer operations mentioned above.
- Apply these separation processes for specific purposes by using the experience obtained while conducting experiments in laboratory.
- Can operate, design and debug any problems emanating in equipment used in industries for the above operations.
- Be able to operate and debug any problems emanating in equipments used in industries for the above operations.

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III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

CHEMICAL REACTION ENGINEERING – II (15A08604)

OBJECTIVES:

- Learn the importance of RTD and the compartmental models for modeling of Non-ideal flow reacting vessels.
- Calculate the conversions based on segregated flow model, dispersion model and tanks-in-series models.
- Knowledge of rate law given the rate controlling step in catalytic reactions, internal and external diffusion effects.
- Learn the factors influencing catalyst decay, the role of pore diffusion on catalyst activity rate.
- Shrinking core model for spherical particles of unchanging size and design the fluid-solid reactors.

UNIT I

Basics of non-ideal flow: E, the exit age distribution function of fluid, the RTD, conversion in non-ideal flow reactors, diagnosing reactors (qualitative discussion only).

The dispersion model: axial dispersion, correlations for axial dispersion, chemical reaction and dispersion.

UNIT II

The tanks in series model: pulse response experiments and the RTD, chemical conversion. The convection model for laminar flow- the convective model and its RTD, chemical conversion in laminar flow reactors

Earliness of mixing, segregation and RTD: self-mixing of a single fluid, mixing of two miscible fluids.

UNIT III

Catalysis and Catalytic reactors: catalysts, steps in catalytic reactions, synthesizing a rate law, mechanism and rate limiting step. (From chapter 10, Fogler)

Heterogeneous reactions: Introduction to Solid catalyzed reactions: The rate equation for Surface Kinetics- Pore diffusion resistance combined with surface kinetics, Porous catalyst particles, heat effects during reaction, Performance equations for reactors containing porous catalyst particles.

UNIT IV

Solid catalyzed reactions- Experimental methods for finding rates. Deactivating catalysts- mechanisms of catalyst deactivation, the rate and performance equations.

UNIT–V

Fluid-fluid reactions: kinetics- the rate equation.

Fluid-particle reactions: kinetics- selection of a model, shrinking core model for spherical particles of unchanging size, rate of reaction for shrinking spherical particles, extensions, determination of rate controlling step.

TEXT BOOKS:

1. Chemical Reaction Engineering, 3rd ed., O. Levenspiel, John Wiley & Sons, 1999.
2. Elements of Chemical Reaction Engineering, 4th ed., H.S. Fogler, PHI Learning Pvt. Ltd., New Delhi, 2010.

REFERENCES:

1. Chemical Engineering Kinetics, 3rd ed., J.M. Smith, McGraw-Hill, New York, 1981.
2. The Engineering of Chemical Reactions, 2nd ed., L.D. Schmidt, Oxford University Press, New Delhi, 2010

Outcome:

- Modeling of compartmental models for Non-ideal flow reacting vessels.
- Calculation of conversions based on variousmodels
- Students can design the fluid-solid reactors.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

CHEMICAL PLANT DESIGN AND ECONOMICS (15A08605)

OBJECTIVES:

- To familiarize the students about various economic aspects of chemical processes
- Learn basics of Cost estimation, Working Capital and Capital Investment and understand the time value of money
- Learn the importance of Cash flow diagrams and Break-even analysis.
- Study depreciation methods and methods of estimation of profitability of an industry
- Study the procedures adopted for Replacement and Selection from Alternatives.

UNIT I

Introduction, Process Design development.General design considerations, Cost and asset accounting.Cash flow for industrial operations, factors effecting investment and production cost, capital investments, estimation of capital investments, cost indices, cost factors in capital investment

UNIT II

Organizations for presenting capital investments, estimates by compartmentalization, estimation of total product of cost direction, production costs, fixed charges, plant overhead costs, financing.

Interest and investment cost, type interest, nominal and effective interest rates, continuous interest, present worth and discount annuities, cost due interest on investment, source of capital.

UNIT III

Taxes and insurances, type of taxes: federal income taxes, insurance-types of insurance, self insurance.

Depreciation : types of depreciation, services life, salvage value, present value, methods for determining depreciation, single unit and group depreciation.

UNIT IV

Profitability: alternative investments and replacements, profitability standards, discounted cash flow, capitalized cost, pay out period ,alternative investments, analysis with small investments, increments and replacements.

UNIT V

Optimum design and design strategy, incremental cost, general procedure for determining optimum condition, comparison of graphical and analytical methods, optimum production rates, semi continuous cyclic operation, fluid dynamics, mass transfer strategy of linearization

TEXT BOOK:

1. Plant Design and Economics for Chemical Engineering, 4th ed., M.S. Peters and K.D. Timmerhaus, McGraw-Hill,1991

REFERENCE:

1. Process Engineering Economics, Schweyer

Outcome:

- Estimate various costs involved in a process industry and evaluate the tax burden of an establishment
- They will be ready with tools to estimate profitability of a company
- Find the replacement costs of an equipment and select best one from different alternatives
- Compute break even period for an investment and rate of return

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III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

BASICS OF NANOTECHNOLOGY (OPEN ELECTIVE) (15A08606a)

OBJECTIVES:

- Basic knowledge of nanotechnology, classification and properties of nanomaterials
- Various methods of synthesis of nanomaterials
- Applications of nanomaterials

Unit I

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit II

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations. **Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, Enhanced solid solubility.

Unit III

Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit IV

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly

Unit V

Top down approaches: Mechanical alloying, Nano-lithography.

Consolidation of Nanopowders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

Applications of Nanomaterials: Nano-electronics, Nanosensors, Nanocatalysts, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications

TEXT BOOKS

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES:

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

Outcomes:

- Understand the importance of nanotechnology and its interdisciplinary nature.
- Understand the methods of fabrications and applications of nanomaterials
- Understand the Unique properties of nanomaterials.

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III Year B.Tech. Chem. Engg. II-Sem

L	T	P	C
3+1*		0	4

GREEN TECHNOLOGY (OPEN ELECTIVE) (15A08606b)

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 byproduct synergies.

TEXT BOOKS

SHONNARD, D.ALLEN, D. Green Egineering: Environmentally Conscious Design of Chemical Processes.

Outcomes:

- To present approaches and methodologies for evaluating and improving the environmental performance of chemical processes and chemical products.
- To understand the basic knowledge of environmental issues and environmental regulations.
- To discuss the type of wastes and emissions that drive the environmental impacts.

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III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

NUCLEAR ENGINEERING (OPEN ELECTIVE) (15A08606c)

UNIT-1

Introduction: Motivation for Nuclear Energy, India’s Nuclear Power Program

Nuclear Physics: Nuclear model of the atom - Equivalence of mass and energy - Binding - Radio activity - Half life - Neutron interactions - Cross sections.

UNIT-II

Nuclear Reactions and Reactor Materials

Mechanism of nuclear fission and fusion - Radio activity - Chain reactions - Critical mass and composition - Nuclear fuel cycles and its characteristics - Uranium production and purification - Zirconium, thorium, beryllium.

UNIT-III

Reprocessing

Nuclear fuel cycles - spent fuel characteristics - Role of solvent extraction in reprocessing - Solvent extraction equipment.

UNIT-IV

Nuclear Reactors

Reactors - Types of fast breeding reactors - Design and construction of fast breeding reactors - heat transfer techniques in nuclear reactors - reactor shielding.

UNIT-V

Safety, Disposal and Proliferation

Nuclear plant safety- Safety systems - Changes and consequences of an accident - Criteria for safety - Nuclear waste - Type of waste and its disposal - Radiation hazards and their prevention - Weapons proliferation.

Text Books:

1. Thomas J.Cannoly, " Fundamentals of Nuclear Engineering ", John Wiley (1978).
2. G,Vaidyanathan,” Nuclear Reactor Engineering”, Chand Publishers, 2013

References:

1. Collier J.G., and G.F.Hewitt, " Introduction to Nuclear Power ", (1987), Hemisphere Publishing, New York.
2. Lamarsh U.R. " Introduction to Nuclear Engineering Second Edition ", (1983), Addison Wesley M.A.
3. Lipschutz R.D. " Radioactive Waste - Politics, Technology and Risk ", (1980), Ballingor, Cambridge. M.A.

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III Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

SOLID WASTE MANAGEMENT (OPEN ELECTIVE) (15A08606d)

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 a energy recovery from a given waste data using case standing

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.

Text Books:

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.

Outcomes:

The student should be able to

- Apply his knowledge of characterization of waste and develop a suitable management plan
- Assess the cost of transportation laboratory processing of solid waste
- Identify hazardous nature of waste if any and can suggest suitable dumping methods.
- Suggest processing waste for material for energy recovery.
- Develop a management plan for land filling composting deep well injection for non-recoverable waste.

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. II-Sem

L	P	C
0	3	2

CHEMICAL REACTION ENGINEERING LAB (15A08607)

OBJECTIVES:

- Operate lab equipments like CSTR, Batch, PFR reactors.
- Analyze the concentration versus time data and determine the specific rate constant and the order of the reaction.
- Compare theoretical and experimental conversions in a CSTR and PFR.
- Estimate RTD and model parameters in a CSTR, PFR, packed bed and CSTRin-series.

1. Determination of the order of a reaction using a batch reactor and analyzing the data by (a) differential method (b) integral method.
2. Determination of the activation energy of a reaction using a batch reactor .
3. To determine the effect of residence time on conversion and to determine the rate constant using a CSTR.
4. To determine the specific reaction rate constant of a reaction of a known order using a batch reactor.
5. To determine the order of the reaction and the rate constant using a tubular reactor.
6. CSTRs in series- comparison of experimental and theoretical values for space times and volumes of reactors.
7. Mass transfer with chemical reaction (solid-liquid system) – determination of mass transfer coefficient.
8. Mass transfer with chemical reaction (liquid-liquid system) – determination of mass transfer coefficient
9. Axial mixing in a packed bed. Determination of RTD and dispersion number for a packed-bed using tracer
10. Determination of RTD and dispersion number in a tubular reactor using a tracer.

Outcomes:

- Skills of deriving the kinetic expressions by performing the experiments on batch and continuous flow reactors.
- Understand the effects of non ideal flow.
- Proficient to estimate RTD and model parameters in a CSTR, PFR, packed bed and CSTRin-series

JNTUA College of Engineering (Autonomous), Ananthapuramu

III Year B.Tech. Chem. Engg. II-Sem

L	P	C
0	3	2

MASS TRANSFER OPERATIONS LAB (15A08608)

OBJECTIVES: This lab gives an overall idea of various mass transfer operations used in the industry.

1. Estimation of diffusivity coefficients for vapor in gas
2. Estimation of solid diffusion coefficient in air
3. Steam distillation
4. Simple distillation
5. Evaluation of HETP in packed towers
6. Vapor Liquid Equilibria
7. Batch Drying
8. Evaluation of Mass transfer coefficients for Surface Evaporation
9. Evaluation of Mass transfer coefficients for Wetted wall column
10. Liquid- Liquid Equilibria (Tie line data)
11. Ternary Liquid Equilibria (binodal curve)
12. Leaching
13. Adsorption studies

Outcomes:

1: The student will be able to perform VLE, LLE related experiments and can estimate diffusivity coefficients.

2: The student will be able to learn about the calculation of different parameters in distillation, absorption, drying and evaporation.

3: The student will be able to design distillation units, drying and evaporation units.

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III Year B.Tech. Chem. Engg. II-Sem	**L**	**P**	**C**
	0	**3**	**0**

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(AUDIT Lab) (15A55601)

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.

Syllabus:

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.

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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IV Year B.Tech. Chem. Engg. I-Sem

L	P	C
3+1*	0	4

TRANSPORT PHENOMENA (15A08701)

OBJECTIVES:

- Different types of fluids, their flow characteristics and different mathematical models applied to actual situations
- Mechanism of fluids in motion under different conditions.

UNIT-I

Viscosity and the mechanisms of momentum transfer: Newton's law of viscosity (molecular momentum transport), generalization of Newton's law of viscosity, pressure and temperature dependence of viscosity, molecular theory of the viscosity of gases at low density, molecular theory of the viscosity of liquids. Thermal conductivity and the mechanisms of energy transport: Fourier's law of heat conduction (molecular energy transport), temperature and pressure dependence of thermal conductivity, and theory of thermal conductivity of gases at low density. Diffusivity and the mechanisms of mass transport: Fick's law of binary diffusion (molecular mass transport), temperature and pressure dependence of diffusivities, theory of diffusion in gases at low density.

UNIT -II

Shell momentum balances and velocity distributions in laminar flow: shell momentum balances and boundary conditions, flow of a falling film, flow through a circular tube, flow through annulus, flow of two adjacent immiscible fluids, creeping flow around a sphere.

UNIT -III

Shell energy balances and temperature distributions in solids and laminar flow: shell energy balances; boundary conditions, heat conduction with an electrical heat source, heat conduction with a nuclear heat source, heat conduction with a viscous heat source, heat conduction with a chemical heat source, heat conduction through composite walls, heat conduction in a cooling fin, forced convection, free convection.

UNIT -IV

Concentration distributions in solids and laminar flow: shell mass balances; boundary conditions, diffusion through a stagnant gas film, diffusion with a heterogeneous chemical reaction, diffusion with a homogeneous chemical reaction, diffusion into a falling liquid film (gas absorption), diffusion into a falling liquid film (solid dissolution), diffusion and chemical reaction inside a porous catalyst.

UNIT -V

The equations of change: Derivation of the equation of continuity in Rectangular and Polar coordinates, the equation of motion, the equation of energy, the equation of continuity of a component in multi component mixture (in rectangular coordinates only) the equations of change in terms of the substantial derivative. Use of equations of change to solve one dimensional steady state problems of momentum, heat and component transfer, Introduction to Turbulent transport, Time smoothing of equation change.

TEXT BOOK:

1. Transport Phenomena by Bird R.B., Stewart W.C., Lightfoot F.N., 2nd ed. John Wiley &Sons Inc,U.S.A,1960.

Reference:

1. Transport phenomena for engineers by L. Theodore, International text book company, U.S.A.1971.
2. Transport processes and unit operations by C.J. Geankoplis, PHI, 3rded. 1997.
3. Fundamental of heat, momentum and mass transfer, Welty, Wicks and Wilson, John Wiley.

Pre-requisite: Fluid Mechanics for Chemical Engineers, Process heat transfer, Mass Transfer operations- I & II and Chemical Reaction Engineering I and II

Codes / Tables: 1. Leonard – Jones potential parameters and critical properties.
2. Equations of change (from Bird)

Outcomes:

1. Ability to understand the chemical and physical transport processes and their mechanism.
2. Ability to do heat, mass and momentum transfer analysis.
3. Ability to analyze industrial problems along with appropriate approximations and boundary conditions.
4. Ability to develop steady and time dependent solutions along with their limitations.

JNTUA College of Engineering (Autonomous), Ananthapuramu

IV Year B.Tech. Chem. Engg. I-Sem

L	**P**	**C**
3+1*	**0**	**4**

CHEMICAL PROCESS EQUIPMENT DESIGN (15A08702)

OBJECTIVES:

- Study design safe process and design appropriate equipment like reactors, mass transfer heat transfer equipment, pipelines storage tanks etc.
- Study relevant codes for design of chemical plant equipment as per the standard procedures specified by design code books.
- Learn the fabrication techniques and testing methods.
- Learn design and engineering skills directly applied in design, installation and commissioning of equipments.

UNIT-I

Basic Considerations in Process Equipment Design: Introduction, general design procedure, fabrication techniques, equipment classification, power for rotational motion, drives for process equipment

Materials of Construction: Mechanical properties, materials, corrosion, corrosion prevention, choice of material.

UNIT-II

Design Considerations: Introduction, stress created due to static and dynamic loads, design stress, combined stresses and theories of failure, fatigue, brittle fracture, creep, effects of temperature, radiation and fabrication methods.

Process Hazards and Safety Mechanisms in Equipment Design: Introduction, hazards in process industries, safety measures, safety measures in equipment design, pressure relief devices.

UNIT-III

Material Handling Equipment Design: Piping in fluid transportation process-selection of piping material, design of piping system, pumping of fluids: selection of pumps, design procedures for pumps, compression and expansion of fluids: selection of compressors, fans and blowers, vacuum system equipment, turbines and expanders, design procedures for compressors, turbines and expanders

Heat Transfer Equipment Design: Selection of heat exchangers types- key heat exchanger types available, preliminary selection of heat exchanger types,Design of key heat exchanger types- Double pipe and multiple double pipe exchangers, shell and tube heat exchangers, plate exchangers, compact exchangers, air cooled exchangers.

UNIT-IV

Seperation Equipment Design: Distillation design procedures for columns with sieve trays, with random packing, with structural packing, Absorption and Stripping design procedures for trayed columns, packed columns separating dilute solutions

Equipment Selection for liquid-liquid extraction: Design procedure for liquid liquid extraction, selection of sorbent for separation by adsorption, basic adsorption cycles, selection of appropriate adsorption cycles, general design for separation by adsorption

UNIT-V

Pressure Vessels: Introduction, operating condition, pressure vessel codes, selection of materials, vessels operating at low temperatures and elevated temperatures, Design conditions and stresses.

Design of shell and its components, Fabrication, Inspection and Tests.

TEXT BOOKS:

1. Joshi's Process Equipment Design, Fourth Edition by V. V. Mahajani and S. B. Umarji, Macmillan Publishers India Ltd., 2009.
2. Plant Design and Economics for Chemical Engineers, Fifth Edition by Max. S. Peters, Klans Timmerhaus and Ronald E. West, McGrawHill International Edition, 2004.

REFERENCE BOOKS:

1. Coulson J.M. and Richardson J.F., Chemical Engineering Vol.VI (An introduction to Chemical Engineering Design), Pergamon Press, 1993.

Outcome:

The student will be able to do

1. Mechanical design of pressure vessels
2. Process design of separation equipments for distillation, absorption, stripping, liquid-liquid extraction, adsorption
3. Selection of piping materials, pumps, compressors, compressors, fans and blowers, vacuum system equipment, turbines and expanders
4. Design of material handling equipment like piping system, pumps, compressors, turbines and expanders.

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IV Year B.Tech. Chem. Engg. I-Sem

L	P	C
3+1*	0	4

OPTIMIZATION OF CHEMICAL PROCESSES (15A08703)

OBJECTIVES:

- To learn problem formulation of optimization.
- To realize the numerical methods of un-constrained optimization.
- To learn linear programming and its applications
- To understand the use of genetic algorithms in optimization
- To know the applications of numerical optimization.

UNIT I

Nature and organization of optimization problems: Introduction to optimization, scope and hierarchy of optimization, examples of applications of optimization, essential features of optimization problems, general procedure for solving optimization problems, Optimization of a manufacturing problem with a stepwise procedure, obstacles of optimization, constraints in optimization, examples and formulation of constrained optimization problems.

Basic concepts of optimization: Continuity of functions, unimodal versus Multimodel functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function.

UNIT II

Optimization of unconstrained single variable functions: Region elimination methods: Fibonacci search, Golden section search. Polynomial approximation methods- Sequential search

Methods specifying optimum by a point: Newton's method, Secant method, Quadratic interpolation, Cubic interpolation. Applications of one- dimensional search methods to chemical engineering problems.

UNIT III

Unconstrained multivariable optimization: Random search methods, grid search, uni-variate search, multivariable Newton's method, steepest descent method, Conjugate search directions, Conjugate gradient method

.

UNIT IV

Optimization of Unit operations: Optimal pipe diameter, optimizing recovery of waste heat, optimization of multiple effect evaporator, Determination of optimal reflux ratio for staged distillation column, shell and tube heat exchanger.

UNIT V

Linear programming and applications: Basic concepts in linear programming, graphical solution, artificial variable technique, exceptional cases in LPP, non-existing feasible solution, degeneracy, duality in linear programming, dual simplex method, revised simplex method.

TEXT BOOKS:

1. Optimization of Chemical Processes, T.F. Edgar and D.M. Himmelblau, McGraw-Hill, New York, 2001.
2. Optimization for Engineering Design, Kalyan Moy Deb, PHI Pvt. Ltd., New Delhi, 2000

Outcome:

- Knowledge of optimization to formulate the problems and analyze the optimization criterion for solving problems
- Apply different methods of optimization and to suggest a technique for specific problem
- Advanced optimization techniques like Genetic algorithms and other optimization techniques can be used to solve the industrial problems of relevance to the chemical industry

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IV Year B.Tech. Chem. Engg. I-Sem

L	P	C
3+1*	0	4

SEPARATION TECHNIQUES FOR BIOPROCESSING (15A08704)

OBJECTIVES:

- Learn the fundamentals of adsorptive separations and modeling
- Study the Pressure swing & thermal swing adsorption, Counter current separations.
- Study the basic concepts and design procedures of chromatographic columns.
- Learn different membrane separation technological processes and their design

UNIT -I

Crystallization: crystal geometry, principles of crystallization equilibria and yields, nucleation, crystal growth, adsorption and mass transfer theories, precipitation, crystallization from melts. (Textbook 3)

UNIT -II

Adsorption: Adsorption, types of adsorption, nature of adsorbents, adsorption equilibrium, single gases and vapors, Adsorption Hysteresis, effect of temperature, Heat of adsorption, vapor and gas mixtures: One component adsorbed, Effect of change of temperature or pressure. Liquids, Adsorption of solute from dilute solution, The Freundlich equation, Adsorption from concentrated solutions, adsorption operations, stage wise operation, application of Freundlich equation to single and Multistage adsorption (cross current & counter current).

Fluidized and teeter beds, adsorption of vapor from a gas, fluidized bed, continuous contact, steady state moving bed adsorbers, unsteady state–fixed bed adsorbers, adsorption wave, elution, adsorption-desorption operations- thermal desorption of gases, activated carbon solvent recovery, pressure swing and vacuum swing adsorption (qualitative treatment), regeneration with purge and desorbent, ion-exchange: principles of ion exchange, techniques and applications. (Textbook 2)

UNIT –III (qualitative treatment only)

Chromatography: Types of chromatography: Gas and liquid chromatography, paper and thin layer chromatography, polarization chromatography, and continues chromatography, large-scale chromatography. Electrophoretic separations: Theory of electrophoresis, basic concepts of electrophoresis, forces in electrophoresis, complicating factors in electrophoresis, methods of electrophoresis: Moving boundary electrophoresis, gel membrane and paper electrophoresis, zone spreading in zonal electrophoresis, affinity electrophoresis, free solution and capillary electrophoresis. (Textbook 1)

UNIT-IV (qualitative treatment only)

Pressure driven membrane separation processes, reverse osmosis, ultrafiltration, micro filtration, nano filtration, governing equations, effect of operating parameters on flux and rejection, applications. Concentration and electrical driven membrane processes(Text book 1)

UNIT –V (qualitative treatment only)

Gas separation in porous and non-porous membrane, pervaporation, dialysis, liquid membranes, governing equations, effect of operating parameters on flux and selectivity, applications, concentration polarization, approximate analysis for concentration polarization, mass transfer correlations, gel formation and fouling, membrane modules. (Textbook 1)

Text Book:

1. Rate controlled separation by Phillip C. Wankat, Springer international, 2005
2. Mass transfer operations by R.E. Tryebal, Mc Graw Hill, 3rd ed. 1980.
3. Unit operations of Chemical Engineering by Mc.Cabe & Smith, McGraw-Hill, 5th edition 1993

References:

1. Separation processes, C. J. King, Tata McGraw Hill.
2. Transport processes and unit operations, C.J. Geankoplis, Prentice-Hall India, 3rd edition, 2000

Pre-requisite: Mass Transfer operations-I, II, Phase and Chemical Equilibria, Chemical Process Calculations.

Outcome:

- The students would fully understand key concepts of separation processes including equilibrium stages, reflux, countercurrent contacting, limiting cases, efficiency and mass transport effects.
- The student will know about handling of separations using solid- fluid and separation techniques for the low-temperature, heat sensitive materials.
- Facilitate the students with the novel techniques that are required in downstream processing of biotechnology based industries.

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IV Year B.Tech. Chem. Engg. I-Sem **L P C**
3+1*0 4

INDUSTRIAL ENGINEERING AND MANAGEMENT (15A08705)

OBJECTIVES: The objective of the course, is to equip the Engineering students about the fundamental knowledge of general management, management of materials, human resource management, marketing management, inspection and quality control and will be exposed to the latest and contemporary issues of industrial management.

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-Weber's Ideal Bureaucracy –Eltan Mayo's Human relations– Systems theory- Situational or Contingency theory- Social responsibilities of management. **Organizational structure and design**: Features of organizational structure- Work specialization-Departmentation-Span of control-Centralization and Decentralization **Organisational designs**-Line Organization-Line & Staff Organization-Functional Organization- Matrix Organization-Project Organization-Committee form of Organisation

UNIT II

Plant Location and Material Management:

Definition- Factors affecting the plant location- comparison of rural and urban sites-methods for selection of plant-Types of Plant Layout-Methods of production (Job, batch and Mass Production)- Work Study. **Materials Management:**Inventory-functions-Inventory classification techniques-EOQ, ABC and VED analysis- Inventory Control System- Purchase- Procedure - Stores Management.**Marketing Mangement:** Definition-Functions of Marketing- Marketing Mix-Marketing strategies based on Product Life Cycle- Channels of distribution.

UNIT III

Human Resources Management (HRM):

HRM- Definition and meaning – Nature-Managerial and Operative functions-Evolution of HRM-Human Resource Planning(HRP)-Employee Recruitment-Sources of Recruitment -Employee Selection- Process and tests in employee selection- Employee training and development-On- the- job and Off –the- job training methods-Performance Appraisal systems-Concept-methods of Performance Appraisal-Placement-Employee Induction-Wage and Salary Administration-Objectives-Essentials of Wage and Salary Administration-Job Analysis-Process -Job Evaluation-Employee Grievances-Techniques of handling Grievances.

UNIT IV

Inspection and Quality Control: Types of inspections - Difference between Inspection & Quality Control- Statistical Quality Control techniques-Variables and Attributes- Variable control charts - R charts-Attributes control charts-P charts - C charts. Acceptance sampling plan-Single sampling - Double sampling plans-OC curves-Introduction to TQM-Quality Circles-ISO 9000 series procedures.

UNIT V

Contemporary Issues in Management:

The concept of MIS- Materials Requirement Planning (MRP)- Just-In-Time (JIT) System- Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management- Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO)- Business Process Re-engineering and Bench Marking- Balanced Score Card-Knowledge Management.

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.

Outcome: After completion of this course, the prospective engineering technocrats will be able to understand various fundamentals of functional areas such general management, plant and materials management, marketing management,human resource management, statistical quality control techniques, strategic management and also aware of the latest and contemporary issues of industrial management.

Text Books:

1. GuptaA.K.EngineeringManagement,SChand&CompanyLimitedNewDelhi-2014(Reprint)
2. Khanna O.P and Dhanpat Rai Industrial Engineering &Management.

Reference Books:

1. A.R Aryasri: Management Science, TMH, 2013.
2. Stoner. Freeman. Gilbert. Managemem. 6th Ed, Pearson Education. New Delhi, .
3. Fanner Selvam, Production and Operations Management, PHI.
4. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering &Quality Engineering. Galgotia Publications, Pvt Limited.
5. Ralph M Barnes. Motion and Time Studies. John Wiley and Sons. 2004.
6. Chase. Jacobs. Aquilano. Operations Management. TM Ii 10th Edition. 2013.

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IV Year B.Tech. Chem. Engg. I-Sem	L	P	C
	3+1*	0	4

ELECTIVE – I (Through Mooc) (15A08706)

JNTUA College of Engineering (Autonomous), Ananthapuramu

IV Year B.Tech. Chem. Engg. I-Sem L P C
0 3 2

PROCESS EQUIPMENT DESIGN AND DRAWING LAB (15A08707)

OBJECTIVES: To make the student familiar with design and drawing aspects of chemical processes equipments.

1. Drawing of flow sheet symbols.
2. Drawing of instrumentation symbols.
3. Drawing of instrumentation diagrams.
4. Mechanical aspects chemical equipment design and drawing of following equipment.
    a) Double pipe heat exchanger
    b) Shell and tube heat exchanger
    c) Evaporator
    d) Distillation column
    e) Batch reactor.

Text Book:

1. Process Equipment Design by M. V. Joshi
2. Chemical Process Equipment Design and Drawing, S.C. Maidargi, PHI, 2013

Reference:

1. Process Equipment Design by Brownell and Young
2. Chemical Process Equipment Design by Bhattacharya
3. Process Equipment Design by Wallas

Pre-requisite: Chemical Process equipment design

<u>Outcome:</u>

- Students would gain knowledge to develop key concepts and techniques to design the process equipment in a process plant. These key concepts would be utilized to make design and operating decisions.

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IV Year B.Tech. Chem. Engg. I-Sem

L	P	C
0	3	2

SIMULATION LAB (15A08708)

Objective: To make the student familiar with software's and simulation of chemical processes equipments.

The following experiments have to be conducted using C and MATLAB

1. General introduction to MATLAB
2. Functions (log, exp, conv, roots).
3. Matlab Scripts and function files
4. Gravity Flow tank.
5. Three CSTRs in series – open loop
6. Three CSTRs in series – Closed loop
7. Non isothermal CSTR
8. Binary Distillation column
9. Batch Reactor isothermal; Batch reactor non isothermal – closed loop
10. Isothermal batch reactor – open loop
11. Heat Exchanger
12. Interacting System- two tank liquid level
13. Non interacting system-two tank liquid level
14. Plug flow reactor
15. Bubble point calculations
16. Dew point calculations

TEXT BOOKS:

1. A Guide to MATLAB for Chemical Engineering Problem Solving, Kip D. Hauch
2. Understanding MATLAB A Textbook for Beginners by S.N. Alam

Pre-requisite: Fluid mechanics for chemical Engineers, Process Heat transfer, Mass transfer operation- 1 & 2, Chemical Reaction Engineering.

Outcomes:

1. Helps to interconnect knowledge of mathematics, science, and engineering to real world problems.
2. Helps to identify, formulate, and solve engineering problems
   (for ex: most of chemical engineering problems are based on transport equations consisting broader areas of kinetics, thermodynamics and mass transfer which can be

   thoroughly solved using MATLAB inbuilt functions)
   - The complex multi component distillation column design can be modeled and simulated
   - System of ordinary and partial differential equations obtained in multiple reactors in series/parallel can be solved
   - Process control and optimization of reactors can be handled easily
3. "Genetic algorithms" can be implemented at a more pronounced way via MATLAB to solve various linear and non linear models of chemical engineering systems.
4. Most fascinating approach of Artificial Neural Networks (ANN) for electrical related concepts of chemical engineering systems can also be well handled in MATLAB
5. Steady state and unsteady state problems of chemical engineering and allied fields can be modeled and solved using MATLAB

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Project Work Part - A (15A08709)

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IV Year B.Tech. Chem. Engg. II-Sem **L P C**
3+1* 0 4

DESIGN AND ANALYSIS OF EXPERIMENTS (15A08801a)
Elective – II

Objectives:

- Which factors affect a given experiment?
- Find the most significant factor for an experiment.
- Calculate the factor levels that optimize the outcome of an experiment.
- Factorial Design of experiments.

UNIT- I

Introduction to probability, probability laws, Baye's theorem.Probability distributions, parameters and statistics.Normal and t-distributions, central limit theorem, random sampling and declaration of independence significance tests

UNIT- II

Randomization and blocking with paired comparisons significance tests and confidence interval for means, variances, proportions and frequencies.

UNIT-III

Analysis of variance, experiments to compare k-treatment means, Two-way factorial designs, blocking, Yate's algorithm

UNIT- IV

Fractional factorial designs at two levels, concept of design resolution, Simple modeling with least squares (regression analysis), Matrix versions of normal equations

UNIT- V

Mechanistic model building, Empirical and mechanistic models, model building process, model testing with diagnostic parameters.

Text Book:

1. Statistics for experimenters by G.E.P. Box, William G. Hunter and J.S. Hunter, John Wiley & Sons.

Reference:

1. "Design and analysis of experiments" by D.C. Montgomery, 2nd edition John Wiley and sons, NewYork (1984).

<u>Outcome</u>:

- Predict how many numbers of experiments are to be carried out, given the number of important factor
- Design an experiment and calculate the factor levels that optimize a given objective.
- Use response surface methodology to optimize the process, by considering curvature effects.
- Understand strategy in planning and conducting experiments
- Choose an appropriate experiment to evaluate a new product design or process improvement

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IV Year B.Tech. Chem. Engg. II-Sem	**L**	**P**	**C**
	3+1*	**0**	**4**

INDUSTRIAL SAFETY AND HAZARD MANAGEMENT (15A08801b)
ELECTIVE-II

OBJECTIVES:

- Have awareness of different hazards in process industries
- Classification of hazards and their identifications
- Precautions in chemical storage and handling
- Learn risk analysis techniques and quantify them
- Learn emergency management plans

Unit – I

Introduction, Factors Contributing to the Costs of Accidents, List of some Notable accidents in the process industry/selected case histories, some common features of high cost accidents, reasons for high priority towards safety.

Unit – II

Material hazards1: Introduction Hazardous substances-categories, Toxicity, Radiation, Flammability, Ignition, Fires and explosions.

Unit – III

Material hazards 2: Fire balls, Fire damage, run away chemical reaction, incompatible materials, material safety and data sheets

Process and plant Hazards: Hazards of pressure, causes of over pressures, flow deviations, effects of leakages/releases, hazards of temperatures.

Unit – IV

Hazard analysis: process safety management, process hazards analysis, hazards analysis methods, check list, preliminary hazard analysis, what-if / check list, hazard and operability analysis, FMEA, Fault tree analysis, cause and consequence analysis.

Unit – V

Preventive and protective measures: Safety options, process safety approaches, inherent safety and design, plant layout, inherent security, explosion prevention and protection, personal protective systems, plant modifications and management change, relief valves and rupture discs, breather vents for storage tanks, explosions vents, flame arresters, flare systems

TEXT BOOK:

1. Chemical process industry safety by K S N Raju, Mc-Graw Hill education (India) Pvt.Ltd,2014

2. Chemical process Safety by Crowl

REFERENCES:

1. Chemical process safety by sanders

Outcome:

- The student will be equipped with the knowledge by which thorough safety is ensured in the organization.
- Classify and identify hazards in chemical industries
- Take precautions in chemical storage and handling
- Perform fault tree and event tree risk analysis and quantify them
- Suggest and make others in the plant about emergency management plans

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

CHEMICAL PLANT UTILITIES (15A08801c)
ELECTIVE – II

UNIT- I
STEAM, COMPRESSORS AND VACUUM PUMPS
Steam generation and its application in chemical process plants, steam distribution including appropriate mechanical valves and instrumentation, steam utilization, design of efficient steam heating systems, steam nozzles. Compressed air, process pumps, compressors, vacuum pumps, pressurized air distribution systems. Types of compressors and vacuum pumps.

UNIT- II
REFRIGERATION SYSTEMS AND INSULATION
Refrigeration system and their characteristics, load calculation and load calculation and humidification and de humidification equipments, drying and cooling tower, air blending, exhaust, ventilation, cryogenics, their characteristics and production of liquid N2 and O2 Importance of insulation for meeting for the process equipment, insulation material and the air effect on various materials of equipment piping, fitting and valves, insulation for high, intermediate, low and sub zero temperatures including cryogenic insulation, determination of optimum insulation thickness.

UNIT –III
WATER
Water Resources, process water, boiler feed water, storage and distribution of water, reuse and conservation of water.

UNIT- IV
PIPING
Piping: Role & scope of piping, line diagram, Process flow diagram and piping and instrumentation diagram

UNIT- V
PINCH ANALYSIS
Problem representation, temperature enthalpy diagram, simple match matrix. Heat content diagram, Temperature interval diagram. Heat Exchanger Network Synthesis using Pinch technology

TEXT BOOK
1.Jack Broughton,Process Utility Systems:Introduction to Design, Operation and Maintenance ,IChemE, 1994

REFERENCES
1.Mahesh Rathore,"Thermal Engineering,"Tata McGraw Hill India, New Delhi,2010
.
2.Robin M. Smith,"Chemical Process: Design and Integration",John Wiley &Sons Ltd., 2005

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L	P	C
3+1*	0	4

INDUSTRIAL POLLUTION & CONTROL ENGINEERING (15A08802a)
ELECTIVE-III

OBJECTIVES: The aim of this course is that the students will learn the essential principles used in industrial pollution abatement and understand important issues in industrial pollution abatement and pertinent environmental legislations.

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.

UNITII

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.

TEXT BOOKS:

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.

REFERENCES:

1. Wastewater Treatment, M. Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.

OUTCOMES:

2. Understand the different types of wastes generated in an industry, their effects on living and non-living things.
3. Understand environmental regulatory legislations and standards and climate changes.
4. Understand about the quantification and analysis of wastewater and treatment.
5. Understand the different unit operations and unit processes involved in conversion of highly polluted water to potable standards.
6. Understand the atmospheric dispersion of air pollutants, and operating principles, design calculations of particulate control devices.

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IV Year B.Tech. Chem. Engg. II-Sem **L P C**

3+1* 0 4

COMPUTATIONAL FLUID DYNAMICS (15A08802b)

ELECTIVE-III

UNIT I - CONSERVATION LAWS OF FLUID MOTION

Governing equations of fluid flow and heat transfer - Equation of state – Navier Stokes equations for a Newtonian fluid – Governing equations of the flow of compressible Newtonian fluid – Differential and integral forms of the general transport equations.

UNIT II - FINITE VOLUME METHOD FOR DIFFUSION PROBLEMS

One-dimensional, two dimensional and three dimensional steady state diffusion problems – One dimensional unsteady heat conduction.

UNIT III - THE FINITE VOLUME METHOD FOR CONVECTIVE-DIFFUSION PROBLEMS

Steady one-dimensional convective and diffusion – Assessment of the central differencing scheme for convective diffusion problems – The upwind differencing scheme – The hybrid differencing scheme – Higher order differencing schemes for convective diffusion – Discretisation of transient convection-diffusion equation

UNIT IV - SOLUTION ALGORITHMS FOR PRESSURE-VELOCITY COUPLING IN STEADY FLOWS

Introduction – The staggered grid – The momentum equations – The SIMPLE algorithm – The SIMPLER algorithm – The SIMPLEC algorithm – The PISO algorithm – Transient SIMPLE algorithm

UNIT V - SOLUTION OF DISCRETISED EQUATIONS

Introduction – The tri-diagonal matrix algorithm – Application of TDMA to two dimensional problems – Application of the TDMA method to three-dimensional problems

TEXT BOOK

1. Versteeg. H. K and Malalasekera. W. "*An introduction to computational fluid dynamics – The finite volume method"*, Longman Group Ltd 1995

REFERENCES

1. Ferziger. J.H, and Peric. M. "*Computational Methods for Fluid Dynamics*," Springer, 2002

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IV Year B.Tech. Chem. Engg. II-Sem	L	P	C
	3+1*	0	4

INTRODUCTION TO STATISTICAL THERMODYNAMICS (15A08802C)
ELECTIVE-III

UNIT I - CASCADES
Typical cascade configurations, Solid-liquid cascades, Single-section Liquid-Liquid extraction cascades, Degrees of freedom and specifications for countercurrent cascades.

UNIT II - APPROXIMATE METHODS FOR MULTICOMPONENT, MULTISTAGE SEPARATIONS
Fenske-Underwood – Gilliland Method, Kremser Group Method.

UNIT III - EQUILIBRIUM – BASED METHODS FOR MULTICOMPONENT ABSORPTION, STRIPPING AND EXTRACTION
Theoretical Model for an Equilibrium Stage, General Strategy of Mathematical Solution, Equation – Tearing Procedures – Tridiagonal Matrix Algorithm, Bubble Point Method for Distillation.

UNIT IV - ENHANCED DISTILLATION
Use of triangular graphs – Extractive Distillation, Azeotropic Distillation, Reactive Distillation.

UNIT V - ADSORPTION
Equilibrium Consideration – Liquid adsorption, Kinetic and Transport Considerations.

TEXT BOOK
1. Treybal. R .E, "*Mass Transfer Operations*", 3rd Edition, McGraw Hill, 1980.
REFERENCES
1. Seader. J D, & E J Henley, "*Separation Process Principles*", John Wiley & Sons Inc., 1998.

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

FLUIDIZATION ENGINEERING (15A08803a)
ELECTIVE –IV

UNIT I

Introduction: The phenomenon of fluidization; liquid like behavior of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds

Industrial applications of fluidized beds: Coal gasification; gasoline from other petroleum fractions; Gasoline from natural and synthesis gases; Heat exchange; Coating of metal objects with plastics; Drying of solids; Synthesis of phthalic anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; incineration of solid waste; Activation of carbon; gasification of waste; bio-fluidization.

UNIT II

Fluidization and mapping of regimes: Minimum fluidization velocity; Pressure drop vs. velocity diagram; effect of temperature and pressure on fluidization; Geldart classification of particles; terminal velocity of particles, Transport disengaging height; turbulent fluidization; pneumatic transport of solids; fast fluidization; solid circulation systems; Voidage diagram; Mapping of regimes of fluidization.

UNIT III

Bubbles in dense bed: Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles.

Bubbling Fluidized beds: Experimental findings; Estimation of bed Voidages; Physical models: simple two phase model; K-L model.

UNIT IV

High velocity Fluidization: Turbulent fluidized bed; Fast fluidization pressure drop in turbulent and fast fluidization.

Solids Movement, Mixing, Segregation and staging: Vertical movement of solids; Horizontal movement of solids; Staging of fluidized beds.

UNIT V

Gas Dispersion and Gas interchange in Bubbling Beds: Dispersion of gas in beds; Gas interchange between bubble and emulsion; Estimation of gas interchange coefficients.

Particle to Gas Mass Transfer: Experimental interpolation of mass transfer coefficients; Heat transfer; Experimental heat transfer from the bubbling bed model.

TEXT BOOKS

1. Fluidization Engineering by Kunil, Diazo and Octave Levenspiel, John Weiley& Sons Inc, Newyork, 1969.

2. Fluidization Engineering by J.R. Howard, Adam Heilgar

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

INTERFACIAL ENGINEERING (15A08803b)

Elective- IV

(Qualitative Treatment only)

Objectives:

1. Importance of various components of interfacial science in different chemical engineering industries viz. food, paint and pharmaceutical industries are emphasized.
2. The properties and functioning of surfactants and detergency are made familiarized. Interfacial and vander Waals forces play important role in the nano particles

UNIT-I:

Basic concepts of Colloids and Interfaces: Introduction, Examples of Interfacial Phenomena, Solid-Fluid Interfaces, Colloids.Properties of Colloid Dispersions: Introduction, Sedimentation under Gravity, Sedimentation in a Centrifugal Field, Brownian Motion, Osmotic pressure, Optical properties, Electrical Properties, Rheological Properties of Colloid Dispersions.

UNIT-II:

Surfactants and their properties: Introduction, Surfactants and their Properties, Emulsions and Microemulsions, foams.

UNIT-III:

Surface and Interfacial Tension: Introduction, Surface tension, Interfacial Tension, Contact Angle and Wetting, Shape of the Surfaces and interfaces.Measurement of Surface and Interfacial Tension, Measurement of Contact Angle;

UNIT-IV:

Intermolecular and Surface Forces: Introduction, Vanderwalls Forces.Intermolecular and Surface Forces: Electrostatic double layer force, The DLVO theory, Non-DLVO forces.

UNIT-V:

Adsorption at interfaces: Introduction, The Gibbs Dividing surface, Gibbs Adsorption Equation, Langmuir and Frumkin Adsorption Isotherms, Surface Equation of state(EOS), Effect of Salt on Adsorption of Surfactants.Adsorption Isotherms incorporating the Electrostatic Effects, Calculation of Free energy of Adsorption.

TEXT BOOKS:

1. **Foundations of Colloid Science by** R. J. Hunter, 2nd edition, Oxford University Press, USA, 2001.
2. **Principles of Colloid and Surface Chemistry**, Third edition, Revised and Expanded, Paul C. Hiemenz and Raj Rajagopalan.
3. **Physical Chemistry of Sciences**, 6th edition, A. Adamson, 1997.
4. **Interfacial Science: An Introduction by** G.Barnes, I.Gentle, Oxford University Press, USA, 2006.
5. **Coloid and Interface Science by** Pallab Ghosh, PHI, NEWDELHI.

Outcomes:

1. Realize the factors influencing stability of dispersions & emulsions.
2. Get the knowledge to measure surface tension & contact angle and apply them for practical problems.
3. Comprehend about detergency, surfactants and their applications.

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

POLYMER TECHNOLOGY (15A08803c)
Elective- IV

OBJECTIVES:

To enable the students to compute molecular weight averages from the molecular weight distribution, Condensation polymerization and transition in polymers

Unit I

Introduction; definitions: polymer& macro molecule, monomer, functionality, average functionality, co-polymer, polymer blend., plastic and resin. Classification of polymers: based on source, structure, applications, thermal behavior, mode of polymerization. Concept of average molecular weight of polymers, molecular weight distribution, poly disparity index. Determination of average molecular weights: End group analysis, osmometry, light scattering techniques, viscometer, Gel permeation chromatography.

Unit II

Natural polymers: brief study of i) Natural rubber ii) shellac iii) rosin iv) cellulose v) proteins.

Mechanism and kinetics of: Addition or chain polymerization

a) Free radical addition polymerization b) Ionic addition polymerizations

c) Coordination polymerization d) Coordination or step growth or condensation polymerization.

Unit III

Methods of polymerization: mass or bulk polymerization process, solution polymerization process, suspension polymerization process and emulsion polymerization method comparison of merits and demerits of these methods. Properties of polymers: crystalline and amorphous status, melting and glass transition temperatures and their determination, effect of polymer structure on mechanical, physical, chemical and thermal properties.

Unit IV

Degradation of polymers, Role of the following additives in the polymers: i) Fillers and reinforcing fillers ii) Plasticizers iii) Lubricants iv)Antioxidants and UV stabilizers v) Blowing agents vi)Coupling agents vii)Flame retardants viii) Inhibitors

Brief description of manufacture, properties and uses of: i) Polyethylene (HDPE&LDPE), ii) Poly propylene iii) Polyvinylchloride iv) Polystyrene v) Polytetra fluoroethylene vi) Polymethyl mehacrylate vii) Polyvinylacetate & Polyvinylalcohol.

Unit V

Brief description of manufacture, properties and uses of: i) Polyesters (Polyethylene terephthalate polycarbonate and unsaturated polyesters) ii) Nylon(Nylon 66) iii) Phenol-Formaldehyde resins iv) Epoxy resins v) Polyurethane vi) Silicones

Compounding of polymer resins, brief description of: i) Compression and transfer moulding ii) Injection moulding iii) Extrusion iv) Blow moulding v) Calendaring vi) Laminating and pultrusion

TEXT BOOKS:

1. Polymer Science & Technology, 2nd ed., J.R. Fried, PHI Learning Pvt. Ltd., New Delhi, 2009
2. Plastic materials, J.A. Brydson, Newnes-Butterworth (London) 1989.

REFERENCES:

1. Text book of polymer science, F.W.Jr. Bill Meyer, (3rd ed.) John Wiely&sons 1984
2. Introduction to Plastics, J.H. Brison and C.C. Gosselin, Newnes-Butterworth, London 1968.

Outcome:

- Classify the polymers and also able to identify the structural configurations of any polymer.
- Distinguish the modification of a polymer and also in a position to examine the mechanism of a polymerization.
- Synthesize any elastomer and optimize their deformation properties on applying force.
- Explain the processing of polymer, identify the mode of deformation of a polymer and test the mechanical strength of a polymer.

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

PETROLEUM REFINING AND PETROCHEMICALS (15A08804a)
ELECTIVE –V

OBJECTIVES:

- Learn the formation, refining of crude oil and products of refinery.
- Understand the means of processing data including thermal properties, important products characteristics.
- Develop skills in drawing neat flow diagrams of different petroleum refining processes
- (cracking/reforming/alkylation/isomerization / hydrocracking etc.,) that are aimed at producing high value/demand products.
- Identify important testing methods for important petroleum products.
- Have idea on Indian standards for major petroleum products

UNIT-I:

Origin, formation and composition of petroleum: Origin and formation of petroleum, Reserves and deposits of world, Indian Petroleum Industry. Petroleum processing data: Evaluation of petroleum, thermal properties of petroleum fractions, important products, properties and test methods.

UNIT-II:

Fractionation of petroleum: Dehydration and desalting of crudes, heating of crude pipe still heaters, distillation of petroleum, blending of gasoline. Treatment techniques: fraction-impurities, treatment of gasoline, treatment of kerosene, treatment of lubes.

UNIT-III:

Thermal and catalytic processes: Cracking, catalytic cracking, catalytic reforming, Naphtha cracking, coking, Hydrogenation processes, Alkylation processes, Isomerization process.

UNIT-IV:

Petrochemical Industry – Feed stocks Chemicals from methane: Introduction, production of Methanol, Formaldehyde, Ethylene glycol, PTFE, Methylamines.

UNIT-V:

Chemicals from Ethane-Ethylene-Acetylene: Oxidation of ethane, production of Ethylene, Manufacture of Vinyl Chloride monomer, vinyl Acetate manufacture, Ethanol from Ethylene, Acetylene manufacture, Acetaldehyde from Acetylene.

TEXT BOOKS:

1. Nelson. W.L. “Petroleum refining Engineering”, 4 Edition, Mc Graw Hill, New York, 1969.

2. Rao, B.K.B. “Modern Petroleum Refining Processes”, 4 Edition, Oxford and IBH Publishing, 2002.

REFERENCES:

1. Goldstine. R.F. “The Petroleum Chemicals Industry”, Taylor and Francis, London, 1967.

2. Gruese. W.S.and Stevens, D.R. “Chemical Technology of Petroleum”, McGraw Hill, 1980.

3 Chauvel. A. and Lefevrev, “Petro Chemicals”, Volume 1 and 2, Gulf Publishing company 1989.

Outcomes:

- Describe the formation of crude oil, its refining techniques.
- Describe the chemical composition and physical properties of crude oil
- Understand various processes employed in petroleum refinery such that we can meet customer demand in terms of quality & quantity.
- Demonstrate the different methods available for removal of impurities from crude and products manufacture
- Understand, draw and describe the process flow diagrams of various refinery processes like distillation, cracking and reforming etc.,
- Understand the difference between thermal and catalytic cracking.

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IV Year B.Tech. Chem. Engg. II-Sem **L P C**
3+1* 0 4

FOOD PROCESSING TECHNOLOGY (15A08804b)
Elective – V

Objectives: To impart knowledge to the students about food processing and various unit operations involved in it, packaging, storing and preservation.

UNIT I
Food process engineering - Fundamentals: Fundamentals of food process engineering, application of quantitative methods of material and energy balances in food engineering practices.
UNIT II
Unit Operations in food industries: Fluid flow, thermal process calculations, refrigeration, evaporation and dehydration operations in food processing.
UNIT III
Microwave heating: Theory of microwave heating, microwave properties of foods, comparison of microwave and conventional heating, benefits of microwave heating, applications in food processing, microwave heating equipment, hazards of microwave heating.

UNIT IV
Mechanical Operations in food processing: Conversion operations, Size reduction and screening of solids, mixing and emulsification, filtration and membrane separation, centrifugation, crystallization, extraction.
UNIT V
Preservation operations: Preservation methods & Strategies, Thermal Methods, Nabla Factor Sterilization Types Pasteurization Dehydro freezing Irradiation Dosimetry Transport of food & Preservation strategies Cheap and applicable everywhere.

TEXT BOOKS

1. R. T. Toledo, "Fundamentals of Food Process Engineering", AVI Publishing Co., 1980.
2. R. Angold,G.Beech and J.Taggart, " Food Biotechnology", Cambridge University Press, 1989.
3. Fundamentals of Food Engineering, D G Rao, PHI, New Delhi, 2012.

REFERENCES

1. J. M. Jackson and B. M. Shinn, "Fundamentals of Food Canning Technology", AVI Publishing Co., 1978.
2. J. G. Bernnan, J. R. Butters, N. D. Cowell and A.E.V.Lilley, "Food Engineering Operations", 2nd Edn., Applied Science, 1976.

Outcomes:
1. Understanding the various causes of food deterioration and food poisoning.
2. Identification of appropriate processing, preservation, and packaging method.
3. Analyze product quality and effect of processing technique on it.

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IV Year B.Tech. Chem. Engg. II-Sem

L	P	C
3+1*	0	4

RHEOLOGY OF POLYMERS (15A08804c)
Elective – V

Unit I

Stress tensor, principal stress and invariants, polar decomposition theorem, finger tensor, strain tensor, inverse deformation tensors, principal strains, uniaxial extension and simple shear in neo-hookean solid, rate of deformation tensor, Newton's law in three dimensions, uniaxial extension, viscosity models for general viscous fluids and visco-plastic models.

Unit II

General linear viscoelastic model, stress relaxation and creep, non-linear viscoelasticity - normal stress difference in shear, shear thinning, interrelations between shear functions, extensional thickening, differential-type constitutive equations - single mode differential constitutive equations and multimode constitutive equations for viscoelastic fluids, integral type constitutive equations, rate-type constitutive equations for viscoelastic fluids.

Unit III

Shear rheometer: sliding plates, falling ball rheometer, concentric cylinder rheometer, cone and plate rheometer, parallel disks, capillary rheometer, slit rheometer and squeezing flow behavior.

Unit IV

Rheology of polymeric liquids: polymer chain conformation, zero shear viscosity, rheology of dilute polymer solutions, entanglement, Reptation Model, effect of long chain branching, effect of molecular weight distribution, temperature dependence.

Unit V

Rheology in polymer processing operations: Calendaring and two roll mill, Twin screw extruders, Blow molding, Wire coating, Thermoforming, Sheet extrusion, Internal mixers, Rubber extrusion

Reference books:

1. Rheology, Principles, Measurements and Applications, Christopher W. Macasko, WileyVCH,1994
2. Rheology and Processing of Polymeric Materials, Vol. 1, Oxford University Press, 2007
3. Rheology: Concepts, Methods, and Applications, Prof. Dr. Alexander Ya. Malkin, Prof. Dr. Avraam I Isayev, ChemTec Publishing, 2006

4. Dynamics of Polymeric Liquid, Volume I, R. Byron Bird, Robert C Armstrong, Ole Hassager, John Wiley and Sons, 1976
5. Polymer Processing Fundamentals, Tim A Osswald, Hanser Publishers, Munich, 1998.
6. Melt Rheology and its Role in Plastic Processing: Theory and applications, John M. Dealy, Kurt F. Wissbrun, Reprinted by Chapman and Hall,1999.

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IV Year B.Tech. Chem. Engg. II-Sem **L P C**
3+1* 0 4

CORROSION ENGINEERING (15A08804d)

Elective – V

OBJECTIVES:

The course will enable the students to:

1. Be introduced to the principles of electrochemistry as well as the essential elements of electrochemical corrosion.
2. Lay a foundation for understanding the forms of corrosion, the mechanisms of corrosion, electrochemical methods.
3. Develop the thermodynamic and kinetic aspects of electrochemistry, including potential-pH (Pourbaix) diagrams, mixed potential theory, and the theory and application of polarization.
4. Design methods for combating corrosion, the principles and methods leading to mitigation of corrosion problems that might occur in engineering practice.

UNIT- I:

Introduction

Definitions of Corrosion - Overall classification of types of corrosion-Basic electrochemistry – Galvanic and electrolytic cells – Potential measurements - EMF and Galvanic series – Galvanic corrosion and bimetallic contacts – Eh – pH diagrams, Cost of Corrosion, Metallurgical properties influencing corrosion.

UNIT-II:

Forms of Corrosion

Uniform attack, galvanic, crevice, pitting, Inter granular, selective leaching, erosion and stress corrosion – Mechanisms, testing procedures and their protection.

UNIT- III:

Electrode kinetics and polarization phenomena

Electrode – solution interface – Electrode kinetics and polarization phenomena – Exchange current density – Polarization techniques to measure corrosion rates – Mixed potential theory – Activation and diffusion controlled mixed electrodes.

UNIT IV:

Methods of corrosion prevention and control

Design, coatings and inhibition – Cathodic protection – Stray current corrosion – Passivity phenomena and development of corrosion resistant alloys – Anodic control.

UNIT-V:

Industry Approach

Selection for a given Chemical Engineering Service Environment- Materials for Chemical Engineering Industry to resist the given chemical Environment.-Ferritic, Austenitic steels and stainless steels- Copper and its alloys-Brasses, bronzes, Nickel and its alloys- Monel alloys-materials for a petroleum refinery industry.

TEXT BOOKS:

1. M. G. Fontana, Corrosion Engineering (Third Edition) McGraw-Hill Book Company.
2. Denny A Jones, Principles and Prevention of Corrosion (second edition), Prentice-Hall, N. J. (1996).

REFERENCE:

1. H. H. Uhlig and R. W. Revie, Corrosion and Corrosion Control, Wiley (NY) (1985).

Outcomes:

At the end of the course, the students will be able to:
1. Understand the electrochemical and metallurgical behavior of corroding systems.
2. Apply the electrochemical and metallurgical aspects of combating eight forms of corrosion.
3. Select or choose the testing procedures for corroding systems.
4. Evaluate the polarization behavior of corroding systems.
5. Design of suitable materials, methods to combat corrosion.
6. Predict the function of corrosion inhibitors.

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L	P	C
0	4	2

SEMINAR (15A08805)

JNTUA College of Engineering (Autonomous), Ananthapuramu

IV Year B.Tech. Chem. Engg. II-Sem	**L**	**P**	**C**
	0	**20**	**10**

PROJECT WORK (15A08806)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) – R17 Regulation – w.e.f. 2017-18 Academic Year

COURSE STRUCTURE

I Year I Semester

Subject Code	Subject	L	T	P	C
17A15501	English	3	-	-	3
17A15101	Mathematics -I	2	2	-	3
17A15201	Applied Physics	3	-	-	3
15A10101	Environmental Studies	3	-	-	3
17A10301	Engineering Drawing	1	1	3	3
17A10501	Problem Solving & Computer Programming	3	0	-	3
17A15502	English Language Communication Skills Lab.	-	1	3	2
17A15202	Applied Physics Lab	-	1	3	2
17A10502	Computer Programming Lab	-	1	3	2
17A12451	Comprehensive Objective type Examination	-	-	-	1
	Total	**15**	**6**	**12**	**25**

I Year II Semester

Subject Code	Subject	L	T	P	C
17A25501	Technical Communication and Presentation Skills	3	-	-	3
17A25101	Mathematics -II	2	2	-	3
17A20103	Engineering Mechanics	2	2	-	3
17A25301	Applied Chemistry	3	-	-	3
17A20201	Electric Circuits - I	2	2	-	3
17A20404	Electronic Devices and Circuits	3	-	-	3
17A25302	Applied Chemistry Lab	-	1	3	2
17A23501	Engineering Workshop & IT Workshop	-	1	3	2
17A20405	Electronic Devices and Circuits Lab	-	1	3	2
17A29901	Community Service (Audit)	-	-	2	-
17A20202	Comprehensive Objective type Examination	-	-	-	1
	Total	**15**	**9**	**11**	**25**

II Year I Semester

Code	Subject	L	T	P	C
17A35401	Managerial Economics and Financial Analysis	3	-	-	3
17A35102	Mathematics –III	2	2	-	3
17A35103	Complex Variables and Special Functions	2	2	-	3
17A30201	Electric Circuits - II	2	2	-	3
17A30202	Electrical Machines - I	2	2	-	3
17A30203	Linear Control Systems	2	2	-	3
17A35104	Exploratory Data Analysis Lab	-	1	3	2
17A30204	Electric Circuits & Simulation Lab	-	1	3	2
17A30205	Comprehensive Objective type Examination	-	-	-	1
	Total	**13**	**12**	**6**	**23**

II Year II Semester

Code	Subject	L	T	P	C
17A40201	Electrical Machines - II	2	2	-	3
17A40202	Electric Power Generating Systems	2	2	-	3
17A40203	Electromagnetic Fields	2	2	-	3
17A40407	Analog Electronic Circuits	2	2	-	3
17A40408	Switching Theory & Logic Design	2	2	-	3
17A45101	Human Values & Professional Ethics(Audit)	2	-	-	-
17A40204	Control Systems & Simulation Lab	-	1	3	2
17A40206	Electrical Machines Lab-I	-	1	3	2
17A40207	Comprehensive Objective type Examination	-	-	-	1
	Total	**12**	**12**	**6**	**20**

III Year I Semester

Code	Subject	L	T	P	C
17A55401	Management Science	3	-	-	3
17A50201	Transmission of Electric Power	2	2	-	3
17A50202	Electrical Machines - III	3	-	-	3
17A50203	Power Electronics	3	-	-	3
17A50204	Electrical & Electronic Measurements	3	-	-	3
17A50205	Linear & Digital Integrated Circuits	3	-	-	3
17A50206	Electrical Machines Lab – II	-	1	3	2
17A50207	Electrical and Electronic Measurements Lab	-	1	3	2
17A50208	Power Electronics & Simulation Lab	-	1	3	2
17A50209	Comprehensive Objective type Examination	-	-	-	1
	Total	**17**	**5**	**9**	**25**

III Year II Semester

Code	Subject	L	T	P	C
17A60201	Switchgear & Protection	3	-	-	3
17A60202	Power Semiconductor Controlled Drives	2	2	-	3
17A60203	Computer Aided Power System Analysis	2	2	-	3
17A624501	Microprocessors & Microcontrollers	3	-	-	3
	Open Elective- I*	2	2	-	3
17A60204a	Instrumentation				
17A60204b	Wind Energy Conversion Systems				
17A60204c	Reliability and Safety Engineering				
17A69901	Foreign Language (Audit)	2	-	-	-
17A65501	Advanced Communication Skills Lab	-	1	3	2
17A624502	Microprocessors & Microcontrollers Lab	-	1	3	2
17A60205	Linear & Digital ICs Lab	-	1	3	2
17A60206	Comprehensive Objective type Examination	-	-	-	1
	Total	**14**	**9**	**9**	**22**

IV Year I Semester

Code	Subject	L	T	P	C
17A70201	Electric Power Distribution Systems	2	2	-	3
17A70202	Digital Signal Processing	2	2	-	3
17A70203	Power System Operation and Control	2	2	-	3
	Open Elective-II*	2	2	-	3
17A70204a	a) PLC & Its Applications				
17A70204b	b) Solar Energy Conversion Systems				
17A70204c	c) Optimization Techniques				
	Elective – I	2	2	-	3
17A70205a	Special Electrical Machines				
17A70205b	HVDC Transmission				
17A70205c	FACTS Controllers				
17A79902	**MOOC-I (Audit)****	-	-	-	-
17A70206	Power Systems & Simulation Lab	-	1	3	2
17A70207	Digital Signal Processing Lab	-	1	3	2
17A70208	Comprehensive Objective type Examination	-	-	-	1
	Total	**10**	**12**	**6**	**20**

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.**

IV Year II Semester

Code	Subject	L	T	P	C
	Elective – II	2	2	-	3
17A80201a	Power Quality				
17A80201b	Modern Control Theory				
17A80201c	Switched Mode Power Converters				
	Elective – III	2	2	-	3
17A80202a	Utilization of Electrical Energy				
17A80202b	Costing of Electrical Systems				
17A80202c	High Voltage Engineering				
	Elective – IV	2	2	-	3
17A80203a	Neural Networks & Fuzzy Logic Applications				
17A80203b	Reliability Engineering and its Application to Power Systems				
17A80203c	Power System Deregulation				
	Elective – V	2	2	-	3
17A80204a	Electrical machine Design				
17A80204b	Grid Integration of Distributed Generation				
17A80204c	Energy Auditing & Demand Side Management				
17A89902	**MOOC-II(Audit)*** **	-	-	-	-
17A80205	Seminar	-	-	4	2
17A80206	Project Work	-	-	20	10
17A80207	Comprehensive Objective type Examination	-	-	-	1
	Total	**08**	**08**	**24**	**25**

***** 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 – Theory P – Practical/Drawing C – Credits

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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

Course Outcomes:

CO1 Understand the importance of LSRW skills and develop communicative competence.

CO2 Learn and apply key rhetorical concepts through analyzing and composing a variety of texts and promote ethical values.

CO3 Develop facility to analyze a variety of situations and contexts calling for purposeful shifts in voice, tone, level of formality, design, medium, and/or structure.

CO4 Develop capacity to evaluate a mass of data on the net and to glean the necessary information.

CO5 Become creative in the use of different modes of written communication in a professional environment.

Mapping of Course outcomes with Program outcomes:

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

SYLLABUS

UNIT – I

Chapter entitled Humour from "Using English"
Chapter entitled "Jagadish Chandra Bose" 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 "Dhyan Chand" 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 "After Twenty Years" 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 "The Tiger in the Tunnel" 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 a. "Daffodils" b. "Where the mind is Without Fear" 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

Text Books:

1. Using English (for detailed study) published by Orient Black Swan, 2013
2. 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.

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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.

Course Outcomes: After completion of the course a successful student is able to

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.

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	-	-	-	-	-

SYLLABUS

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.

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, McGraw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
5. Advanced Engineering Mathematics 3rd Edition,by R.K.Jain&S.R.K.Iyengar, Narosa publishers.

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Subject Code	Title of the Subject	L	T	P	C
17A15201	Applied Physics		-	-	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, the use of lasers as light sources for low and high energy applications, study of propagation of light through transparent dielectric waveguides along with engineering applications.
3. To enlighten the concepts regarding the bulk response of materials to the EM fields and their analytical study in the back-drop of basic Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications
4. To get an insight into the microscopic meaning of conductivity, classical and quantum free electron models, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors.
5. To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications.
6. 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 to be elicited.

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 Basics of Electromagnetic fields are focused along with the understanding of quantum mechanical picture of subatomic world.

CO3 The discrepancies between the classical estimates and laboratory observations of electron transportation phenomena are successfully explained by free electron theory and band theory. The physical properties exhibited by materials would be lifted through the understanding of properties of semiconductors.

CO4 The dielectric and magnetic response of materials are focused.

CO5 The importance of superconducting materials, nano-material's and smart materials along with their engineering applications are well elucidated.

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	-	1	-	1	1	1	1
CO2	3	3	1	3	1	-	-	1	-	1	-	1	1		1
CO3	3	3	1	3	1	-	-	1	-	1	-	1	1	1	
CO4	3	-	1	3	-	-	-	1	1	1	-	1	1		
CO5	3	-	1	-	3	-	3	1	1	1	-	1	1	1	1

SYLLABUS

UNIT - I: Physicaloptics, Lasers and Fiber Optics

Physical Optics: Introduction to interference – Colours in thin films – Newton's Rings – Michelson interferometer – Fraunhofer 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–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 - II: Electromagnetic Fields and Quantum Mechanics

Electromagnetic Fields: Scalar and Vector Fields – Electric Potential – Gradient, Divergence of fields - Gauss and Stokes theorems - Derivations of Maxwell's equations.

Quantum Mechanics: Black Body radiation – Dual nature of radiation – Schrodinger's time independent wave equation – Significance of wave function – Particle in a one dimensional infinite potential well.

UNIT - III: Free Electron Theory and Semiconductors

Free electron theory: Classical free electron theory – Sources of electrical resistance – Equation for electrical conductivity – Quantum free electron theory – Fermi-Dirac distribution – Kronig-Penny model (qualitative) – Origin of bands in solids – Effective mass.

Semiconductor physics: Introduction –Direct and Indirect band gap semiconductors – Drift & diffusion currents – Einstein's equation – Continuity equation – Hall Effect.

UNIT - IV: **Dielectrics and Magnetic Materials**

Dielectrics: Introduction – Dielectric Polarization – Types of Polarization – Lorentz field – Clausius - Mosotti equation – Piezoelectricity – Ferro electricity – 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 - V: **Advanced Materials**

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

Nano-materials: Introduction – Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic – Applications of nano materials.

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

Text books:

1. Engineering physics – D.K. Battacharya and PoonamTandon, Oxford University press.
2. Engineering physics – M.N. Avadhanulu and P.G. KrshiSagar, Chand and Co.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons.
2. Introduction to modern optics – Grant R Fowles.
3. A text book on Optics – Brijlal & Subramanyam.
4. Semiconductor physics and devices- Basic principle – Donald A, Neamen, McGraw Hill.
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley.
6. Shape Memory Alloys-Modeling and Engg. Applications – C Lagoudas, Springer.
7. Engineering Physics – V. Rajendran, K.Thyagarajan, Tata MacGraw Hill Publishers.
8. Engineering Physics – S.O.Pillai, New Age Publications.
9. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press.
10. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning.
11. Engineering Physics – M. Arumugam, Anuradha Publications.

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Subject Code	Title of the Subject	L	T	P	C
15A10101	Environmental Studies		-	-	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.

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 on sustainability

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	-	3	3	-	1	-	1	2	2	1
CO2	1	3	-	-	1	-	3	3	-	1	-	1	2	2	1
CO3	2	-	3	-	-	-	3	3	-	1	-	1	2	2	1
CO4	3	2	-	3	-	-	3	3	-	1	-	1	2	2	1
CO5	3	2	-	3	-	-	3	3	-	1	-	1	2	2	1

SYLLABUS

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 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 Programme. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.
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 Kaushik, New Age Pubilishers.
3. Environmental Studies by Benny Joseph, TMHPubilishers.

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 Publications.
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.

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Subject Code	Title of the Subject	L	T	P	C
17A10301	**Engineering Drawing**	1	1	3	3

Course Objectives:

1. To draw and understand the practical importance of geometrical constructions.
2. To understand the representation of the regular planes and solids in first angle of projections

Course Outcomes:

CO1 Student will be familiar with the BIS conventions and dimensions
CO2 Student will be familiar with the positions of points and straight lines under different cases
CO3 Student will be able to represent regular planes and solids on the drawing sheet for various cases
CO4 Student can draw the development for regular solids
CO5 Student will familiarize with the 2D and 3D projections of various figure

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	1	2	-	1	-	1	-	1	1	-	-
CO2	3	2	2	1	2	2	-	1	-	1	-	1	1	-	-
CO3	3	2	3	1	2	1	-	1	-	1	-	1	1	-	-
CO4	3	2	3	1	2	1	-	1	-	1	-	1	1	-	-
CO5	3	2	3	1	2	1	-	1	-	1	-	1	1	-	-

SYLLABUS
(Common to EEE, ECE and CSE).

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

Principles of orthographic projection, I and III angle projections –Conventions –Projections of points.

UNIT –II

Projection of lines inclined to both planes –traces, Projection of plane figures inclined to both planes.

UNIT –III

Projection of simple solids inclined to both planes.

UNIT –IV

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

UNIT –V

Isometric projections: Principles of pictorial representations-Isometric projection- Isometric scale-Isometric views- conventions- Isometric views of plane figures, solids-Isometric projection of objects with non-isometric lines-Isometric projection of spherical parts.

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.

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Subject Code	Title of the Subject	L	T	P	C
17A10501	Problem Solving & Computer Programming	3	-	-	3

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.

Course Outcomes:

CO1 Develop flowcharts, algorithms for given complex problems.
CO2 Analyze basic programming constructs.
CO3 Write C programs for real world problems.
CO4 Implement C programming by using various control structures.
CO5 Appreciate coding standards and best practices for program development.

Mapping between Course Outcomes and Programme Outcomes:

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

SYLLABUS

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 an 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 Integer, 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.

Text Books:

1. Programming in C, Pradip Dey, 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, Pearson Eductaion.
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.

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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.

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.

Mapping between Course Outcomes and Programme Outcomes:

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

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.

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.

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Subject Code	Title of the Lab	L	T	P	C
17A15202	Applied Physics Laboratory	-	1	3	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.

Course Outcomes:

CO1 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	PSO 2	PSO 3
CO1	3	3	1	-	-	-	-	1	-	1	-	1	1	1	1
CO2	3	3	1	3	1	-	-	1	-	1	-	1	1		1
CO3	3	3	1	3	1	-	-	1	-	1	-	1	1	1	
CO4	3	-	1	3	-	-	-	1	1	1	-	1	1		
CO5	3	-	1	-	3	-	3	1	1	1	-	1	1	1	1

List of Experiments:

Any TEN of the following experiments have 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 the 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

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Subject Code	Title of the Lab	L	T	P	C
17A10502	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.

Course Outcomes:

CO1 Able to write, compile and debug programs in C language.
CO2 Able to formulate problems and implement algorithms in C.
CO3 Able to effectively choose programming components that efficiently solve computing problems in real-world.
CO4 Able to design programs involving decision structures, loops and functions.

Mapping between Course Outcomes and Programme Outcomes:

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

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 size of operators print the size of 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 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.

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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.

Course Outcomes:

CO1 To understand the various components of technical communication.

CO2 To apply life skills such as resilience emotional intelligence and can do attitude in order to meet the demands of work place environment.

CO3 To analyze verbal and non-verbal interpretations in multicultural context.

CO4 To evaluate different aspects of verbal and linguistic competence to become effective presenters.

CO5 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	PSO1	PSO 2	PSO 3
CO1	1	-	-	3	-	1	1	1	-	-	1	1	-	-	-
CO2	1	-	-	-	-	1	1	1	3	-	1	1	-	-	-
CO3	1	-	-	-	-	1	1	1	3	-	1	1	-	-	-
CO4	1	-	-	-	-	1	1	1	-	3	1	1	-	-	-
CO5	1	-	-	3	-	1	1	1	-	-	1	1	-	-	-

SYLLABUS

UNIT - I

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

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., 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.

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Subject Code	Title of the Subject	L	T	P	C
17A25101	Mathematics – II		2	-	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.

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, 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

Mapping of Course outcomes with Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
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	-	-	-	-	-

SYLLABUS

UNIT - I: Fourier Series

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

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

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

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

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 - 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, McGraw Hill publishers.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
4. Advanced Engineering Mathematics 3rd Edition,by R.K.Jain & S.R.K.Iyengar, Narosa publishers.

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B. Tech (E.E.E) I-Year II-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A20103	**Engineering Mechanics**	2	2	0	3

Course Objectives:

1. Able to identify the moment of force, degrees of freedom and different types of loading.
2. Able to analyze the concept of friction, centre of gravity and moment of inertia.
3. Able to determine the velocity and acceleration, types and their analysis in planer motion.
4. Able to analyze the concept of perfect frames, mechanical vibrations.

Course Outcomes:

CO1 Identify the moment of force, degrees of freedom and different types of loading.
CO2 Analyze the concept of friction, center of gravity and moment of inertia.
CO3 Determine the velocity and acceleration, types and their analysis in planer motion.
CO4 Analyze the concept of perfect frames, mechanical vibrations.

Mapping of Course outcomes with Program outcomes:

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

SYLLABUS

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 publishers.

References:

1. Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
2. Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.
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.
7. Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning.

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Subject Code	Title of the Subject	L	T	P	C
17A25301	Applied Chemistry	3	-	-	3

Course Objectives:

1. The Applied 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 main aim of the course 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 to 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.

Course Outcomes:

CO1 After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers, nano-materials with their applications and engineering materials.

CO2 Understand industrially based polymers, various engineering materials

CO3 Understand industrially based fuels preparations and applications.

CO4 Differentiation and uses of different kinds of engineering materials.

CO5 After completion of course students would able to demonstrate and apply basic concepts of nano-science and nano-technology

Mapping between Course Outcomes and Programme Outcomes:

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

SYLLABUS

UNIT - I: 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, Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and catholic protection and electro and electroless plating. (10h)

UNIT - II: Polymers

i. Introduction to polymers, Polymerization 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
iv. Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications. (12h)

UNIT - III: 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 ovenprocesses.
ii. Liquid Fuels: Petroleum: Refining of Petroleum, Gasoline: Octane and cetane 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.
Combustion: reaction of combustion and related problems.
iv. Nuclear Fuels: Controlled and uncontrolled reactions. Breeder reactor and Power reactors. (12h)

UNIT - IV: Chemistry of Engineering Materials

i. Electrical Insulators or Dielectric materials: Definition and classification, Characteristics of electrical insulators. Applications of electrical insulating materials (Gaseous, liquid and solid insulators)
ii. Semiconducting and Super Conducting materials-Principles and some examples
iii. Magnetic materials – Principles and types of magnetic materials-examples (9h)

UNIT- V: Nano-Chemistry & Composite Materials

i. Nano-Chemistry Introduction, nano-materials, nanoparticles, nanostructure, supramolecular systems, nanotechnology applications, future perspective.
ii. Composite Materials: Classification of Composites materials, Constituents of Composite materials. Disperse Phase composite materials.Glass fibre reinforced polymer composite and Carbon fibre reinforced polymer composite materials. Advantages and applications of Composites.

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, DhanapathiRai 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.ChandraSekhar, UN.Das and Sujatha Mishra, SCITECH Publications 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.

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Subject Code	Title of the Subject	L	T	P	C
17A20201	Electric Circuits - I	2	2	0	3

Course Objectives:

1. Understand the basic characteristics of R, L, C parameters, their Voltage and Current Relations and various combinations of these parameters.
2. Analyze Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference.
3. Apply the techniques to find of real power, reactive power, series and parallel resonances, bandwidth and current locus diagrams.
4. Develop the methods to find Tree, Cut-set, Tie-set for the network.

Course Outcomes:

CO1 Understand the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across any element.
CO2 Analyze the circuit and the excitation, determine the real power, reactive power, power factor etc.
CO3 Apply the network theorems suitably.
CO4 Determine the Dual of the Network, Calculate the Cut Set and Tie-set Matrices for a given Circuit.

Mapping between Course Outcomes and Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	3	3

SYLLABUS

UNIT – I: Introduction to Electrical & Magnetic Circuits

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements (For Different Input Signals-Square, Ramp, Saw Tooth, and Triangular). Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

UNIT - II: Single Phase A.C Circuits

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, J-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) With Sinusoidal Excitation- Phasor diagrams - Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

UNIT - III: Locus Diagrams & Resonance

Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

UNIT - IV: Network Theorems

Superposition and Reciprocity Theorems, Thevenin's, Norton's, Maximum Power Transfer, Millman's Theorems, Tellegen's and Compensation Theorems for D.C and Sinusoidal Excitations.

UNIT – V: Network Topology

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks with Dependent & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis, Super Node and Super Mesh for D.C Excitations.

Text Books:

1. Engineering circuit analysis by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company.
2. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill.
3. Circuit Theory (Analysis & Synthesis) by A. Chakrabarti, Dhanpat Rai & Sons.

Reference Books:

1. Network Analysis by M.E Van Valkenberg, Prentice Hall (India), 3rd Edition.
2. Electrical Engineering Fundamentals by V. Del Toro, Prentice – Hall International.
3. Electric Circuits by N.Sreenivasulu, REEM Publications.
4. Electric Circuits- Schuam Series.
5. Electrical Circuit Theory and Technology by John Bird, Routledge, Taylor & Fransis.
6. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.

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Subject Code	Title of the Subject	L	T	P	C
17A20404	Electronic Devices and Circuits	3	0	0	3

Course Objectives:

1. Understand the importance of basic electronic devices.
2. Analyze the theory, construction, and operation of Basic electronic devices.
3. Apply the techniques for biasing of BJTs & FETs.
4. Design of single stage and multi stage amplifiers.

Course Outcomes:

CO1 Understand the theory, construction, and operation of basic electronic devices.
CO2 Analyze the concept of feedback and design feedback amplifier.
CO3 Apply the biasing techniques for basic electronic devices.
CO4 Develop single and multi-stage amplifiers for various applications.

Mapping between Course Outcomes and Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	2	3	3	2	2	3	-	-	3	-	-	2	2	3	3
CO2	2	3	3	2	3	3	-	-	3	-	-	2	2	3	3
CO3	2	3	3	2	3	3	-	-	3	-	-	2	2	3	3
CO4	2	3	3	2	2	3	-	-	3	-	-	2	2	3	3

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UNIT- I

P-N Junction Diode: Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.
Special Purpose Diodes: Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With help of Energy band diagram) and Varactor Diode.

UNIT - II

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters

UNIT - III

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations.
Transistor Biasing And Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in V_{BE} and β, Bias Compensation using Diodes and Transistors.

UNIT - IV

BJT Amplifiers: Classification of Amplifiers – Distortion in amplifiers, Analysis of CE, CC, and CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors, Design of single stage RC coupled amplifier Different coupling schemes used in amplifiers, Analysis of Cascaded RC Coupled amplifiers, Cascode amplifier, Darlington pair, Frequency response of BJT amplifier – Analysis at low and high frequencies.

UNIT - V

Field Effect Transistor: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.FET Biasing. FET Amplifiers - Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOS Amplifiers, MOSFET Characteristics in Enhancement and Depletion mode – MOS Small signal model, Common source amplifier with resistive, load, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

Text Books:

1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J.Millman and C.C.Halkias, Satyabratajit, TMH, 2/e, 1998.

References:

1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education.
2. Electronic Devices and Circuits, Anil K. Maini, Varsha Agarwal, Wiley India Pvt. Ltd. 1/e 2009.
3. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. DeCarlo and Pen-Min-Lin, Oxford University Press-2004.
4. Network Theory by N.C.Jagan & C. Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. Electronic Devices and Circuits – 2nd Edition by Muhammad H.Rashid, Cengage Learning.

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Subject Code	Title of the Lab	L	T	P	C
17A25302	Applied Chemistry lab	-	1	3	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.

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 Would be able to carry out scientific experiments as well as accurately record and analyze the results of such experiments

Mapping between Course Outcomes and Programme Outcomes:

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

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)

Text Books:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – SM Enterprises Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera.

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Subject Code	Title of the Lab	L	T	P	C
17A23501	**Engineering Workshop & IT Workshop Lab**	-	1	3	2

Part – A: Engineering Workshop

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.

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.

Mapping between Course Outcomes and Programme Outcomes:

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

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

Text Book:

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

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.

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.

Mapping between Course Outcomes and Programme Outcomes:

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

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its 1peripherals. 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.

References:

1. Introduction to Computers, Peter Norton, McGraw Hill.
2. MOS study guide for word, Excel, Power point & 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Lab	L	T	P	C
17A20405	Electronic Devices and Circuits Lab	0	1	3	2

Course Objectives:

1. Understand the importance of basic electronic devices.
2. Analyze the theory, construction, and operation of Basic electronic devices.
3. Apply the techniques for biasing of BJTs & FETs.
4. Design of single stage and multi stage amplifiers.

Course Outcomes:

CO1 Understand the theory, construction, and operation of basic electronic devices.
CO2 Analyze the concept of feedback and design feedback amplifier.
CO3 Apply the biasing techniques for basic electronic devices.
CO4 Develop single and multi-stage amplifiers for various applications.

Mapping between Course Outcomes and Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	2	3	3	3	3	3	-	-	3	-	-	2	2	3	3
CO2	2	3	3	3	3	3	-	-	3	-	-	2	2	3	3
CO3	2	3	3	3	3	3	-	-	3	-	-	2	2	3	3
CO4	2	3	3	3	2	3	-	-	3	-	-	2	2	3	3

List of Experiments

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART B:
(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias & Reverse bias)
   Part B: Silicon Diode (Forward bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode act as a Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics(CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics(CS Configuration)
   Part A: Drain (Output) Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

Equipment required for Laboratory

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. Bread Boards
11. Connecting Wires
12. CRO Probes etc.

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B. Tech (E.E.E) II-Year I-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A35401	**Managerial Economics and Financial Analysis**	3	0	0	3

Course Objectives:

1. The objective of this Course is to inculcate the basic knowledge to the students with the concepts of Economics & Demand to make them effective business decision makers.
2. To understand fundamentals of Production & Cost Concepts which is an important subject helps to the Technocrats to take certain business decisions in the processes of optimum utilization of resources.
3. To know the various types of Market Structures & pricing methods and its strategies & Trade Blocks.
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 about accounting and to explain the process of preparing accounting statements & analysis for effective business decisions.

Course Outcomes:

CO1 Capable of analyzing fundamentals of Economics such as Demand, Elasticity & Forecasting methods.
CO2 To apply production, pricing & supply concepts for effective business administration.
CO3 Students can able to identify the influence of various markets, the forms of business organization and its International Economic Environment.
CO4 Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.
CO5 Prepare and analyze accounting statements like income & expenditure statement, balance sheet apart from the fundamental knowledge, to understand financial performance of the business and to initiate the appropriate decisions to run the business profitably.

Mapping between Course Outcomes and Programme Outcomes:

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

SYLLABUS

UNIT - I: Introduction to Managerial Economics & Demand

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& 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: 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- Trade Blocks (SAARC,EU,NAFTA,BRICS)-EXIM Policy-International Economic Environment.

UNIT - IV: Capital and Capital Budgeting

Concept of Capital - Significance, Types of Capital- Components of Working Capital -Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Cash Budget- **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

Accounting Concepts and Conventions-Introduction 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 ratios-Du Pont Chart.

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, 2013.

Data Books Required:

Present Value Factors table.

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Subject Code	Title of the Subject	L	T	P	C
17A35102	Mathematics - III	2	2	0	3

Course Description:

Fundamentals of matrix theory; numerical solutions of equations curve fitting; interpolation; numerical differentiation and integration; numerical solutions of ordinary differential equations.

Course Objectives:

1. To impart basic knowledge on ranks of matrices, systems of linear equations, numerical methods to solve algebraic and transcendental equations, differential equations, numerical differentiation and integration.
2. To develop skills in analyzing various numerical techniques, designing mathematical models, numerical techniques for engineering problems and fitting of curves to experimental data.

Course Outcomes: After completion of the course a successful student is able to

CO1: Acquire basic knowledge in

(a) Finding the rank of matrices and analyzing them.
(b) Solving algebraic and transcendental equations by various numerical methods.
(c) Fitting of various types of curves to the experimental data.
(d) Estimating the missing data through interpolation methods.
(e) Identification of errors in the experimental data
(f) Finding the values of derivatives and integrals through various numerical methods.
(g) Solving differential equations numerically when analytical methods fail to hold.

CO 2: Develop skills in analyzing the

(a) Methods of interpolating a given data
(b) Properties of interpolating polynomials and derive conclusions
(c) Properties of curves of best fit to the given data
(d) Algebraic and transcendental equations through their solutions
(e) Properties of functions through numerical differentiation and integration
(f) Properties of numerical solutions of differential equations

CO3: Develop skills in designing mathematical models for

(a) Fitting geometrical curves to the given data
(b) Solving differential equations
(c) Constructing polynomials to the given data and drawing inferences.

CO4: Develop numerical skills in solving the problems involving

(a) Systems of linear equations
(b) Fitting of polynomials and different types of equations to the experimental data
(c) Derivatives and integrals
(d) Ordinary differential equations

CO5: Use relevant numerical techniques for
(a) Diagonalising the matrices of quadratic forms
(b) Interpolation of data and fitting interpolation polynomials
(c) Fitting of different types of curves to experimental data
(d) Obtaining derivatives of required order for given experimental data

Mapping between Course Outcomes and Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
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	-	-	-	-	-

SYLLABUS

UNIT – I: Matrix Theory

Rank of a matrix, echelon form, normal form, inverse of a matrix by elementary row operations. Solutions of linear system of equations. Eigen values, Eigen vectors and properties, Diagonalization. Quadratic form, reductions to canonical form using orthogonal transformation method and nature of Quadratic forms.

UNIT – II: Numerical Solutions of Equations and Curve Fitting

Solutions of Algebraic and Transcendental equations by Regula falsi method, Newton – Raphson's method. Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method. Curve fitting by the principle of least squares, fitting of a straight line, parabola and exponential curves.

UNIT - III: Interpolation

Interpolation, difference operators and their relationships, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT - IV: Numerical Differentiation and Integration

Numerical differentiation using Newton's forward and backward formulae. Numerical integration using Trapezoidal rule, Simpsons $1/3^{rd}$ rule and $3/8^{th}$ rule.

UNIT – V: Numerical Solutions of Differential Equations

Numerical solutions of first order Initial value problems using Taylor series method, Euler's, modified Euler's, Runge – Kutta method (4^{th} order only) and Milne's predictor – corrector method. Numerical solutions of Laplace equation using finite difference approximation.

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.
5. Advanced Engineering Mathematics 3^{rd} Edition, by R.K.Jain & S.R.K.Iyengar, Naros a publishers.

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Subject Code	Title of the Subject	L	T	P	C
17A35103	Complex Variables and Special Functions	2	2	0	3

Course Description: Beta, Gamma functions and their properties; Limits continuity and analyticity of complex functions; Integration, power series, singularities, residues; conformal mapping.

Course Objectives:

1. To impart basic knowledge on Beta and Gamma functions, Bessel function, Analytic functions, complex integration and power series, residue theorem, Mappings of functions of complex variables.
2. To develop skills in analyzing problems, designing mathematical models, Skills in Beta and Gamma functions, analytic functions, integral formulae, Residue theorem, and conformal mappings for engineering problems.

Course Outcomes: After the completion of the course, a successful student is able to

CO1: Acquire knowledge in
- (a) Beta and Gamma functions
- (b) Expressing complex functions in power series
- (c) Differentiation and integration of complex functions
- (d) Conformal mappings and bilinear transformations
- (e) Expressing complex functions in terms of graphs and power series

CO2: Develop skills in Analyzing the
- (a) The properties exhibited by complex functions in Argand plane
- (b) Properties of real integrals through complex variable techniques
- (c) The properties of improper integrals through residue theory
- (d) Conformal transformations of complex valued functions for inferences
- (e) The properties of complex functions by expressing them in power series and graphs

CO3: Develop skills in designing mathematical models involving
- (a) Integrals of complex variable functions
- (b) Improper integrals using beta and gamma functions
- (c) Residue theory of complex functions
- (d) Power series expansions of complex variable functions
- (e) Transformations of complex variable functions
- (f) Fluid flow patterns and flux functions.

CO4: Develop analytical skills in providing solutions for problems involving
(a) Fluid, Electrical and Magnetic Potential functions
(b) Integration of complex functions
(c) Improper real integrals

CO5: Use relevant Complex variable techniques for
(a) Residues and integrals of complex functions.
(b) Improper real integrals through complex functions
(c) Techniques of Beta and Gamma functions to improper integrals

Mapping between Course Outcomes and Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
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	-	-	-	-	-

SYLLABUS

UNIT - I: Special Functions

Beta and Gamma functions - Properties - Relationship between Beta and Gamma functions-Evaluation of improper integrals. Series Solutions of ordinary differential equations (Power series and Frobenius Method). Bessel & Legendre function-Orthogonality -Generating function (without proof) - Recurrence relations, Rodrigue's formula.

UNIT - II: Analytic Functions

Function of a Complex Variable - Limits and Continuity of functions, uniform continuity, Differentiability and Analyticity – Cauchy Riemann equations (both Cartesian and polar) - Conjugate and harmonic conjugate functions - Milne Thompson method-Potential functions.

UNIT - III: Complex Integration and Power Series

Line integral - Evaluation of line integrals along curves and closed contours - Cauchy's Integral theorem (without proof) - Cauchy's integral formula - Derivatives of analytic function - Generalized integral formula- Evaluation of integrals using integral formula. Taylor's theorem (without proof) - Laurent's theorem (without proof) - Power series expansion of complex functions.

UNIT-IV: Residue Theorem

Zeros and Singularities – Types of singularities - Residues – Evaluation of Residues at poles- Pole of order m - Residue theorem - Evaluation of integrals using residue theorem – Evaluation of improper and real integrals of the type:

i) $\int_{0}^{2\pi} f(\cos\theta, \sin\theta) d\theta$ ii) $\int_{-\infty}^{\infty} f(x) dx$ iii) $\int_{-\infty}^{\infty} e^{imx} f(x) dx$

UNIT-V: Conformal Mapping

Definitions and examples, Translation, Rotation, Inversion. Mappings defined by $w = e^z, \log z, z^2, \sin z, \cos z$. Bilinear transformation - Properties - Fixed points - Cross ratio - Invariance of circles under bilinear transformation - Determination of bilinear transformation using three given points.

Text Books:

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

References:

1. Mathematics III by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Advanced Engineering Mathematics, Peter V.O'Neil, CENGAGE publisher.
3. Advanced Engineering Mathematics by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel, Oxford.
4. Advanced Engineering Mathematics 3rd Edition, by R.K.Jain & S.R.K.Iyengar, Narosa publishers.

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Subject Code	Title of the Subject	L	T	P	C
17A30201	Electric Circuits - II	2	2	0	3

Course Objectives:

1. To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits
2. How to determine the transient response of R-L, R-C, R-L-C series circuits for DC and AC excitations
3. To know the applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources
4. Study of Different types of filters, equalizers and PSPICE for Circuit Analysis

Course Outcomes:

CO 1: Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
CO 2: Analyze how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
CO 3: Apply Fourier transforms to electrical circuits excited by non-sinusoidal sources.
CO 4: Design of filters, equalizers and PSPICE programs for Circuit Analysis.

Mapping between Course Outcomes and Programme Outcomes:

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

SYLLABUS

UNIT - I: Transient Analysis

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.

UNIT – II: Three Phase A.C. Circuits

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. 3Analysis of Three Phase Unbalanced Circuits - Loop Method - Application of Millman's T3heorem - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

UNIT – III: Fourier Transforms

Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

UNIT – IV: Two Port Networks

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations. Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

UNIT – V: Filters & PSPICE for Circuits

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.
PSPICE for Circuit Analysis – Description of Circuit elements - nodes and sources - Input and Output variables – Modeling of the above elements – Types of DC analysis.

Text Books:

1. Engineering circuit analysis by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company.
2. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill.
3. Circuit Theory (Analysis & Synthesis) by A. Chakrabarti, Dhanpat Rai & Sons.

References:

1. Network Analysis by M.E Van Valkenberg, Prentice Hall (India), 3rd Edition.
2. Electrical Engineering Fundamentals by V. Del Toro, Prentice – Hall International.
3. Electric Circuits by N.Sreenivasulu, REEM Publications.
4. Electric Circuits- Schuam Series.
5. Electrical Circuit Theory and Technology by John Bird, Routledge, Taylor & Fransis.

6. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.

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Subject Code	Title of the Subject	L	T	P	C
17A30202	Electrical Machines – I	2	2	0	3

Course Objectives:

1. Will be able to Acquire knowledge about the fundamental principles of Electromechanical Energy Conversion.
2. Will be able to understand the constructional details and principle of operation of various type of DC Machines (as generators and motors).
3. Will be able to Analyze characteristics and application of various type of DC machines.
4. Will be able to Acquire knowledge about testing and applications of dc machines.

Course Outcomes:

CO1 Understand the concepts of D.C. Machines, construction, armature reaction and characteristics

CO2 Analyze the load shared by each generator when several generators operate in parallel.

CO3 Apply suitable method and conditions for obtaining the required speed of DC Generator and Motor

CO4 To study Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance

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	-	-	-	-	-	-	2	2	3	3
CO2	2	3	3	3	3	-	-	-	-	-	-	2	2	3	3
CO3	2	3	3	3	3	-	-	-	-	-	-	2	2	3	3
CO4	2	3	3	3	2	-	-	-	-	-	-	2	2	3	3

SYLLABUS

UNIT – I: Basic Concepts of Rotating Machines

Principle of Electromechanical Energy Conversion – Forces and Torque In Magnetic Field Systems – Energy Balance – Energy and Force in A Singly Excited Magnetic Field System, Determination of Magnetic Force - Co-Energy – Multi Excited Magnetic Field Systems.

UNIT – II: D.C. Generators -I

D.C. Generators – Principle of Operation – Constructional Features – Armature Windings – Lap and Wave Windings – Simplex and Multiplex Windings – Use of Laminated Armature – E. M.F Equation– Numerical Problems – Parallel Paths-Armature Reaction – Cross Magnetizing and De-Magnetizing AT/Pole – Compensating Winding – Commutation – Reactance Voltage – Methods of Improving Commutation.

UNIT – III: D.C Generators – II

Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Causes for Failure to Self-Excite and Remedial Measures-Load Characteristics of Shunt, Series and Compound Generators – Parallel Operation of D.C Series Generators – Use of Equalizer Bar and Cross Connection of Field Windings – Load Sharing.

UNIT – IV: D.C. Motors

D.C Motors – Principle of Operation – Back E.M.F. – Circuit Model – Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors – Armature Reaction and Commutation.
Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Ward-Leonard System–Braking of D.C Motors – Permanent Magnet D.C Motor (PMDC).
Motor Starters (3 Point and 4 Point Starters) – Protective Devices-Calculation of Starters Steps for D.C Shunt Motors.

UNIT – V: Testing of D.C. Machines

Losses – Constant & Variable Losses – Calculation of Efficiency – Condition for Maximum Efficiency.
Methods of Testing – Direct, Indirect – Brake Test – Swinburne’s Test – Hopkinson’s Test – Field’s Test – Retardation Test in a D.C. Motor Test

Text Books:

1. Electrical Machines – P.S. Bimbhra, Khanna Publishers, 2011.
2. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
3. Electric Machinary – A. E. Fritzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th Editon, 2003.

Reference Books:

1. Electrical Machinery Fundamentals by Stephen J Chapman, Mc Graw Hills, 2005.
2. Performance and Design of D.C Machines by Clayton & Hancock, BPB Publishers, 2004.
3. Electrical Machines by S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.
4. Electrical Machines by M.V Deshpande, Wheeler Publishing, 2004.

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Subject Code	Title of the Subject	L	T	P	C
17A30203	Linear Control Systems	2	2	0	3

Course Objectives:

1. Merits and demerits of open loop and closed loop systems; the effect of feedback.
2. The use of block diagram algebra and Mason's gain formula to find the effective transfer function.
3. Transient and steady state response, time domain specifications and The concept of Root loci.
4. Frequency domain specifications, Bode diagrams and Nyquist plots & The fundamental aspects of modern control.

Course Outcomes:

CO1 Understand control systems architecture and define transfer function using mathematical modeling.
CO2 Analyze time response of 1st and 2nd order system and frequency response of systems using frequency domain techniques.
CO3 Apply the control components like AC servomotor , Synchros
CO4 Design a control system and understand concept of state space modeling

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	2		-	-	-	1	1	1	3	3	3
CO2	2	3	3	3	3	2	-	-	-	1	2	2	3	3	3
CO3	2	3	3	3	3	2	-	-	-	1	2	2	3	3	3
CO4	2	3	3	3	3	2	-	-	-	1	1	3	3	3	3

SYLLABUS

UNIT – I: Control Systems Concepts

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver

UNIT - II: Time Response Analysis

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants-Effects of Proportional, Integral and Derivative controllers.

UNIT – III: Stability Analysis in Time Domain

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT – IV: Frequency Response Analysis

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

UNIT – V: State Space Analysis of Continuous Systems

Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Text Books:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.
3. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell, Pearson.

References:

1. Control Systems Principles & Design 4th Edition, M.Gopal, Mc Graw Hill Education, 2012.
2. Automatic Control Systems– by B. C. Kuo and Farid Golnaraghi – John wiley and son's, 8th edition, 2003.

3. Control Systems 3rd Edition, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, Schaum's Mc Graw Hill Education.
4. Control System Design by Goodwin.

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Subject Code	Title of the Subject	L	T	P	C
17A35104	Exploratory Data Analysis Lab	-	1	3	2

Course Description: Statistical and Numerical Techniques – Measures of central tendency/dispersion, Curve fitting by method of least squares, linear regression and correlation, ANOVA; Data analysis using R, Numerical Solution of algebraic, transcendental and ordinary differential equations, Inverse and Eigen values of a matrix – Numerical method.

Course Objectives:

1. To impart knowledge on the application of Statistical and Numerical techniques – analysis of data, solution of algebraic, transcendental and differential equations, Matrices, transformation from time domain to frequency domain.
2. To develop skills in analyzing the data using appropriate statistical tools, solving algebraic and differential equations, matrices using appropriate numerical methods, obtaining amplitude and frequency of a time signal

Course Outcomes: After completion of the course, a successful student is able to

CO1: Develop skills in designing appropriate statistical method for
- (a) Determining the measures of central tendency/dispersion.
- (b) Box plot representation using Origin Software.
- (c) Finding a best fit curve to a given set of data.
- (d) Determining the coefficient of correlation and linear regression.

CO2: Develop skills in using suitable statistical technique for
- (a) Analyzing variance (ANOVA) for one variable.
- (b) Determination of R function for a given set of data and appropriate interpretation.
- (c) Representing three dimensional data in contour plot using MATLAB.

CO3: Transform a time signal/pulse to a frequency domain using concepts of Fourier series

CO4: Develop skills using suitable numerical technique for
- (a) Solving algebraic, transcendental and differential equations.

(b) Determining Eigen Values and dominant Eigen value of a matrix.
(c) Differentiation, integration and solution of differential equations.

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	2	3	-	3	-	-	-	2	-	-	-	-	-	-	-
CO3	2	-	3	-	3	3	-	-	2	-	-	-	-	-	-
CO4	3	2	-	3	3	-	-	-	3	-	-	-	-	-	-

List of Experiments

Required Software's: ORIGIN, MATLAB, R-LAB.

I. Statistical and Fourier series Techniques: To a given set of data

1. Determine measures of central tendency/dispersion - Mean, Median, Mode, Range and Variance; Box plot representation using Origin Software.
2. Fit a straight line, parabola, exponential curve.
3. Determine the coefficient of correlation and regression.
4. Analysis of variance (ANOVA) for one variable.
5. Determine R function and give interpretation.
6. Transforming signal in time domain into frequency domain.
7. Represent in contour plot using MATLAB.

II. Numerical Techniques:

8. Solving algebraic and transcendental equations using Regula - Falsi and Newton - Raphson methods.
9. Determine the inverse of a matrix; solving system of algebraic equations using Gauss-Siedal method.
10. Determine the Eigen values of a matrix and dominant Eigen value by power method.
11. Numerical differentiation and integration.
12. Numerical solution of Ordinary differential equations - Modified Euler method & R-K fourth order method.

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Subject Code	Title of the Subject	L	T	P	C
17A30204	**Electric Circuits & Simulation Lab**	-	1	3	2

Course Objectives:

1. Experimental verification of theorems.
2. Experimental verification of Resonance phenomenon.
3. Drawing current locus diagrams and Practical implementation of active and reactive power measurement techniques.
4. Practical determination of two port network parameters and introduction to P-Spice.

Course Outcomes:

CO1 To understand the fundamentals of electrical circuits & PSpice simulation.
CO2 Analyze the characteristics of Electrical circuits & PSpice Simulation.
CO3 Apply various theorems to linear DC and AC electrical circuits.
CO4 Design the time constants of an electrical circuit for satisfactory performance during transient.

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	3	2	2	-	-	3	-	-	2	2	3	3
CO2	2	3	3	3	3	2	-	-	3	-	-	2	2	3	3
CO3	2	3	3	3	3	2	-	-	3	-	-	2	2	3	3
CO4	2	3	3	3	2	2	-	-	3	-	-	2	2	3	3

Part - A: Electrical Circuits

1. Verification of Thevenin’s and Norton’s Theorems
2. Verification of Superposition Theorem and Maximum Power Transfer Theorem
3. Verification of Compensation Theorem
4. Verification of Reciprocity , Millmann’s Theorems
5. Locus Diagrams of RL and RC Series Circuits
6. Series and Parallel Resonance

7. Determination of Self, Mutual Inductances and Coefficient of Coupling
8. Z and Y Parameters
9. Transmission and Hybrid Parameters
10. Measurement of Active Power for Star and Delta Connected Balanced Loads
11. Measurement of Reactive Power for Star and Delta Connected Balanced Loads
12. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

Part - B: PSPICE Simulation

1. Simulation of DC Circuits
2. DC Transient Response
3. Mesh Analysis
4. Nodal Analysis

References:

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A40201	Electrical Machines – II	2	2	0	3

Course Objectives:

1. The performance of different types of single phase Transformers.
2. The performance of different types of three phase Transformers.
3. The performance of different types of Induction motors and their characteristics.
4. The Speed control of Induction motor.

Course Outcomes:

CO 1: Understand and analyze how to draw the equivalent circuit of transformer.
CO 2: Conduct O.C, S.C tests and predetermine the regulation and efficiency.
CO 3: Analyze how to draw the circle diagram of a three phase Induction motor and predetermine the performance characteristics of three phase induction motor.
CO 4: Identified the similarities and differences between transformers and Induction motors.

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	2	2	-	1	1	-	1	-	2	3	1	3
CO2	1	2	2	2	1	-	-	1	-	1	1	2	3	1	3
CO3	2	2	2	2	2	-	-	1	-	1	1	2	3	1	3
CO4	1	2	2	2	1	-	-	1	-	1	-	2	3	1	3

SYLLABUS

UNIT - I: Single Phase Transformers

Single Phase Transformers- Constructional Details- Hystersis and Eddy Current Losses-Emf Equation - Operation on No Load and on Load - Phasor Diagrams
Equivalent Circuit - Losses and Efficiency-Regulation. All Day Efficiency - Effect of Variations of Frequency & Supply Voltage on Iron Losses.

UNIT - II: Performance of Single Phase Transformers

OC and SC Tests - Sumpner's Test - Predetermination of Efficiency and Regulation-Separation of Losses Test-Parallel Operation with Equal and Unequal Voltage Ratios - Auto Transformers-Equivalent Circuit - Comparison with Two Winding Transformers.

UNIT – III: Three Phase Transformers and Induction Motors

Three Phase Transformers - Connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and Open Δ, Third Harmonics in Phase Voltages-Three Winding Transformers-Tertiary Windings- Scott Connection.

Polyphase Induction Motors-Construction Details of Cage and Wound Rotor Machines-Production of a Rotating Magnetic Field - Principle of Operation - Rotor EMF and Rotor Frequency - Rotor Reactance, Rotor Current and Pf at Standstill and During Operation.

UNIT - IV: 3-Phase Induction Motor Characteristics

Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and Their Inter Relation-Torque Equation-Deduction From Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristic –Generator Operation - Double Cage and Deep Bar Rotors - Equivalent Circuit - Phasor Diagram - Crawling and Cogging -Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance

UNIT - V: Starting and Speed Control of Induction Motors

Starting Methods and Starting Current and Torque Calculations, Speed Control-Change of Frequency; Pole Changing and Methods of Consequent Poles; Cascade Connection. Injection of an EMF.

Text Books:

1. Electrical Machines – P.S. Bimbhra, Khanna Publishers, 2011.
2. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
3. Electric Machinary – A. E. Fritzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th Editon, 2003.

Reference Books:

1. Performance and Design of AC Machines by MG.Say, BPB Publishers, 2002.

2. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2nd edition, 2008.
3. Electrical Machinery Fundamentals by Stephen J Chapman, Mc Graw Hills, 2005.
4. Electrical Machines by S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A40202	Electrical Power Generating Systems	2	2	0	3

Course Objectives:

1. To know about the principles of power generation. Investigate the line diagram and components in thermal power station.
2. To accredit hydro and nuclear power stations.
3. To enable the process involved in solar, wind, biogas, geothermal and ocean energy generation
4. To analyze economic aspects in power generation and to investigate different tariff methods.

Course Outcomes:

CO1 Understand the principles of power generation. Analyze the construction, working and operating principle and essential components of Thermal power generating station with their relative merits and demerits.

CO2 Analyze the construction, working and operating principle, and essential components of Hydro and Nuclear power generating stations.

CO3 Analyze the different methods and characteristics of solar, wind, biogas, geothermal and ocean power generating systems along with their economic and environmental aspects.

CO4 Demonstrate the knowledge about the electric power generations and their impacts.

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	3	3	3
CO2	3	3	-	-	-	-	2	-	-	2	-	3	3	3	3
CO3	3	3	2	-	-	-	2	-	-	2	-	3	3	3	3
CO4	3	3	2	-	-	-	2	-	-	2	-	2	3	3	3

SYLLABUS

UNIT - I: Thermal Power Generating Systems

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers, Cogeneration.

UNIT - II: Hydro & Nuclear Power Generating Systems

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction- Nuclear Fuels - Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants - Radiation Hazards: Shielding and Safety Precautions - Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT – III: Solar & Wind Power Generating Systems

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.
Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics- Pitch & Yaw Controls – Power Electronics Application – Economic Aspects.

UNIT – IV: Biogas & Geothermal Power Generating Systems

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.
Geothermal and Ocean Power Generation: Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

UNIT – V: Economic Aspects of Power Generation

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs of Generation and their Division into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method- Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

Reference Books:

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND & COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha& S. Banerjee – Oxford University Press, 2013.

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Subject Code	Title of the Subject	L	T	P	C
17A40203	Electromagnetic Fields	2	2	0	3

Course Objectives:

1. The laws concerning static electric fields: Columb's law, Gauss's law; the laws concerning static magnetic fields: Biotsavart law, ampere circuital law.
2. The Maxwell's equations concerned with static electric fields and static magnetic fields.
3. The difference between the behaviors of conductors and dielectrics in electric fields, The energy stored and energy density in (i) static electric field (ii) magnetic field.
4. Electromagnetic wave propagation and attenuation in various medium and propagation through boundaries between media and Significance of Poyinting theorem with it's Vector.

Course Outcomes:

CO 1: Understand basic principles, concepts and use of fundamental laws like Gauss's Law, Coulomb's law, Biot-Savart law, ampere circuital law and Poisson's Equation to find fields and potentials for a variety of situations including charge distributions and capacitors.
CO 2: Analyze vector algebra, 3-dimensional co-ordinate systems, electrostatics, magneto statics, time-varying fields and interaction between electricity and magnetism.
CO 3: Understand the behavior of magnetic and electric fields in the presence of dielectric and magnetic materials; appreciate how to simply modify expressions for capacitance and inductance from free space expressions.
CO 4: Derive and solve basic 1-D electromagnetic wave equations and analyze electromagnetic wave propagation and attenuation in various medium and propagation through boundaries between media.

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	1	-	2	1	2	-	1	1	-	2	2	3	3
CO2	2	2	2	2	2	1	2	-	-	1	-	1	2	3	3
CO3	2	1	2	1	-	-	2	-	-	-	-	1	3	3	3
CO4	2	2	1	2	2	1	2	-	-	1	-	1	2	3	3

SYLLABUS

UNIT – I: Electrostatics

Electrostatic Fields - Coulomb's Law - Electric Field Intensity(EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss's Law-Application of Gauss's Law-Maxwell's First Law – Numerical Problems.
Laplace's Equation and Poisson'2s Equations - Solution of Laplace's Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

UNIT – II: Conductors and Dielectrics

Behavior of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

UNIT – III: Magneto Statics

Static Magnetic Fields – Biot-Savart Law – Oerstead's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems.
Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

UNIT – IV: Magnetic Potential

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.
Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

UNIT – V: Time Varying Fields

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.
Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedance and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.

Text Books:

1. Engineering Electromagnetics by William.H.Hayt, Mc.Graw – Hill, 2010.
2. Electromagnetic Fields by Sadiku – Oxford University Press, 5th Edition, 2010.
3. Field Theory – K.A.Gangadhar, Khanna Publications, 2003.

Reference Books:

1. Electrodynamics by Griffith, PHI, 3rd Edition, 1999.
2. Electromagnetics by J. D. Kraus, Mc. Graw – Hill Inc,5th edition,1999.
3. Electromagnetics by Joseph Edminister, Tata Mc Graw Hill, 2006.

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Subject Code	Title of the Subject	L	T	P	C
17A40407	Analog Electronic Circuits	2	2	0	3

Course Objectives:

1. To give understanding of various types of amplifier circuits such as large signal and tuned amplifiers.
2. To familiarize the concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
3. To explain clippers, clampers, switching characteristics of transistors.
4. To construct various multi vibrators using transistors.

Course Objectives:

CO1 Understand the applications of diode as integrator, differentiator, clippers, clampler circuits.
CO2 Analyse the various stabilities of oscillators
CO3 Apply the diode to integrator, differentiator, clippers, clampler circuits.
CO4 Design and realize different classes of power amplifiers and tuned amplifiers useable for audio and radio applications.

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	3	2	-	-	-	-	-	-	2	3	3	3
CO2	2	3	3	3	3	-	-	-	-	-	1	2	3	3	3
CO3	2	3	3	3	3	-	-	-	-	-	1	2	3	3	3
CO4	2	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO5	2	3	2	2	2	-	2	-	-	1	-	2	3	3	3

SYLLABUS

UNIT – I: Positive & Negative Feedback in Amplifiers

Classification of amplifiers, Concepts of feedback – Classification of feedback amplifiers – General characteristics of negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

Condition for oscillations. RC and LC type Oscillators – Frequency and amplitude stability of oscillators – Generalized analysis of LC oscillators, Quartz, Hartley, and Colpitts Oscillators – RC-phase shift and Wien-bridge oscillators.

UNIT – II: Large Signal Amplifiers

Class A Power Amplifier, Maximum Value of Efficiency of Class – A Amplifier, Transformer Coupled Amplifier, Push Pull and Complimentary Symmetry Class B and Class AB Power Amplifiers – Principle of operation of class –C Amplifier, Transistor Power Dissipation, Heat Sinks.

UNIT – III: Tuned Amplifiers

Introduction, Q-Factor, Small Signal Tuned Amplifiers, Effect of Cascading single Tuned amplifiers on Bandwidth, Effect of Cascading Double Tuned amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of Tuned amplifiers.

UNIT – IV: Linear Wave & Non-Linear Wave Shaping

Linear Wave Shaping: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator.
Non-Linear Wave Shaping: Diode clippers, Transistor clippers, Clipping at two independent levels. Clamping Operation, Clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem, Practical Clamping Circuits.

UNIT- V: Switching Characteristics & Multi-Vibrators

Switching Characteristics of Devices: Diode as a Switch, Piecewise Linear Diode Characteristics, Diode Switching times, Transistor as a Switch, Break down voltages, Transistor in Saturation, Temperature variation of Saturation Parameters, Transistor-switching times.
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

Text Books:

1. Electronic Devices and Circuits, David A. Bell – 5thEdition, Oxford.
2. Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. PrakashRao, 2 Ed., 2008, TMH.

References:

1. Integrated Electronics, Jacob Millman, Christos C Halkias, TMH.
2. Introductory Electronic Devices and Circuits (Conventional flow version) – Robert T. Paynter, 7th Edition, 2009, PEI.
3. Microelectronic Circuits – Sedra / Smith – 5th Edition – Oxford, 2009.

4. Electronic Devices and Circuit Theory, Robert L.Boylestad, Louis Nashelsky, 9th Edition, Pearson Education.

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Subject Code	Title of the Subject	L	T	P	C
17A40408	**Switching Theory & Logic Design**	2	2	0	3

Course Objectives:

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
3. To implement simple logical operations using combinational logic circuits
4. To design combinational logic circuits, sequential logic circuits.
5. To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

Course Outcomes:

CO1 Understand numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray and BCD.
CO2 Analyze different methods used for simplification of Boolean expressions.
CO3 Apply K Map method for implementing programming logic devices
CO4 Design and implement synchronous and asynchronous sequential circuits and to use them as building blocks to build complex circuits.

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	3	2	-	-	1	-	-	-	2	2	3	3
CO2	2	3	3	3	3	-	-	1	-	-	-	2	2	3	3
CO3	2	3	3	3	3	-	-	1	-	-	-	2	2	3	3
CO4	2	3	3	3	2	-	-	1	-	-	-	2	2	3	3
CO5	2	3	3	3	2	-	-	1	-	-	-	2	2	3	3

SYLLABUS

UNIT - I

Number Systems and Switching Functions: Review of number systems, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Error Detecting and Correcting Codes.
Boolean Algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II

Minimization methods: Introduction, The Minimization of switching function using theorem, The Karnaaugh Map Method-Up to Five Variable Maps, Don't Care Map Entries, Tabular Method.
Combinational Circuits: Design of Combinational Logic: Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code converters, Basic PLD's-ROM, PROM, PLA, PAL Realizations. Hazards and Hazard Free Relations.

UNIT - III

Introduction to Sequential Circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Fundamentals of Sequential Machine Operation, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Design of a Clocked Flip-Flop, Timing and Triggering Consideration, Clock Skew, Conversion from one type of Flip-Flop to another.
Registers and Counters: Shift Registers, Data Transmission in Shift Registers, Operation of Shift Registers, Shift Register Configuration, Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation Of Asynchronous And Synchronous Counters.

UNIT - IV

Sequential Circuits: Introduction, State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Synthesis of Synchronous Sequential Circuits, Serial Binary Adder, Sequence Detector, Parity-bit Generator, Design of Asynchronous Counters, Design of Synchronous Modulo N –Counters.

UNIT - V

Finite State Machines: Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table.
Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL and CMOS Logic Families and its Comparison.

Text Books:

1. Switching and Finite Automata Theory- ZviKohavi&Niraj K. Jha, 3rdEdition, Cambridge.
2. Digital Design- Morris Mano, PHI, 3rd Edition.

3. Digital Systems Principles and Applications (8th Edition) - Ronald J. Tocci Neal S. Widmer, 8th edition.

Reference Books:

1. Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. PrakashRao, 2 Ed., 2008, TMH.
2. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.
3. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed,John Wiley & Sons Inc.
4. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
5. Digital Logic Design - Ye Brian and Holds Worth, Elsevier.
6. Fundamentals of Logic Design- Charles H. Roth, CengageLEanring, 5th, Edition, 2004.

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Subject Code	Title of the Subject	L	T	P	C
17A45101	Human Values and Professional Ethics (Audit Course)	2	0	0	0

Course Objectives:

1. To bring awareness among engineering graduates on ethics, human values & obligations.
2. To understand the ethical theories and their application to work ethics.
3. To understand the risk and safety measurements to be taken in various engineering areas.
4. To know various codes of ethics used by professional bodies & to learn about professional responsibility as an engineer.
5. To identify the global issues & measures to control adversity.

Course Outcomes:

CO1 Develop awareness on ethics, human values & obligations related to Self, Family, Society and State.
CO2 Become morally and socially responsible.
CO3 As a social experimentalist they can ensure less hazards & can find out engineering solutions from the ethical platform.
CO4 Students Can know how to ensure safety by minimizing risk through detailed analysis & can plan to get Intellectual property Rights (IPR).
CO5 Can identify various global issues, moral & social responsibilities.

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	1	3	-	2	-	2	-	-	-
CO2	2	-	-	1	-	1	1	3	-	2	-	2	-	-	-
CO3	2	-	-	1	-	2	1	3	3	2	-	2	-	-	-
CO4	2	-	-	1	-	2	1	3	-	2	3	2	-	-	-
CO5	2	-	-	1	-	2	1	3	-	2	-	3	-	-	-

SYLLABUS

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- Obligations to Self, Family, Society and the State.

UNIT - II: Engineering Ethics

Senses of 'Engineering Ethics- Variety of Moral Issues – 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.

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 Human beings.

UNIT - IV: Engineers Responsibility for Safety and Risk

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk-Safety and the Engineer- Designing for the Safety- Intellectual Property rights (IPR).

UINIT - V: Global Issues

Globalization – Cross Culture Issues- Environmental Ethics – Computer Ethics – Computers as The Instrument of Unethical Behavior – Computers as the Object of Unethical Acts – Autonomous Computers- Computer Codes of Ethics – Weapons Development - Ethics and Research- Moral & Social Responsibility- Code of Conduct.

Text Books:

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.Senthil Kumar- PHI Learning Pvt. Ltd-2009.

References:

1. "Human Values & Ethics", SK Chakraborty & D.Chakraborty, Himalaya Publishing House, Mumbai, 2014.
2. "Human Values & Professional Ethics", B.S.Raghava and Jayashree Suresh, S.Chand &co., New Delhi, 2012.
3. "Human Values & Ethics in the Workplace", Glenn Martin, GP Martin Publishing, Australia, 2007.

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Subject Code	Title of the Subject	L	T	P	C
17A40204	Control Systems & Simulation Lab	0	1	3	2

Course Objectives:

1. Determination of transfer functions of various systems and control of it by different methodologies.
2. To provide knowledge in the analysis and design of controllers and compensators.
3. The characteristics of servo mechanisms which are helpful in automatic control systems.
4. To know the stability analysis using MATLAB.

Course Outcomes:

CO1 Understand the knowledge of feedback control.
CO2 Analyze the physical systems represented in transfer function.
CO3 Apply the effect of poles and zeros location to transient and steady state behavior of second order systems and can implement them to practical systems.
CO4 Design the bode plot , root locus and polar plot for various .linear time invariant systems using MATLAB

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	3	2	3	1	-	3	-	-	2	3	3	3
CO2	2	3	3	3	3	3	2	-	3	-	1	2	3	3	3
CO3	2	3	3	3	3	3	2	-	3	-	1	2	3	3	3
CO4	2	3	3	3	2	3	-	-	3	-	-	2	3	3	3

Any Eight of the following experiments are to be conducted:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor

5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor

Any two simulation experiments are to be conducted:

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
4. State space model for classical transfer function using MATLAB – Verification.

Reference Books:

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

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Subject Code	Title of the Subject	L	T	P	C
17A40206	Electrical Machines Lab - I	0	1	3	2

Course Objectives:

1. Learn about DC motors and DC Generators
2. Various characteristics and performance analysis of DC machines
3. Various test conditions of DC machines
4. Understand the speed control techniques of DC machines.

Course Outcomes:

CO1 Understand the speed control techniques of DC machines..
CO2 Analyze various characteristics and performance analysis of DC machines.
CO3 Apply various test conditions on DC machines.
CO4 Determine the performance characteristics of DC shunt and DC compound generators by conducting various tests.

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	3	2	-	-	2	3	-	2	-	2	1	1
CO2	3	1	1	3	2	-	-	2	3	-	2	-	1	1	1
CO3	3	1	1	3	2	-	-	2	3	-	2	-	1	1	2
CO4	3	1	1	3	2	-	-	2	3	-	2	-	1	1	1

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson’s tests on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne’s test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Brake test on DC compound motor. Determination of performance curves.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted.

9. Load test on DC series generator. Determination of characteristics.
10. Retardation test on DC shunt motor. Determination of losses at rated speed.
11. Separation of losses in DC shunt motor.

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Subject Code	Title of the Subject	L	T	P	C
17A55401	Management Science	3	0	0	3

Course Objectives:

1. To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2. To understand the role of management in Production.
3. To study Materials/Purchases/Stores/Inventory/Marketing Management and Quality control
4. To study HRM in order to have an idea on Recruitment, Selection, Training &Development, job evaluation and Merit rating concepts.
5. To identify Strategic Management areas & to Study the PERT/CPM for better Project Management.

Course Outcomes:

CO1 To apply the concepts & principles of management & designs of organization in a practical world.

CO2 To design good plant layout and apply Work-study principles, Quality Control techniques, in real life industry & To maintain & control the Inventory & students can able to identify the importance of marketing in emerging world.

CO3 To apply the concepts of HRM in Recruitment, Selection, Training & Development.

CO4 To develop PERT/CPM Charts for projects of an enterprise and estimate time & cost of project & to analyse the business through SWOT.

CO5 They can aware of the latest and contemporary issues of management science.

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	1	1	1	-	2	-	-	-
CO2	1	-	-	1	-	1	1	3	1	1	-	2	-	-	-
CO3	1	-	-	1	-	1	1	2	3	1	-	2	-	-	-
CO4	1	-	-	1	-	1	1	2	1	1	3	2	-	-	-
CO5	1	-	-	1	-	1	1	2	1	1	-	3	-	-	-

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- Eltan Mayo's Human relations-Systems Theory- **Organizational Structure and Design**: Features of Organizational Structure-Work Specialization - Depart mentation-Span of Control-Centralization and Decentralization. **Organizational Designs**-Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.

UNIT - II: Operations Management

Principles and Types of Plant Layout-Methods of Production (Job, batch and Mass Production), Work Study- Statistical Quality Control**:** *C* chart, *P* chart, (simple Problems) Deming's contribution to Quality. **Material Management:** Objectives-Inventory-Functions, Types, Inventory Techniques-EOQ-ABC Analysis-Purchase Procedure and Stores Management- Just-In-Time (JIT). **Marketing Management:** Concept- Meaning - Nature- Functions of Marketing-Marketing Mix- Channels of Distribution -Advertisement and Sales Promotion- Marketing Strategies based on Product Life Cycle.

UNIT - III: Human Resources Management (HRM)

HRM- Definition and Meaning – Nature-Managerial and Operative functions-Evolution of HRM-Job Analysis -Human Resource Planning(HRP)-Employee Recruitment-Sources of Recruitment-Employee Selection- Process and Tests in Employee Selection- Employee Training and Development-On- the- job & Off- the- job training methods-Performance Appraisal Concept-Methods of Performance Appraisal-Placement-Employee Induction-Wage and Salary Administration-Objectives-Essentials of Wage and Salary Administration-Job Evaluation-Employee Grievances-Techniques of handling Grievances.

UNIT - IV: Strategic & Project Management

Definition& Meaning-Setting of 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).

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.

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 Management Principles and Guidelines, Biztantra.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005.
5. Samuel C.Certo: Modern Management, 9/e, PHI, 2005.
6. Schermerhorn, Capling, Poole & Wiesner: Management, Wiley, 2002.
7. Parnell: Strategic Management, Biztantra, 2003.
8. Lawrence R Jauch, R.Gupta &William F.Glueck: Business Policy and Strategic Management, Frank Bros., 2005.

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Subject Code	Title of the Subject	L	T	P	C
17A50201	**Transmission of Electric Power**	2	2	0	3

Course Objectives:

1. About the various factors that affect the performance of Transmission lines
2. Understand the theory of transmission lines modeling
3. To comprehend the different issues related to overhead lines and underground cables.
4. To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines.

Course Outcomes:

CO 1: Understand the calculations of resistance, Inductance and Capacitance of Transmission Lines.
CO 2: Analyze various factors governing the performance of Transmission Line.
CO 3: Apply two port network parameters for short , medium and long transmission lines.
CO 4: Design and draw the construction of Underground Cables.

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	-	2	1	-	-	-	2	3	2	3
CO2	3	2	2	-	1	-	2	2	-	-	1	2	3	2	3
CO3	3	2	2	-	1	-	2	2	-	1	1	2	3	2	3
CO4	3	2	2	-	1	-	2	2	-	1	1	2	3	2	3

SYLLABUS

UNIT - I: Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance,

capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT - II: Modeling of Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current, Need of Shunt Compensation.

UNIT -III: Insulators, Corona and Mechanical Design of lines

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT - IV: Power System Transients

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT - V: Power Cables

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Text Books:

1. Power System Analysis by W.D.Stevenson, J.J. Grainger Mc Grawhill.
2. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A. Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
3. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1998.

Reference Books:

1. Power System Analysis Hadi Saadat, TMH.
2. Power System Analysis and Design Duncan Glover Cengage Learning.
3. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.

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Subject Code	Title of the Subject	L	T	P	C
17A50202	Electrical Machines - III	3	0	0	3

Course Objectives:

1. To study the working principles of Synchronous Generator and Synchronous Motor, study of their performance characteristics.
2. To familiarize the constructional details and to predetermining the regulation of alternators.
3. To Understand the concepts of load sharing among alternators.
4. To Study single phase & special motors which have significant applications in house hold appliances.

Course Outcomes: At the end of the course, students will able to

CO1 Understand the working principles of Synchronous Generator and Synchronous Motor, study of their performance characteristics.
CO2 Analyze the constructional details and able to Estimate the regulation of synchronous generator using different methods.
CO3 Demonstrate operation of synchronous motor at constant load and variable excitation (V curve and inverted V curves) and constant excitation and variable load.
CO4 Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

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	1	1	-	-	-	-	-	2	3	2	-
CO2	3	2	3	2	2	1	-	-	-	1	-	2	3	2	1
CO3	3	2	3	2	2	1	-	-	-	1	-	2	3	2	1
CO4	3	2	3	2	2	1	-	-	-	1	-	2	3	2	1

SYLLABUS

UNIT – I: Synchronous Machines & Characteristics of Synchronous Generators

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation - Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT – II: Regulation of Alternators

Predetermination of Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation.

UNIT – III: Parallel Operation of Alternators

Synchronization of alternators with infinite bus bar – synchronizing power, synchronizing torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

UNIT – IV: Synchronous Motors

Principle of operation – phasor diagram – Variation of current and power factor with excitation – V and Inverted V Curves - Power developed – Synchronous Condensers - Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT – V: Single Phase Motors and Special Motors

Single Phase Motors: Single phase induction motor – Constructional features - Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.
Special Motors: Construction, working principle, performance of- Stepper Motors, Reluctance motors, A.C. Series motors, Universal motors, BLDC motor.

Text Books:

1. Electrical Machines – P.S. Bimbhra, Khanna Publishers, 2011.
2. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
3. Electric Machinary – A. E. Fritzgerald, C. Kingsley and S. Umans, Mc Graw Hill Companies, 5th Editon, 2003.

Reference Books:

1. Performance and Design of AC Machines by MG.Say, BPB Publishers, 2002.
2. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2nd edition, 2008.
3. Electrical Machinery Fundamentals by Stephen J Chapman, Mc Graw Hills, 2005.
4. Electrical Machines by S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.
5. Electric Machines - by M. S. Sarma and M. K. Pathak, CENGAGE Learning.

6. Special Electrical Machines by K. Venkataratnam, Universities Press, 2013.

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B. Tech (E.E.E) III-Year I-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A50203	**Power Electronics**	3	0	0	3

Course objectives:

1. The objective of this course is to study the high efficient and high reliable Power conversion systems.
2. To study the basic power semiconductor switching devices and their principles of operation
3. To study the various power conversion methods, controlling and designing of power converters.
4. To study the applications of Power electronic conversion to domestic, industrial, aerospace, commercial and utility systems etc.

Course Outcomes:

CO 1: Remember & understand the knowledge about basic operating principles of various power semiconducting switching devices.

CO 2: Apply the concepts of power electronics techniques, understand high efficiency and high reliability power conversion methods.

CO 3: Understand the operation of various power electronics converter their control and to solve the problems and demonstrate the use of these techniques through good power skills.

CO 4: Design and develop of power electronics converter methods, able to apply principles and methods to practical applications.

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	-	2	1	2	-	-	-	2	2	3	3
CO2	1	-	2	1	2	2	1	2	-	-	1	2	2	3	3
CO3	1	-	2	1	2	2	1	2	-	-	1	2	3	3	3
CO4	1	-	2	1	1	2	1	2	-	-	-	2	3	3	3

SYLLABUS

UNIT – I: Power Semi-Conductor Devices and Commutation Circuits

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT, SiC, GaN and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn-on and Turn-off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points –– Series and parallel connections of SCR's – Snubber circuit design – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems - Two transistor analogy – SCR – R and RC Triggering - UJT firing circuit – Line Commutation and Forced Commutation circuits.

UNIT – II: Phase Controlled Rectifiers

Phase control technique – Single phase Line commutated converters – Midpoint and Bridge connections – Half controlled converters with Resistive, RL and Fully controlled converters with Resistive, RL, Parallel RC and RLE load– Derivation of average load voltage & current -Active & Reactive power inputs to the converters without and with Freewheeling Diode, Effect of source inductance –Numerical problems
Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage with R, RL and RLE loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

UNIT – III: Choppers and DC-DC Converters

Principle of chopper operation– Time ratio and Current limit control strategies – Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper; Buck, Boost & Buck-Boost, Types of chopper circuits (A, B, C, D & E) – Basic principle operation – waveforms, Morgan's chopper – Jones chopper and Oscillation chopper (Principle of operation only) Waveforms –– AC Chopper – Numerical Problems.

UNIT – IV: Inverters

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

UNIT – V: AC Voltage Controllers & Cyclo Converters

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCR's in anti-parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor - wave forms – Numerical problems.
Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Text Books:

1. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 1998.
3. Power Electronics – by Dr P.S.Bimbhra, Khanna Publishers, Fourth Edition, 2010.

Reference Books:

1. Power Electronics A first Course - Ned Mohan, Wiley.
2. Fundamentals of Power Electronics – Robert W. Erickson, Kluwer publisher.
3. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers.
4. Power Electronics - by V.R.Murthy, 1st edition -2005, OXFORD University Press.
5. Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.

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Subject Code	Title of the Subject	L	T	P	C
17A50204	**Electrical & Electronic Measurements**	3	0	0	3

Course Objectives:

1. This course introduces the basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
2. It also explains the measurements of RLC parameters using bridge principles.
3. The principles of magnetic measurements are also explained.
4. The principle of working of CRO and its applications are explained.

Course Outcomes:

CO1 Understand the various working principles of instruments and equipment's used for the measurement of various parameters like Voltage, Current, Power, Energy, P.F, Resistance, Inductance and Capacitance.

CO2 Analyze the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.

CO3 Apply the concepts to Extend the range of ammeters and voltmeters, measurement of various parameter by DC and AC bridge and different characteristics of periodic and aperiodic signals using CRO

CO4 Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

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	2	1	1	1	2	2	-	2	3	3	3
CO2	3	3	1	3	2	1	1	1	2	2	-	2	3	3	3
CO3	3	3	1	2	2	1	1	1	2	2	-	2	3	3	2
CO4	3	3	2	2	2	1	1	1	2	2	-	2	3	3	3

SYLLABUS

UNIT - I: Measuring Instruments

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range.

UNIT – II: Measurement of Power, Power Factor and Energy

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter.

UNIT – III: Instrument Transformers, Potentiometers and Magnetic Measurements

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.
Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples.

UNIT – IV: D.C & A.C Bridges

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge.

UNIT – V: CRO and Digital Meters

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns.
Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.

Reference Books:

1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.

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Subject Code	Title of the Subject	L	T	P	C
17A50205	**Linear & Digital IC Applications**	3	0	0	3

Course Objectives:

1. To introduce the basic building blocks of linear & digital integrated circuits.
2. To learn the linear and non – linear applications of operational amplifiers.
3. To introduce the theory and applications of 555 and PLL.
4. To learn the theory of ADC and DAC
5. To understand different families of digital integrated circuits and their characteristics.

Course Outcomes:

CO1 Understand the basic concepts of Op –AMPs, characteristics and specifications.
CO2 Analyze circuits for advanced applications using Opamps, PLL, VCO and Analog multipliers.
CO3 Develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.
CO4 Design circuits using operational amplifiers for various applications.

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	-	1	-	-	-	-	2	3	3	3
CO2	2	3	3	2	3	-	2	-	1	-	1	2	3	3	3
CO3	2	3	3	2	3	-	2	-		-	1	2	3	3	3
CO4	2	3	3	3	2	-	-	-	2	-	-	2	3	3	3
CO5	2	3	3	3	2	-	-	-	-	-	-	2	3	3	3

SYLLABUS

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 IC's 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.

Text Books:

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
3. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

Reference Books:

1. Op Amps and Linear Integrated Circuits-Concepts and Applications James M. Fiore, Cengage Learning/ Jaico, 2009.
2. Operational Amplifiers with Linear Integrated Circuits by K.Lal Kishore – Pearson, 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH.
4. Modern Digital Electronics – RP Jain – 4/e – TMH, 2010.
5. Digital Design Principles and Practices – John. F. Wakerly 3/e, 2005.
6. Operational Amplifiers with Linear Integrated Circuits, 4/e William D.Stanley, Pearson Education India, 2009

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Subject Code	Title of the Subject	L	T	P	C
17A50206	Electrical Machines Lab - II	0	1	3	2

Course Objectives:

1. Transformers and understand their performance characteristics.
2. Induction Motors and understand their performance characteristics.
3. Alternators and understand their performance characteristics.
4. Synchronous motors are experimented in detail and their performance characteristics are evaluated.

Course Outcomes:

CO1 Understand the operation, and characteristics transformers.

CO2 Analyze the performance of the transformers, induction machines and synchronous machines.

CO3 Apply different speed controlling techniques of Induction motor based on the required application.

CO4 Demonstrate the parallel operation of transformers for load sharing under various loading conditions.

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	3	2	-	-	2	3	-	3	-	2	1	1
CO2	3	1	1	3	2	-	-	2	3	-	3	-	1	1	1
CO3	3	1	1	3	2	-	-	2	3	-	3	-	1	1	2
CO4	3	1	1	3	2	-	-	2	3	-	3	-	1	1	1

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

1. O.C. & S.C. Tests for predetermination of regulation and efficiency of single phase transformers.
2. Sumpner’s test on a pair of single phase transformers.
3. Scott connection of transformers.
4. No-load & Blocked-rotor tests for construction of circle diagram and predetermination of performance characteristics of three-phase Induction motor.
5. Regulation of a three phase alternator by synchronous impedance & M.M.F methods.
6. V and inverted V curves of a 3-phase synchronous motor.
7. Determination of Equivalent circuit of a single phase induction motor.

8. Determination of X_d and X_q of a salient pole synchronous machine.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted.

9. Parallel operation of single phase transformers.
10. Separation of core losses of a single phase transformer.
11. Load test on three phase Induction motor.
12. Regulation of three-phase alternator by Z.P.F. and A.S.A. methods.

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Subject Code	Title of the Subject	L	T	P	C
17A50207	**Electrical And Electronic Measurement Lab**	0	1	3	2

Course Objectives:

1. Calibration of various electrical measuring instruments.
2. Accurate determination of inductance and capacitance using D.C and A.C Bridges.
3. Measurement of coefficient of coupling between two coupled coils.

Course Outcomes:

CO1 Understand the Calibration of various electrical measuring instruments.
CO2 Analyze the values of inductance and capacitance using AC bridges.
CO3 Determine the values of inductance and capacitance using AC bridges
CO4 Develop the fundamental knowledge and demonstrate various electrical measuring instruments.

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	3	-	2	-	-	2	-	-	2	3	3	3
CO2	1	3	3	2	3	3	-	-	3	-	1	2	3	3	3
CO3	1	3	3	2	3	3	-	-	3	-	1	2	3	3	3
CO4	1	3	3	3	-	2	-	-	3	-	-	2	3	3	3

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

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance.
5. Determination of Coefficient of coupling between two mutually coupled coils.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3-phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:

9. Maxwell's bridge and DeSauty Bridge.
10. Calibration of LPF wattmeter – by Phantom loading.
11. Measurement of 3-phase power with Two-watt meter method (Balanced & Unbalanced).
12. Wheatstone bridge – measurement of medium resistances.
13. LVDT and capacitance pickup – characteristics and Calibration
14. Resistance strain gauge – strain measurement and Calibration
15. Transformer turns ratio measurement using A.C Bridge.
16. A.C. Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil.

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Subject Code	Title of the Subject	L	T	P	C
17A50208	**Power Electronics and Simulation Lab**	0	1	3	2

Course Objectives:

1. Various characteristics of power electronic devices with gate firing circuits, Various forced commutation techniques.
2. The operation of single-phase half & fully-controlled converters, and inverters with different types of loads.
3. The operation of single-phase AC Voltage controllers with different loads.
4. Experimentation and also by the PSPICE/PSIM.

Course Outcomes:

CO1 Understand various power electronic devices and their commutation circuits.
CO2 Analyze voltage and current characteristics of various converters and inverters at different firing angles.
CO3 Apply different types converters and inverters to different types of loads.
CO4 Develop PSPICE/PSIM programming for various power electronic devices.

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	1	3	1	-	-	-	3	1	1	1	3	3	3
CO2	2	2	2	3	2	-	2	-	3	1	2	2	3	3	3
CO3	2	2	2	3	3	-	2	-	3	1	2	2	3	3	3
CO4	1	2	1	3	2	-	2	-	3	1	1	3	3	3	3

Any Eight of the Experiments in Power Electronics Lab

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D and Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

Any two simulation experiments with PSPICE/PSIM

14. PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
15. PSPICE simulation of resonant pulse commutation circuit and Buck chopper.
16. PSPICE simulation of single phase Inverter with PWM control.

Reference Books:

1. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

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Subject Code	Title of the Subject	L	T	P	C
17A60201	**Switchgear and Protection**	3	0	0	3

Course Objectives:

1. To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
2. The study of different Circuit Breakers and Relays
3. The protection of Generators and Transformers
4. The protection of various feeder bus bars from abnormal conditions and over voltages & importance on Neutral grounding for overall protection.

Course Outcomes:

CO 1: Understand the operation of different circuit breakers.
CO 2: Analyze the concepts of different relays which are used in real time power system operation.
CO 3: Apply various protective schemes for Transformers , Rotating machines, Busbars, Feeders.
CO 4: Develop the practical applications of power system operation and planning.

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	-	1	1	-	-	2	2	3	3
CO2	1	3	3	2	3	3	-	1	1	-	1	2	2	3	3
CO3	1	3	3	2	3	3	-	1	1	-	1	2	3	3	3
CO4	1	3	3	3	-	2	-	1	1	-	-	2	3	3	3

SYLLABUS

UNIT - I: Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT - II: Electromagnetic, Static and Numerical Relays

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT) and Distance Relays and their Flow Charts.

UNIT - III: Protection of Generators and Transformers

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

UNIT - IV: Protection of Feeders, Transmission Lines and Busbars

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars -Differential protection.

UNIT - V: Protection against over voltages

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding- Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral onsystem performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

Text Books:

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers.
2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.
3. Power System Protection- P. M. Anderson, Wiley Publishers.

Reference Books:

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A60202	Power Semiconductor Controlled Drives	2	2	0	3

Course Objectives:

1. Operation of electric motor drives those are controlled from power electronic converters.
2. Analyze the stable steady-state operation and transient dynamics of a motor-load system.
3. Analyze the operation of the chopper fed DC drive.
4. Gives the differences between synchronous motor drives and induction motor drives.

Course Outcomes:

CO1 Understand the principle of electrical drives & be able to understand the dynamics of electrical drive systems.
CO2 Analyze various starting and braking methods on electrical drives including their effects on power supply, motor and load
CO3 Apply speed control of induction motor drives in an energy efficient manner using power electronic
CO4 design a drive for a particular application based on power rating & to select a drive based on mechanical characteristics for a particular drive application

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	2	3	3
CO2	1	1	3	2	3	-	-	-	-	-	1	2	2	3	3
CO3	1	1	3	2	3	-	-	-	-	-	1	2	3	3	3
CO4	1	1	3	3	-	-	-	-	-	-	-	2	3	3	3

SYLLABUS

UNIT - I: Introduction

Electrical Drives, Parts of electrical Drives –Electrical motors, Power modulators, sources and control unit -dynamics of electrical drives -torque equation -equivalent values of drive parameters-components of load torques, types of load Torques–steady state stability –Load equalization.

UNIT-II: Control of Electrical Drives

Modes of operation- speed control and drive classifications- Closed loop control of Drives- current limit control, closed loop torque control, closed loop speed control, closed loop speed control of multi-motor drives- speed sensing-current sensing.

UNIT - III: DC Motor Drives

DC motors & their performance (shunt, series, compound, permanent magnet motor, universal motor, dc servomotor) –Braking –regenerative braking, dynamic braking, plugging –Transient analysis of separately excited motor –converter control of dc motors – analysis of separately excited & series motor with 1-phase and 3-phase converters –dual converter –analysis of chopper controlled dc drives –converter ratings and closed loop control.

UNIT - IV: Induction Motor Drives

Three-phase Induction Motors- Analysis and Performance- stator voltage control of induction motor –torque-slip characteristics –control by ac voltage controllers and soft start–stator frequency control –variable frequency operation –V/F control- Voltage Source Inverter Control- Current Source Inverter Control - Cycloconverter Control- rotor resistance control –slip torque characteristic- slip power recovery – Static scherbius drive- Static Kramer drive.

UNIT - V: Synchronous Motor Drives

Separate and self-control of synchronous motors- operation of self-controlled By VSI, CSI and Cyclo-converters. Load commutated CSI fed synchronous motors- operation- waveforms- speed torque characteristics- Applications- Advantages and Numerical problems- Closed loop control operation of Synchronous motor drives.

Text Books:

1. Fundamentals of Electric Drives –by G K Dubey, Narosa. Publishers 2007.
2. Power Electronics –MD Singh and K B K hanchandani, Tata – McGraw-Hill Publishing Company, 1998.
3. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998.

Reference Books:

1. Modern Power Electronics and AC Drives by B.K.Bose, PHI Publications. Prentice Hall PTR-2002.
2. Thyristor Control of Electric drives –Vedam Subramanyam Tata McGraw Hill Publilcations-2008.
3. First Course on Power Electronics and Drives - Ned Mohan, Mnpere USA.

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B. Tech (E.E.E) III-Year II-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A60203	Computer Aided Power System Analysis	2	2	0	3

Course Objective:

1. Represent of a power system elements including generators, transmission lines and transformers.
2. Analyze power system models based on nodal admittance and impedance matrices for the large networks.
3. Calculation of power flow in a power system network using various techniques.
4. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

Course Outcomes:

CO1 Understand the concept of load characteristics and economic operations of Power Systems.
CO2 Analyze short circuit faults in power system networks using Z_{Bus} method..
CO3 Apply contingency analysis for power system networks using Z_{Bus} method.
CO4 Design the turbine model and governor model in Isolated Power System

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	-	-	-	-	-	1	-	3	3	3
CO2	3	2	3	3	2	-	-	-	-	-	1	-	3	3	3
CO3	3	2	3	3	2	-	1	-	-	-	1	-	3	3	3
CO4	3	2	3	3	2	-	1	-	-	-	1	-	3	3	3

SYLLABUS

UNIT – I: Power System Network Matrices-I

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System. Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} formation by Direct and Singular Transformation Methods, Numerical Problems.

UNIT – II: Power System Network Matrices-II

Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Z_{Bus} for the changes in network (Problems)

UNIT – III: Power flow Studies

Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods. Comparison of Different Methods.

UNIT – IV: Short Circuit Analysis

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory, Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT – V: Power System Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Text Books:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Computer Techniques in Power System Analysis – M A Pai, McGraw Hill.
3. Computer aided power system analysis – George Kusic, CRC Press.
4. Power System Analysis by Hadi Saadat – TMH Edition.
5. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing Company, 2nd edition.

Reference Books:

1. Computer Methods in Power Systems, Stagg El – Abiad & Stags.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Computer Analysis of Power Systems – J Arrillaga.
4. Power System Stability – Vol-1, Kimbark, IEEE Press.
5. Power System Analysis by B.R.Gupta, Wheeler Publications.
6. Analysis of Faulted Power Systems – P M Anderson, IEEE Press.

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Subject Code	Title of the Subject	L	T	P	C
17A624501	**Microprocessors and Microcontrollers**	3	0	0	3

Course Objectives:

1. Architecture and designing of 8085 & 8086 Microprocessor with Assembling language programming and interfacing with various modules.
2. Understand the Interfacing of 8086 with various advanced communication devices.
3. Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules.
4. Write Assembly Language Programs for the Digital Signal Processors and use Interrupts for real-time control applications.
5. Write Xilinx programming and understanding of Spartan FPGA board.

Course Outcomes:

CO1 Understand the concepts of internal architecture, organization and Pin diagram of 8086,Functional block diagram of 8051 microcontroller, Basic architectural features, Physical memory of TMS320LF2407 DSP Controller, Xilinx, XC3000 and 4000 Series, Configurable Logic Blocks (CLB) , Input /Output Block (IOB) ,Programmable Interconnect Point (PIP), Spartan 3E and Virtex II pro FPGA boards**.**

CO2 .Analyze the concepts of Minimum and Maximum mode of operation with Timing diagrams of 8086 microprocessor, Addressing modes and assembler directives of 8086,data transfer information through serial & parallel ports, properties of Microprocessors & Microcontrollers, DSP controllers

CO3 .Apply knowledge of various addressing modes and instruction set to write simple programs, data transfer instructions of the 8086 microprocessor and 8051 microcontroller, Xilinx 4000 Series

CO4 Design and Develop simple programming exercises of 8086 microprocessor, 8051 microcontroller interfacing with other devices and its applications, FPGA based Xilinx-HDL Programming.

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	2	-	-	1	-	1	-	-	3	3	3
CO2	1	3	3	3	2	-	-	1	-	1	-	1	3	3	3
CO3	1	2	3	3	2	-	-	1	-	1	-	1	3	3	3
CO4	1	3	3	2	1	-	-	1	-	1	-	2	3	3	3

SYLLABUS

UNIT - I: Introduction to Microprocessors

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation. Timing diagrams.

UNIT - II: Assembly Language Programming & I/O Interface

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

UNIT - III: 8051 Micro Controller Programming and Applications

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

UNIT - IV: Digital Signal Processor

Introduction to the TMS320LF2407 DSP Controller: Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. **C2xx DSP CPU and Instruction Set:** Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

UNIT - V: FPGA

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study

Text Books:

1. Ramesh S. Gaonkar, ‘Microprocessor Architecture Programming and Applications with 8085’, Penram Intl.Publishing, 6th Edition, 2013
2. Ray A. K., Bhurchandi K. M., ‘Advanced Microprocessor and Peripherals’, Tata McGraw-Hill Publications, 3rd Edition, 2013.
3. Hamid A. Tolyat, “DSP Based Electro Mechanical Motion Control”-CRC press, 2004.
4. Application Notes from the webpage of Texas Instruments.
5. XC 3000 series datasheets (version 3.1). Xilinx,Inc., USA, 1998
6. XC 4000 series datasheets (version 1.6). Xilinx,Inc., USA, 1999
7. Wayne Wolf, ‘FPGA based system design’, Prentice hall, 2004.

Reference Books:

1. Microprocessor and Interfacing - Douglas V Hall 2nd Edition, Tata McGrawhill-1992.
2. Microprocessor – NILESH B BAHADURE – PHI, 2010.
3. The 8051 Micro Controller Architecture, Programming and Applications – Kenneth J Ayala, Pearson International publishing (India).
4. Krishna Kant, ‘Microprocessors and Microcontrollers, Architecture, Programming and System Design-8085, 8086, 8051, 8096’, Prentice Hall India Ltd Publications, 1st Edition, 2010.
5. Kenneth Ayala, ‘The 8051 Microcontroller’, Cengage Learning Publications, 3rd Edition, 2007.

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Subject Code	Title of the Subject	L	T	P	C
17A60204a	Instrumentation Open Elective- I*	2	2	0	3

Course Objectives:

1. Measuring system, Common errors, test signals and modulation phenomenon.
2. Data acquisition system, various telemetry systems and various modulation systems.
3. Measuring various meters and analyzers.
4. Basic transducers and their usage in various measurements.

Course Outcomes:

CO1 Understand Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques.
CO2 Analyze Various telemetry systems and basic operation of Data acquisition systems.
CO3 Apply LVDT principle to different applications like strain gauge.
CO4 Develop various transducers using various principles like LVDT

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	-	-	2	2	-	-	3	1	3	3
CO2	3	-	-	2	-	3	1	3	3	1	-	-	2	3	3
CO3	3	3	-	2	2	-	2	3	-	-	3	-	2	3	3
CO4	3	3	-	2	-	-	2	3	-	-	3	-	2	3	3

SYLLABUS

UNIT - I: Instrument Errors, Signals and their Representation

Measuring Systems, Performance Characteristics, - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signal and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

UNIT - II: Data Transmission, Telemetry and DAS

Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems –

Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram –– Modern Digital DAS (Block Diagram)

UNIT - III: Signal Analyzers

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

UNIT - IV: Transducers

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor, LVDT and Capacitor Transducers; LVDT Applications, Strain Gauge and Its Principle of Operation, Guage Factor, Thermistors, Thermocouples, Synchros, Piezo Electric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

UNIT - V: Measurement of Non-Electrical Quantities

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

Text Books:

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India, 2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co., 2012.

Reference Books:

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e., 2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrick and W.D. Cooper, Pearson/Prentice Hall of India., 1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3rd Edition print, 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A60204b	**Wind Energy Conversion Systems Open Elective- I***	2	2	0	3

Course Objectives:

1. Fundamentals of wind turbine and wind energy conversion devices and ratings.
2. Characteristics of wind turbine and control strategy.
3. Basic principles of Induction generators and synchronous generators and grid connected systems.
4. Variable speed applications and hybrid systems.

Course Outcomes:

CO1 .Understand the basics of mechanics involved in wind energy conversion
CO2 Analyze Wind speed statistics and measurements.
CO3 Apply different control strategies for maintaining the satisfactory torque-speed characteristics
CO4 Design of wind turbine rotor by using various methods

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	2	1	-	1	1	-	2	1	3	3
CO2	2	1	-	-	-	3	1	2	-	1	-	2	2	3	3
CO3	2	1	2	2	1	2	2	2	2	1	-	2	2	3	3
CO4	2	1	-	3	3	3	3	3	1	1	-	2	1	3	3

SYLLABUS

UNIT - I: Fundamentals of Wind Turbines

Historical background - basics of mechanical to electrical energy conversion in wind energy - types of wind energy conversion devices – definition - solidity, tip speed ratio, power coefficient, wind turbine ratings and specifications - aerodynamics of wind rotors - design of the wind turbine rotor

UNIT - II: Wind Turbine Control Systems & Site Analysis

Power speed characteristics - torque speed characteristics - Pitch angle control – stall control – power electronic control – Yaw control – Control strategy – wind speed measurements – wind speed statistics – site and turbine selection.

UNIT - III: Basics of Induction and Synchronous Machines

The Induction Machine – constructional features - equivalent circuit model - performance characteristics - saturation characteristics – dynamic d-q model – the wound – field synchronous machine – the permanent magnet synchronous machine – power flow between two synchronous sources – induction generator versus synchronous generator

UNIT - IV: Grid Connected and Self-Excited Induction Generator Operation

Constant – voltage, constant – frequency- single output system –double output system with current converter & voltage source inverter – equivalent circuits – reactive power and harmonics – reactive power compensation – variable – voltage, variable – frequency generation – the self-excitation process – circuit model for the self – excited induction generator – analysis of steady state operation – the steady state characteristics – the excitation requirement – effect of a wind generator on the network

UNIT - V: Wind Generation with Variable-Speed Turbines and Application

Classification of schemes – operating area – induction generators – doubly fed induction generator – wound field synchronous generator – the permanent magnet generator – Merits and limitations of wind energy conversion systems – application in hybrid energy systems – diesel generator and photovoltaic systems – wind photovoltaic systems.

Text Books:

1. S.N.Bhadra,D.Kastha, S.Banerjee, " wind electrical systems" Oxford University Press.

References:

1. S.Rao & B.B.Parulekar, "Energy Technology", 4th edition, Khanna publishers, 2005.
2. "Renewable Energy sources & Conversion Technology" by N.K.Bansal, Manfred Kleemann, Michael Meliss. Tata Mcgraw Hill Publishers.

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Subject Code	Title of the Subject	L	T	P	C
17A60204c	**Reliability and Safety Engineering Open Elective- I***	2	2	0	3

Course Objectives:

1. To introduce the concepts of system reliability and safety and to learn about reliability block diagram, markov models, fault tree analysis, monte carol simulation and dynamic reliability analysis.
2. To know about probabilistic safety assessment procedure, identification of hazards and initiating events.
3. To learn about event tree analysis, importance measures, common-cause failure analysis and human reliability analysis.
4. To learn about various applications of probabilistic safety analysis.
5. To learn about uncertainty management in reliability assessment.

Course Outcomes:

CO1 Understand the concepts of system reliability and safety. Get knowledge on reliability block diagram, markov models, fault tree analysis, monte carlo simulation and dynamic reliability analysis.
CO2 Analyze the probabilistic safety assessment procedure, identification of hazards and initiating events.
CO3 Apply different unertainity theories to assess the system.
CO4 Develop markov models for finding the system reliability.

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	-	2	-	-	-	-	2	3	3	3
CO2	-	1	3	3	3	-	3	3	-	-	-	3	3	3	2
CO3	-	3	3	3	3	-	2	2	-	-	2	3	3	2	2
CO4	2	3	3	3	3	-	1	-	-	3	2	3	3	3	3

SYLLABUS

UNIT - I: Basic Reliability Concepts

Introduction, Need for Reliability and Safety Engineering, Definitions and Terms, Basic Reliability Mathematics - Classical Set Theory and Boolean Algebra, Concepts of Probability Theory, Reliability and Hazard Functions, Distributions Used in Reliability and Safety Studies, Failure Data Analysis, Numerical Problems.

UNIT - II: System Reliability Modeling

Reliability Block Diagram, Markov Models, Fault Tree Analysis, Monte Carlo Simulation, Dynamic Reliability Analysis, Numerical Problems.

UNIT - III: Probabilistic Safety Assessment

Introduction, Concept of Risk and Safety, Probabilistic Safety Assessment Procedure, Identification of Hazards and Initiating Events, Event Tree Analysis, Importance Measures, Common-cause Failure Analysis, Human Reliability Analysis.

UNIT - IV: Applications of Probabilistic Safety Assessment

Objectives of Probabilistic Safety Assessment, Probabilistic Safety Assessment of Nuclear Power Plants, Technical Specification Optimization, Risk Monitor, Risk-informed In-service Inspection.

UNIT - V: Uncertainty Management in Reliability/Safety Assessment

Mathematical Models and Uncertainties, Uncertainty Analysis: an Important Task of Probabilistic Risk/Safety Assessment, Methods of Characterizing Uncertainties, Uncertainty Propagation, Uncertainty Importance Measures, Treatment of Aleatory and Epistemic Uncertainties, Dempster – Shafer Theory, Probability Bounds Approach, Bayesian Approach, Expert Elicitation Methods, Case Study to Compare Uncertainty Analysis Methods, Numerical Problems.

Text Book:

1. Reliability and Safety Engineering – by Ajit Kumar Verma, Srividya Ajit, Durga Rao Karanki, Springer Publications, 2010.

References:

1. Roy Billinton and Ronald N. Allan, Reliability Evaluation of Engineering Systems, Pitman Advanced Publishing Program, 2nd Edition 1998.
2. Charles E. Ebeling , Reliability and Maintainability Engineering, Tata McGraw Hill, 2000
3. E. Balagurusamy, Reliability Engineering, Tata McGraw Hill, 2003.
4. A. K. Gupta, Reliability, Maintenance & Safety Engineering, University Science Press, 2013.

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Subject Code	Title of the Subject	L	T	P	C
17A69901	**Foreign Language (Audit)**	2	0	0	0

Course Objectives:

1. To be able to understand frequently used phrases and expressions in French related to relevant areas of experience.
2. To be able to carry out simple, habitual daily tasks and exchanges in French.
3. To be able to describe in French, in simple terms, their past, their environment and issues related to their immediate needs.

Course Outcomes:

CO1 Respond appropriately to simple statements and instructions in French in everyday situations, for example, questions and directions.
CO2 Participate in conversations based on everyday topics and respond orally in everyday situations in a manner acceptable to native speakers;
CO3 Equipped with sufficient vocabulary to operate in familiar and predictable situations.

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	3	1	1	-	2	-	-	-
CO2	1	-	-	-	-	1	1	3	1	1	-	2	-	-	-
CO3	1	-	-	-	-	1	1	3	1	1	-	2	-	-	-
CO4	1	-	-	-	-	1	1	3	1	1	-	2	-	-	-

SYLLABUS

UNIT - I: Everyday activities

Home life and school- Home life- School routine
Food, health and fitness- Eating and drinking- Health and fitness

UNIT - II: Personal and social life

Self, family and personal relationships- Self, family, pets, personal- relationships- Holidays and special occasions- Festivals and special occasions- Holidays; getting around

UNIT - III: The world around us

Home town and local area- Home town and geographical- surroundings- Natural and made environment- Natural environment- Weather- People, places and customs

UNIT - IV: The world of work

Continuing education- Careers and employment- Language and communication in the work place

UNIT - V: The international world

Tourism at home and abroad- Holiday travel and transport- Life in other countries and communities- Places and customs- World events and issues- Issues according to available resources and individual interest

Text Book:

1. Easy Way to Learn French through English by Sharma Rinkal, Diamond Publiacations.

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Subject Code	Title of the Lab	L	T	P	C
17A65501	**Advanced Communication Skills Lab**	0	1	3	2

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 understand various listening components that includes listening comprehension of gist and detailed information.
CO2 To apply extensive and intensive reading methods for specific reading and voracious reading of vast material.
CO3 To analyze different descriptive and technical writing material.
CO4 To evaluate and develop, academic research paper with appropriate citations, quotations, and references when needed.
CO5 To develop corporate skills such as time management, negotiation, technical and organizational skills.

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	1	3	-	2	-	-	-
CO2	1	-	-	1	-	-	1	2	1	3	3	2	-	-	-
CO3	1	-	-	1	-	-	1	2	1	3	-	2	-	-	-
CO4	1	-	-	1	-	-	1	2	1	3	-	2	-	-	-
CO5	1	-	-	1	-	-	1	2	3	3	-	2	-	-	-

SYLLABUS

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:

1. Walden Infotech English Language Communication Skills.
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. 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) CU
9. Cambridge Advanced Learners' English Dictionary with CD.

Reference Books:

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. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
5. Practice Psychometric Tests: How to familiarize yourself with genuine recruitment tests, 2012.
6. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
7. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
8. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
9. Word Power Made Handy, Shalini Verma, S Chand Publications, 2011.
10. Effective Technical Communication, Ashrif Rizvi, TataMcGrahill, 2011.

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.
- TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- Train2success.com

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Subject Code	Title of the Subject	L	T	P	C
17A624502	Microprocessors and Microcontrollers Lab	0	1	3	2

Course Objectives: The student will understand about

1. Assembly language programming on 8086 Microprocessors.
2. Interfacing of various devices with 8086.
3. MASAM Programming.
4. Interfacing 8051 Microcontroller with its peripheral devices.

Course Outcomes: The student able to perform

CO1 Understand the concepts related to I/O and memory interfacing.
CO2 Design interfacing circuits with 8086.
CO3 Analyze Model serial and parallel interfacing of 8086 microprocessor
CO4 Develop ALP for fixed and Floating Point and Arithmetic operations using 8086 microprocessor.

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	1	3	1	-	-	-	3	1	1	1	2	3	3
CO2	-	1	2	3	2	-	2	-	3	1	2	2	2	3	3
CO3	2	2	2	3	3	-	1	-	3	1	2	2	3	3	3
CO4	-	2	1	3	2	-	2	-	3	1	1	3	3	3	3

I. Microprocessor 8086

Introduction to MASM/TASM.
Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison. Modular Program: Procedure, Near and Far implementation, Recursion.
Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

II. Interfacing

8259 – Interrupt Controller
8279 – Keyboard Display
8255 – PPI
8251 – USART

III. Microcontroller 8051

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.
4. Understanding three memory areas of 00 – FF (Programs using above areas).
5. Using external interrupts
6. Programs using special instructions like swap, bit/byte, set/reset etc.
7. Programs based on short, page, absolute addressing.

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Subject Code	Title of the Lab	L	T	P	C
17A60205	Linear & Digital ICs Lab	0	1	3	2

Course Objectives:

1. To expose the students to linear and digital Ics data sheets and specifications.
2. To understand characteristics of OPAMPs.
3. To understand using OPAMPs for linear and nonlinear applications.
4. To design combinational and sequential circuits using digital Ics.

Course Outcomes:

CO1 Understand using OPAMPs for linear and nonlinear applications.
CO2 Apply OPAMP's to different circuits like integrator and differentiator.
CO3 Analyze the working of PLL and design DC power supply using Ics.
CO4 Design, Test and Evaluate various combinational circuits such as adders, subtractors, multipliers, multiplexers and de-Multiplexers.

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	3	2	2	1	-	3	-	3	2	3	3	3
CO2	2	3	3	2	3	3	2	-	3	-	3	2	3	3	3
CO3	2	3	3	2	3	3	2	-	3	-	3	2	3	3	3
CO4	2	3	3	3	2	2	-	-	3	-	3	2	3	3	3
CO5	2	3	3	3	2	2	-	-	3	-	3	-	3	3	3

LIST OF EXPERIMENTS

PART- A: Linear IC Lab Experiments

1. Linear ICS, Specifications, Interpretation of the data sheets.
2. Inverting, Non inverting amplifiers using op-amp.
3. Integrator and Differentiator using op-amp.
4. Active low-pass, High-pass and band-pass filters using op-amp.
5. Astable and Monostable Multivibrators using op-amp.
6. Phase shift and Wien bridge oscillators using op-amp.
7. Astable and Monostable Multivibrators using NE555 Timer.
8. PLL characteristics and its use as Frequency Multiplier.
9. DC power supply using LM723.

Equipment required for Lab

1. Cathode Ray Oscilloscopes (20MHz)
2. Signal Generator /Function Generators (2 MHz)
3. Regulated Power Supplies (0 – 30V)
4. Bread Boards
5. Digital Multimeters

PART- B: Digital IC Lab Experiments

1. Digital ICs, Specifications, interpretation of the data sheets.
2. Verification of logic gates
3. Code converters
4. 4-bit binary Adder/ Subtractor
5. Multiplexer and De-multiplexer
6. Encoder and decoder
7. 4-bit ripple counter
8. 3-bit synchronous up/down counter
9. Universal shift registers

Equipment for Digital Lab

1. Power Supplies
2. DIGITAL IC Trainer Kits
3. Bread Boards
4. Seven segment display
5. Multimeter
6. ICs -7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151/74154 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474

Note: Any **SIX of** the above experiments from each part are to be conducted

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Subject Code	Title of the Subject	L	T	P	C
17A70201	**Electric Power Distribution Systems**	2	2	0	3

Course Objectives: The student acquires knowledge about:

1. The Characteristics and classification of distribution systems.
2. The technical aspects and design considerations in DC and AC distribution systems and their comparison.
3. Technical issues of substations such as, location, ratings and bus bar arrangements.
4. The causes of low power factor and methods to improve, methods of voltage control and co-ordination procedure for placing protective devices.

Course Outcomes:

CO1 Understand the concepts of different distribution factors, systems, loads, voltage drop, power loss, substations, power factor, voltage control and coordination procedure.

CO2 Analyze different distribution systems, examine best capacitor placement for power factor improvement, most economical power factor, service area with 'n' primary feeders and the best suitable protection scheme for various types of feeder connections by using modern tools and examine the results

CO3 Apply the concepts of voltage drop and power loss to various distribution feeders, rating of substations, bus bar arrangements, voltage control, power factor improvement, voltage control, distribution system protection and co-ordination procedures to be solve the problems and demonstrate the use of these techniques through good communication skills

CO4 Design and develop different types of distribution feeders, bus bar arrangements, optimal location of substation. Implement them in solving real life issues of distribution systems.

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	2	-	-	-	-	1	-	1	3	2	3
CO2	2	2	3	3	2	-	2	-	-	1	-	2	3	3	2
CO3	2	3	3	3	3	-	2	-	-	1	-	2	3	3	3
CO4	2	3	3	3	2	-	2	-	-	1	-	3	3	3	3

SYLLABUS

UNIT – I: General Concepts

Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT – II: General Aspects of D.C. Distribution Systems

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design features of Distribution Systems.
Voltage Drop and power loss derivations in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at both ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network

A.C. Distribution Systems

Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of secondary distribution systems.
Voltage Drop and power loss derivations in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT – III: Substations

Location of Substations: Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.
Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment.
Bus bar arrangements in Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar, Double breaker – One and half breaker system with relevant diagrams, Lightening arrestors, Substation grounding.

UNIT – IV: Power Factor Improvement and Voltage Control

Causes of low P.F -Methods of Improving P.F -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical P.F. for constant KW load and constant KVA type loads-Capacitive compensation for power-factor control - effect of shunt capacitors (Fixed and switched) and other compensating devices, Power factor correction- Economic justification - Procedure to determine the best capacitor location-Numerical Problems.
Dependence of Voltage on Reactive Power flow.- Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers

UNIT – V: Protection and Coordination of Distribution Systems

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizer, and circuit breakers. Coordination of Protective Devices: General coordination procedure.

Text Books:

1. "Electric Power Distribution system, Engineering" – by Turan Gonen, Mc Graw-hill Book Company.
2. Electric Power Distribution – by A.S. Pabla, Tata Mc Graw-hill Publishing company, 4th edition, 1997.

Reference Books:

1. Distribution System Modeling and Analysis – William H Kersting, CRC Press.
2. Principles of Power Systems by V.K.Mehta, S Chand.
3. Electrical Power Distribution and Automation by S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2006.

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Subject Code	Title of the Subject	L	T	P	C
17A70202	Digital Signal Processing	2	2	0	3

Course Objectives:

1. Understanding the fundamental characteristics of signals and systems.
2. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling
3. Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform
4. Realization of FIR and IIR digital filters

Course Outcomes:

CO1 Understand different transformation techniques.
CO2 Analyze the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice.
CO3 Apply Fourier transform to analyze the operations on signals and acquire knowledge about Systems.
CO4 Design FIR Digital Filters Using Window Techniques.

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	1	1	-	1	1	1	-	2	3	2	-
CO2	3	2	3	2	2	1	-	1	1	1	-	2	3	2	1
CO3	3	2	3	2	2	1	-	1	1	1	-	2	3	2	1
CO4	3	2	3	2	2	1	-	1	1	1	-	2	3	2	1

SYLLABUS

UNIT - I: Introduction to Digital Signal Processing

Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems.

UNIT – II: Discrete Fourier Series and Fast Fourier Transforms

Properties of Discrete Fourier Series, DFS Representation of Periodic Sequences, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences Using DFT, Computation of

DFT. Relation between Z-Transform and DFS, Fast Fourier Transforms (FFT)-Radix2 Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT and FFT for Composite N.

UNIT - III: Realization of Digital Filters

Z-Transforms: Concept, Properties, Region of Convergence, and Applications; Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant-Coefficient Difference Equations, Basic Structures of IIR Systems, Transposed Forms, Basic Structures of FIR Systems, System Function.

UNIT - IV: IIR and FIR Digital Filters

Analog Filter Approximations-Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations, Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR Filters, Illustrative Problems.

UNIT - V: Multirate Digital Signal Processing

Basic Sample Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Polyphase Decomposition, Nyquist Filters. Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Signal Compression, Transmultiplexers, Discrete Multitone Transmission of Digital Data.

Text Books:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 2007.
2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd edition, 2009.

Reference Books:

1. Signals - Discrete Time Signal Processing – Allan V Oppenheim and Systems, Pearson.
2. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
3. A Text book on Digital Signal processing – R S Kaler, M Kulkarni, Umesh Gupta, I K International Publishing House Pvt. Ltd., 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A70203	Power System Operation and Control	2	2	0	3

Course Objectives:

1. To learn about load characteristics and economic operations of Power Systems.
2. To know about hydrothermal scheduling and modeling of turbines, generators and automatic controllers.
3. To know about single area and two area load frequency control and economic emission dispatch.
4. To learn about reactive power control and computer control of power systems.

Course Outcomes:

CO 1: Understand the load characteristics and economic operations of Power Systems.
CO 2: Analyze hydrothermal scheduling and modeling of turbines, generators and automatic controllers.
CO 3: Apply methods to find single area and two area load frequency control and economic emission dispatch.
CO 4: Develop the techniques to improve the reactive power control and computer control of Power Systems.

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	2	3	1	1	2	-	2	-	3	2	1	2
CO2	1	3	2	2	2	1	1	2	-	2	-	3	2	1	2
CO3	1	2	3	2	2	2	1	2	-	2	-	3	2	2	2
CO4	1	2	3	2	3	2	1	2	-	2	-	2	2	1	2

SYLLABUS

UNIT - I: Introduction & Economic Dispatch

An Overview of power system operation and control, System load variation, Load characteristics, Formulation of economic dispatch in Thermal Power Stations , Input-output cost characterization, Incremental cost curve, Incremental fuel and Production costs, Input-output characteristics, Coordination equation without and with line losses, Derivation of Loss Coefficients.

UNIT - II: Hydrothermal Scheduling and Governing

Optimal scheduling of Hydrothermal System: Scheduling problems-Short term Hydrothermal scheduling problem, Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System, Derivation of small signal transfer function, Block Diagram.

UNIT - III: Load Frequency Control and Economic Emission Dispatch

Definitions of Control area, Single area control: Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, uncontrolled case. Two area control: uncontrolled case and controlled case, tie-line bias control, Proportional plus Integral control of single area and its block diagram representation, steady state response, Economic dispatch control, Economic emission dispatch, Combined Economic and Emission dispatch.

UNIT - IV: Reactive Power Control

Overview of Reactive Power control, Reactive Power compensation in transmission systems, Advantages and disadvantages of different types of compensating equipment for transmission systems, Load compensation, Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

UNIT - V: Computer Control of Power Systems

Need for computer control of power systems, concept of energy control centre, System monitoring, Data acquisition and control, System hardware configuration, SCADA and EMS functions, Network topology, State estimation, Weighted Least Square Estimation (WLSE), Contingency analysis.

Text Books:

1. Power Generation Operation and Control - Wood and Wollenberg, Wiley Publishers.
2. Electric Energy System Theory : an Introduction O I Elgerd TMH Publishers.
3. Power Systems Operation and Control – Chakravarthi, Halder
4. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd, 2nd edition.

Reference Books:

1. Power System Analysis and Design - J.Duncan Glover and M.S.Sarma, THOMPSON, 3rd Edition.
2. Power System Stability and Control – Prabha Kundur, McGraw Hill Publishers.
3. Reactive Power Control in Electric Systems - T J E Miller, Wiley Publishers.
4. Power System SCADA and Smart Grids by Mini S. Thomas, John Douglas McDonald, CRC Press.

5. Reactive Power compensation, A practical guide by Wolfgang Hofmann, Jurgen Schlabbach and Wolfgang Just – Jhon Wiley Publications.
6. Power System State Estimation Theory and Implementation by Ali Abur, Antonio Gomez Exposito – Marcel Dekker, Inc.

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Subject Code	Title of the Subject	L	T	P	C
17A70204a	**PLC & Its Applications Open Elective-II***	2	2	0	3

Course Objectives:

1. PLC and its basics, architecture, connecting devices and programming.
2. Implementation of Ladder logic for various Industrial applications.
3. Designing of control circuits for various applications.
4. PLC logical and arithmetic operations.

Course Outcomes:

CO1 Understand PLC and its basics, architecture, connecting devices and programming.
CO2 Analyze Ladder logic for various Industrial applications.
CO3 Use Ladder Logic Function and advance function for PLC programming.
CO4 Designing of control circuits for various applications

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	1	3	1	-	-	-	-	1	-	3	3	3	3
CO2	2	2	2	3	2	-	2	-	-	1	-	3	3	3	3
CO3	2	2	2	3	3	-	2	-	-	1	-	2	3	3	3
CO4	1	2	1	3	2	-	2	-	-	2	-	3	3	3	3

SYLLABUS

UNIT - I

PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules.
PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

UNIT - II

Digital Logic Gates, Programming in the Boolean Algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flowchart for Spray Process System.

UNIT - III

PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

UNIT - IV

Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.

UNIT - V

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintanance.

Text Books:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI, 2011.

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Subject Code	Title of the Subject	L	T	P	C
17A70204b	**Solar Energy Conversion Systems Open Elective - II***	2	2	0	3

Course Objectives:

1. Fundamentals of solar cells and know the importance of solar energy.
2. Design of solar cells and PV modules depends on ratings.
3. How to track maximum power from solar cell and how to main constant supply.
4. Different applications of solar PV systems.

Course Outcomes:

CO1 Understand Solar cells and their ratings
CO2 Analyze Series parallel connection of PV modules for different current and voltage ratings.
CO3 Design of DC-DC converters for getting maximum power.
CO4 Apply MPPT algorithms for balance of solar PV system.

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	1	3	1	-	-	-	-	1	-	3	3	3	3
CO2	2	2	2	3	2	-	2	-	-	1	-	3	3	3	3
CO3	2	2	2	3	3	-	2	-	-	1	-	2	3	3	3
CO4	1	2	1	3	2	-	2	-	-	2	-	3	3	3	3

SYLLABUS

UNIT - I: Solar Cell Fundamentals

Place of PV in world energy scenario – need for sustainable energy sources – current status of Renewable energy sources – place of photovoltaic in Energy supply – solar radiation – the sun and earth movement – angle of sunrays on solar collectors – sun tracking – estimating solar radiation empirically – measurement of solar radiation - Fundamentals of semiconductors – charge carriers and their motion in semiconductor – P-N Junction Diode – an introduction to solar cells.

UNIT - II: Design of Solar Cells

Upper limits of cell parameters – short circuit current, open circuit voltage, fill factor, efficiency – losses in solar cells – model of a solar cell, effect of series and shunt resistance on efficiency , effect of solar radiation on efficiency – solar cell design – design for high I_{SC} – Design for high V_{OC} – design for high FF – Analytical techniques.

UNIT - III: Solar Photovoltaic Modules

Solar PV Modules from solar cells – series and parallel connection of cells – mismatch in module – mismatch in series connection – hot spots in the module , bypass diode – mismatching in parallel diode – design and structure of PV modules – number of solar cells in a module, wattage of modules, fabrication of PV module – PV module power output.

UNIT - V: Balance of Solar PV Systems

Basics of Electromechanical cell – factors affecting performance – batteries for PV systems – DC to DC converters – charge controllers – DC to AC converters(Inverters) – Maximum Power Point tracking (MPPT) – Algorithms for MPPT.

UNIT - V: PV System Design and Applications

Introduction to solar PV systems – standalone PV system configuration – design methodology of PV systems – design of PV powered DC fan without battery, standalone system with DC load using MPPT, design of PV powered DC pump, design of standalone system with battery and AC/DC load – wire sizing in PV system – precise sizing of PV systems – Hybrid PV systems – grid connected PV systems.

Text Books:

1. "Solar Photovoltaics Fundamentals, Technologies and Applications" by Chetan singh solanki, PHI publications.

References:

1. Solar Energy Fundamentals and applications by H.P. Garg, J. Prakash "Tata McGraw- Hill publishers Ist edition".
2. S.Rao & B.B.Parulekar, "Energy Technology", 4th edition, Khanna publishers, 2005.

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Subject Code	Title of the Subject	L	T	P	C
17A70204c	**Optimization Techniques Open Elective-II***	2	2	0	3

Course Objectives:

1. The basic concepts of Optimization
2. The emphasis of this course is laid different classical Optimization techniques linear programming and simplex algorithms.
3. About optimality of balanced transportation Problems
4. About Constrained and unconstrained Nonlinear programming.
5. About principle of optimality and dynamic programing

Course Outcomes:

CO1 Understand basic theoretical principles in optimization
CO2 Formulation of optimization models, solution methods in optimization
CO3 Apply LPP in Various fields such as Science, Engineering, Industry, Business, et.
CO4 Develop methods of linear and non-linear (constrained and unconstrained) programming. Applications to a wide range of engineering problems.

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	-	-	-	-	2	-	2	3	3	3
CO2	2	3	3	3	3	-	-	-	2	2	1	3	3	3	3
CO3	2	3	3	3	3	-	-	-	-	2	1	2	3	3	2
CO4	2	3	3	3	3	-	-	-	2	3	1	3	3	3	3

SYLLABUS

UNIT – I: Introduction and Classical Optimization Techniques

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II: Linear Programming

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT – III: Transportation Problem

Formulation, methods of solution: Finding initial basic feasible solution by north – west (NW) corner rule, least cost and Vogel's approximation methods – testing for optimality of balanced transportation problems.

UNIT – IV: Unconstrained & Constrained Nonlinear Programming

One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method. Unconstrained Optimization Techniques: Univariate method, Powell's method and steepest descent method. Constrained optimization Technique: Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods.

UNIT – V: Constrained Nonlinear & Dynamic Programming

Introduction to convex Programming Problem. Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S. Rao, New Age International (P) Limited, 3rd edition, 1998.
2. "Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer (India), Pvt. Ltd.

Reference Books:

1. Practical Methods of Optimization – R Fletcher, Wiley Publishers.
2. Numerical Optimization – Jorge Nocedal, Springer Publishers.
3. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
4. Operations Research – by Dr. S.D.Sharma.
5. "Operations Research: An Introduction" – by H.A. Taha, PHI Pvt. Ltd., 6th edition.
6. Linear Programming – by G. Hadley.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject Code	Title of the Subject	L	T	P	C
17A70205a	**Special Electrical Machines (Elective-I)**	2	2	0	3

Course Objectives:

1. To learn about the stepper motor characteristics, operation and speed control.
2. To learn about the Variable Reluctance (VR) Stepping Motors characteristics, operation and position control.
3. To learn about the Switched mode reluctance motor characteristics, operation and design.
4. To learn about the Brushless DC motor and Permanent magnet motor performance prediction and rotor position sensing and learn about double sided Linear induction motor.

Course Outcomes:

CO1 Understand the stepper motor characteristics, operation and able to do speed control.
CO2 Analyze the Variable Reluctance (VR) Stepping Motors characteristics, operation and able to do position control.
CO3 Apply different control strategies for various machines.
CO4 Develop Approximate Solutions for Current and Torque under Steady State for Brushless dc motor

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	-	-	-	-	2	-	2	3	3	3
CO2	2	3	3	3	3	-	-	-	2	2	1	3	3	3	3
CO3	2	3	3	3	3	-	-	-		2	1	2	3	3	2
CO4	2	3	3	3	3	-	-	-	2	3	1	3	3	3	3

SYLLABUS

UNIT – I: Stepper Motors

Introduction – Synchronous Inductor, Hybrid Stepping Motor, Construction, Principle of Operation, Energisation with two phase at a time – Essential conditions for the satisfactory Operation of a 2 – Phase Hybrid Step Motor –Very Slow-Speed Synchronous Motor for Servo Control – Different Configurations for Switching the Phase Windings – Control Circuits for Stepping Motors – An Open – Loop Controller for a 2-Phase Stepping Motor.

UNIT – II: Variable Reluctance (VR) Stepping Motors

Single – Stack VR step motors, Multiple stack VR motors – Open – Loop Control of 3-Phase VR Step Motor – Closed – Loop Control of Step Motor, Discriminator, Translator, Major loop – Characteristics of Step Motor in Open – Loop Drive – Comparison between Open-Loop Position Control with Step Motor and a Position Control Servo using a Conventional Servo Motor – Suitability and Areas of Application of Stepping Motors, 5–Phase Hybrid Stepping Motor, Single – Phase Stepping Motor - The Construction, Operating Principle, Torque developed in the Motor.

UNIT – III: Switched Reluctance Motor (SRM)

Introduction – Improvements in the Design of Conventional reluctance Motors – Some Distinctive Differences between SR and Conventional Reluctance Motors – principle of Operation of SRM – Some Design Aspects of Stator and Rotor Pole Arcs, Design of stator and Rotor and pole Arcs in SR Motor, Determination of L(θ) – θ Profile – Power Converter for SR Motor – A Numerical Example - Rotor Sensing Mechanism and Logic Control, Drive and Power Circuits, Position Sensing of rotor with Hall Problems – Derivation of Torque Expression, General, Linear Case.

UNIT – IV: Brushless DC Motor and Permanent Magnet Materials and Motors

Types of Construction – Principle of Operation of BLDM – Sensing and Switching Logic Scheme, Sensing, Logic Controller, Lockout Pulses – Drive and Power Circuits, Base Drive Circuit, Power Converter Circuit – Theoretical Analysis and Performance Prediction, Modeling and magnet circuit, d-q analysis of BLDM – Transient Analysis – Formulation in terms of Flux Linkages as State Variables – Approximate Solutions for Current and Torque under Steady State – Theory of BLDM as Variable Speed Synchronous Motor, Rotor position Sensing and Switching Logic for a BLDM for forward and reverse position.

UNIT – V: Linear Induction Motor

Development of a Double sided LIM from Rotary type IM – A Schematic of LIM Drive for Electric Traction – Development of one sided LIM with back Iron – Field Analysis of a DSLIM: Fundamental Assumptions.

Text Books:

1. K. Venkataratnam, Special Electrical Machines, University Press.
2. R. K. Rajput, Electrical machines, 5th Edition (For Chapters I and II refer Chapter VIII of this book).
3. V. V. Athani, Stepper Motors: Fundamentals, Applications and Design, New Age International Pub.
4. N. Mohan, Undeland & Robbins, Power Electronics Converters, Applications & Design.
5. Johan E. Gibson and F. B. Teuter, Control System Components.
6. M. G. Say & E. O. Taylor, D. C. Machines.

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Subject Code	Title of the Subject	L	T	P	C
17A70205b	HVDC Transmission (Elective-I)	2	2	0	3

Course Objectives:

1. Technical and economic aspects of HVAC and HVDC transmission and their comparison, Static power converters.
2. Control of HVDC converter systems.
3. Origin, effects, classification and elimination of harmonics.
4. The occurrence of faults, and transients in HVDC system and their protection.

Course Outcomes:

CO1 Understand the operation of various converters used in HVDC transmission systems
CO2 Analyze the different harmonics generated by the converters and their variation with the change in firing angles
CO3 Determine and select the appropriate HVDC transmission line parameters under different physical conditions
CO4 Design HVDC Filters.

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	1	3	1	-	2	-	-	1	-	3	3	3	3
CO2	2	2	2	3	2	-	2	-	-	1	-	3	3	3	3
CO3	2	2	2	3	3	-	2	-	-	1	-	2	3	3	2
CO4	1	2	1	3	2	-	2	-	-	2	-	3	3	3	3

SYLLABUS

UNIT - I: Introduction to HVDC Transmission

HVDC Transmission: Technical And Economical Comparison of HVAC and HVDC Transmission, Types of DC Links, Power Handling Capabilities of HVDC Lines, static Conversion Principles, Static Converter Configuration.

UNIT - II: Static Power Converter Analysis

Static Power Converters: 3-Pulse, 6-Pulse & 12-Pulse Converters, Converter Station and Terminal Equipment, Commutation Process, Rectifier and Inverter Operation, Equivalent Circuit for Rectifier, Inverter and HVDC Link- Special Features of Converters.

UNIT - III: Control of HVDC Converter Systems

Control of HVDC Converter Systems: Principle of DC Link Control – Constant Current, Constant Extinction Angle and Constant Ignition Angle Control and Voltage Dependent Current Control. Individual Phase Control and Equidistant Firing Angle Control

UNIT - IV: Harmonics and Filters

Origin of Harmonics in HVDC Systems, Classification of Harmonics, Elimination of Harmonics, Suppression Methods, Harmonic Instability Problems, Design of HVDC AC & DC Filters.

UNIT - V: Transients, Faults and Protection of HVDC Systems

Origin of over Voltages in HVDC Systems, Over Voltages due to DC and AC Side Line Faults - Converter Faults, Over Current Protection- Valve Group and DC Line Protection. Over Voltage Protection of Converters, Surge Arresters etc.

Text Books:

1. HVDC Power Transmission Systems, K.R.Padiyar, 3rd Edition, New Age International publishers, 2015.
2. HVDC Transmission, S.Kamakshaiah, V.Kamaraju, Mc Graw Hill Education (India) Pvt. Ltd., 2011.

References:

1. Direct Current Transmission, Vol. 1, E. W. Kimbark, Wiley, 1971.
2. High Voltage Direct Current Transmission, Jos Arrillaga, IEE Power and Energy series 29, 2nd Edition, 1998.
3. EHV-AC, HVDC Transmission & Distribution Engineering, S Rao, Khanna Publishers, 4th Edition, 2008.

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Subject Code	Title of the Subject	L	T	P	C
17A70205c	FACTS Controllers (Elective-I)	2	2	0	3

Course Objectives:

1. The basic concepts, different types, and applications of FACTS controllers in power transmission.
2. The basic concepts of static shunt and series converters.
3. The working principle, structure and control of UPFC.
4. The static compensation schemes.

Course Outcomes:

CO1 Understand various control issues, for the purpose of identifying the scope and for selection of specific FACTS controllers.
CO2 Apply the concepts in solving problems of simple power systems with FACTS controllers.
CO3 Design simple FACTS controllers and converters for better transmission of electric power.
CO4 Analyze the objectives of different types of compensators.

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	1	-	2	-	-	1	-	3	3	3	3
CO2	2	-	3	2	2	-	3	-	-	1	-	3	3	3	3
CO3	2	-	-	2	3	-	2	-	-	1	-	2	3	3	2
CO4	2	-	2	2	2	-	3	-	-	2	-	3	3	3	3

SYLLABUS

UNIT - I: Concepts of Flexible AC Transmission Systems

Transmission line Interconnections, Power flow in parallel lines, Mesh systems, Stability considerations, Relative importance of controllable parameters, Basic types of FACTS controllers, Shunt controllers, Series controllers, Combined shunt and series controllers, Benefits of FACTS.

UNIT - II: Voltage and Current Sourced Converters

Concept of Voltage Sourced Converters, Single Phase Full Wave Bridge Converter, Three Phase Full Wave Bridge Converter, Transformer Connections for 12-Pulse Operation, 24 and 48-Pulse Operation, Three Level Voltage Sourced Converter, Pulse Width Modulation (PWM) Converter,

Converter Rating, Concept of Current Sourced Converters, Thyristor based converters, Current Sourced Converter with Turn off Devices, Current Sourced vs Voltage Sourced Converters.

UNIT - III: Static Shunt Compensators

Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, Power Oscillation Damping, Methods of Controllable VAR Generation, Variable Impedance Type Static VAR Generators, Switching Converter Type VAR Generators, Hybrid VAR Generators, SVC and STATCOM, Transient Stability Enhancement and Power Oscillation Damping, Comparison Between STATCOM and SVC, V-I, V-Q Characteristics, Response Time.

UNIT - IV: Static Series Compensators

Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Subsynchronous Oscillation Damping, Variable Impedance Type Series Compensators, GTO Thyristor Controlled Type Series Capacitor (GCSC), Thyristor Switched Series Capacitor (TSSC), Thyristor-Controlled Series Capacitor(TCSC), Basic Operating Control Schemes for GCSC, TSSC, and TCSC, Switching Converter Type Series Compensators, The Static Synchronous Series Capacitor(SSSC), Transmitted Power Versus Transmission Angle Characteristic, Control Range and VA Rating, Capability to Provide Real Power Compensation.

UNIT - V: Power Flow Controllers

The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control. Control Structure, Basic Control System for P and Q Control, Dynamic Performance, The Interline Power Flow Controller (IPFC), Basic Operating Principles and Characteristics, Generalized and Multifunctional FACTS Controllers.

Text Books:

1. Thyristor Based Facts Controllers for Electrical Transmission Systems – Mohan Mathur, Wiley Publishers.
2. Understanding FACTS – Concepts and technology of Flexible AC Transmission systems, Narain G. Hingorani, Laszlo Gyugyi, IEEE Press, WILEY, 1st Edition, 2000, Reprint 2015.
3. FACTS Controllers in Power Transmission and Distribution, Padiyar K.R., New Age International Publishers, 1st Edition, 2007.

Reference Books:

1. Flexible AC Transmission Systems: Modelling and Control, Xiao – Ping Zhang, Christian Rehtanz, Bikash Pal, Springer, 2012, First Indian Reprint, 2015.
2. FACTS – Modelling and Simulation in Power Networks, Enrigue Acha, Claudio R. Fuerte – Esquival, Huge Ambriz – perez, Cesar Angeles – Camacho, WILEY India Private Ltd., 2004, Reprint 2012.

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Subject Code	Title of the Subject	L	T	P	C
17A70206	Power Systems & Simulation Lab	0	1	3	2

Course Objectives:

1. To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of sub transient reactance's.
2. To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
3. To develop the MATLAB program for formation of Y and Z buses.
   To develop the MATLAB programs for Gauss-Seidel and fast decouples load flow studies.
4. To develop the SIMULINK model for single area load frequency problem.

Course Outcomes:

CO1 Understand the concept of MATLAB programming in solving power systems problems

CO2 Analyze the power flow solution using Gauss-Seidal and Newton Raphson method.

CO3 Apply different techniques to analyze different power system network conditions.

CO4 Develop a Simulink model for a single area load frequency problem and Simulate the same.

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	3	2	-	-	2	3	-	3	-	2	1	1
CO2	3	1	2	3	2	-	-	2	3	-	3	-	1	1	1
CO3	3	1	2	3	2	-	-	2	3	-	3	-	1	1	2
CO4	3	1	2	3	2	-	-	2	3	-	3	-	1	1	1

List of Experiments

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.
2. Fault Analysis – I
   LG Fault
   LL Fault
3. Fault Analysis – II
   LLG Fault
   LLLG Fault
4. Determination of Sub transient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer.
6. Y bus formation using MATLAB
7. Z Bus formation using MATLAB
8. Gauss-Seidel load flow analysis using MATLAB
9. Fast decoupled load flow analysis using MATLAB
10. Develop a Simulink model for a single area load frequency problem and Simulate the same.

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Subject Code	Title of the Subject	L	T	P	C
17A70207	Digital Signal Processing Lab	0	1	3	2

Course Objectives:

1. To implement the processing techniques using the instructions of DSP Processor.
2. To implement various filters using MATLAB Programming.

Course Outcomes:

CO1 Understand Programming concepts to implement various digital filters.
CO2 Analyze Generation of signals and their processing.
CO3 Apply digital signal processing techniques to design discrete time systems and digital filters.
CO4 Develop algorithms for designing and implementation of FIR and IIR filters

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	3	2	3	2	-	-	-	2	2	3	3	3
CO2	2	3	-	3	-	3	2	-	-	-	2	3	3	3	3
CO3	2	3	-	3	-	3	2	-	-	-	2	3	3	3	3

Simulation in MATLAB

Generation of Signals

1. Linear and circular convolution of two sequences
2. Sampling and effect of aliasing
3. Design of FIR filters
4. Design of IIR filters
5. Calculation of FFT of a signal
6. Decimation by polyphase decomposition.

Using Processor

Study of various addressing modes of DSP using simple programming examples.

7. Implementation of Linear and Circular Convolution.

8. Sampling of input signal and display.
9. Waveform generation.
10. Implementation of FIR filter

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Subject Code	Title of the Subject	L	T	P	C
17A80201a	Power Quality (Elective-II)	2	2	0	3

Course Objectives:

1. To know about introduction on power quality issues.
2. To learn about voltage disturbances and power transients that is occurring in power systems.
3. To know the concept of harmonics in the system and their effect on different power system equipment.
4. To study about different power quality measuring and monitoring concepts.

Course Outcomes:

CO1 Understand the different power quality problems in the power system.
CO2 Analyze different types of voltage sags and swells
CO3 Apply the methods to find effect of harmonics in the system and about the equipment that are effected from the harmonics.
CO4 Design the measuring and monitoring issues of power quality.

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	3	1	-	-	-	-	1	-	-	1	-	3
CO2	2	2	-	-	-	-	2	1	-	1	-	2	1	2	3
CO3	2	3	-	3	-	-	-	-	-	1	3	3	1	2	3
CO4	2	2	-	-	1	3	-	-	-	1	3	3	1	-	3

SYLLABUS

UNIT - I: Introduction

What is power quality? Power quality, voltage quality, why are we concerned about power quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

UNIT - II: Voltage Sags and Transient Over Voltages

Sources of sagas and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags and utility system fault-clearing issues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

UNIT - III: Fundamentals of Harmonics

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

UNIT - IV: Long-Duration Voltage Variations

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation flicker.

UNIT - V: Power Quality Bench Marking and Monitoring

Benchmarking process, RMS Voltage variation Indices, Harmonics indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards.

Text Books:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ptd.
2. Power quality by C. Sankaran, CRC Press.

Reference Books:

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons.
2. Understanding Power quality problems by Math H. J. Bollen IEEE Press.

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Subject Code	Title of the Subject	L	T	P	C
17A80201b	**Modern Control Theory (Elective- II)**	2	2	0	3

Course Objectives:

1. To give an overview of system analysis and design based on state space.
2. Design of state feedback control and observer.
3. The properties of Nonlinearities.
4. Stability analysis for linear and nonlinear systems.
5. Design of adaptive control and optimal control problem.

Course Outcomes:

CO1 Understand the State Space Modeling for linear time-invariant systems.
CO2 Analyze the system stability.
CO3 Apply optimal control to statement of the optimal control problems Design an adaptive control.
CO4 Develop Lypanov functions for Linear and Nonlinear continuous time autonomous systems, 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	1	3	3	-	-	2	1	3	-	3	3	3	3
CO2	3	3	2	3	3	-	-	2	1	3	-	3	3	3	3
CO3	3	3	2	3	3	-	-	2	1	3	-	2	3	3	3
CO4	3	3	1	3	3	-	-	2	1	3	-	3	3	3	3

SYLLABUS

UNIT – I: State Variable Description

State space representation of systems – State diagrams for continuous time state models – Solution of state equations – State transmission matrix. Controllability and observability for continuous time systems, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms.

UNIT – II: Pole Placement Observer

Fundamental theorem of feedback control - Pole assignment by state feedback using Ackermann's formula – Eigen structure assignment problem-Design of full order observer using Ackermann's formula. - Full order Observer based controller design. Reduced order observer design.

UNIT – III: Describing Function and Phase-Plane Analysis

Introduction to nonlinear systems, Types of nonlinearities, Concepts of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

UNIT - IV: Stability Analysis

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems, problems.

UNIT –V: Optimal and Adaptive Control

Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Infinite time Regulator, Output regulator problem. Tracking problem, Parameter Optimization. Basic block diagram of adaptive system, Classification of adaptive control systems- MRAC systems- different configuration- classification-Mathematical description.

Text Books:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
3. Control System Design – Goodwin, Pearson.

Reference Books:

1. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw-Hill Companies, 1997.
2. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell, Pearson.
3. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003
4. T. Kailath, T, Linear Systems, Perntice Hall, Englewood Cliffs, NJ, 1980.
5. N. K. Sinha, Control Systems, New Age International, 3rd edition, 2005.
6. K.J.Astrom and Bjorn Wittenmark, Adaptive control, Pearson Edu., 2nd Edn
7. Sankar Sastry, Adaptive control.

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Subject Code	Title of the Subject	L	T	P	C
17A80201c	Switched Mode Power Converters (Elective – II)	2	2	0	3

Course Objectives:

1. To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.
2. To make the student to analyze and control the various power converter circuits.

Course Outcomes:

CO1 Understand the fundamental concepts of DC - DC Converters.
CO2 Analyze and control the various power converter circuits.
CO3 Design the Resonant converters and DC-AC converters
CO4 Develop the Power conditioners and design of inductors and transformers

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	1	-	3	2	1	1	-	2	3	3	3
CO2	2	3	3	2	1	-	3	2	1	1	-	2	3	3	3
CO3	2	3	3	2	2	-	2	2	1	1	-	2	3	3	3
CO4	2	3	3	1	2	-	2	2	1	1	-	2	3	3	3

SYLLABUS

UNIT - I: DC-DC Converters

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT – II: Switching Mode Power Converters

Analysis and state space modeling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT – III: RESONANT Converters

Introduction- Classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control .

UNIT – IV: DC-AC Converters

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT – V: Power Conditioners, UPS & Filters

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Text Book:

1. Power Electronics Essentials and Applications L Umanand, Wiley
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion – V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

References:

1. Philip T Krein, " Elements of Power Electronics", Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design- Third Edition- John Wiley and Sons- 2006
3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.

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Subject Code	Title of the Subject	L	T	P	C
17A80202a	**Utilization of Electrical Energy (Elective – III)**	2	2	0	3

Course Objectives:

1. To make the students aware about the importance of maximizing the energy efficiency by optimum utilization of electrical energy.
2. To ensure that the knowledge acquired can be applied in various fields such as electric heating, illumination, chemical processes and electric traction.
3. To develop ability amongst the students to analyze the performance of arc furnaces, electric traction, different sources of light, illumination schemes, electric traction.
4. To provide knowledge about above processes and applications of these in practical world.

Course Outcomes:

CO1 Understand the importance of maximizing the energy efficiency by its optimum utilization and mould their practical work in professional world accordingly.
CO2 Analyze types of electric light sources based on nature of operation and their objectives, performance and reliability.
CO3 Apply different methods of calculation of various traction system for braking, acceleration and other related parameters.
CO4 Design various illumination systems and apply them to real world usage.

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	2	-	2	1	-	1	-	-	1	3	1
CO2	1	1	3	1	3	-	-	1	-	1	-	-	1	3	1
CO3	1	1	3	1	3	-	-	1	-	1	-	-	1	3	1
CO4	1	1	3	3	3	-	2	1	-	1	-	-	1	3	1

SYLLABUS

UNIT – I: Illumination

Definition – Laws of illumination – Polar curves – Calculation of MHCP and MSCP. Lamps: Incandescent lamp, Sodium Vapour lamp, Fluorescent lamp. Requirement of good lighting scheme – Types, Design and Calculation of illumination. Street lighting and Factory lighting – Numerical Problems.

UNIT – II: Electrical Heating & Electric Welding

Advantages. Methods of Electric heating – Resistance, arc, Induction and dielectric heating. Types of electric welding – Resistance, Electric arc, gas welding and Ultrasonic welding, Welding electrodes of various metals, Defects in welding.

UNIT – III: Electrolytic Process

Basic principle of Electrolysis, Faradays laws of Electrolysis – Numerical problems, Applications of Electrolysis – Electro deposition-manufacturing of chemicals – anodizing – electro polishing – electro cleaning – electro parting – electro metallurgy, Power supply for Electrolysis.

UNIT – IV: Electric Traction

Introduction –Traction Systems, Systems of Electric Traction- Advantages of Electric Traction, Systems of Track Electrification, Desirable features of Traction Motors – Suitability of D.C. series motor, A.C. series motor, 3 phase induction motor and linear induction motor for traction. Electric Braking in traction– Plugging, Rheostatic and Regenarative types – Suitability of different motors for braking, Temperature Rise and Load Equalization.

UNIT – V: Traction Mechanics

Types of services – urban – sub-urban and main line services, Speed-time curves of different services – trapezoidal and quadrilateral speed-time curves – Numerical Problems, Tractive effort, Power, Specific Energy Consumption- factors affecting Specific Energy Consumption, Mechanics of train movement - Adhesive weight and coefficient of adhesion – Problems.

Text Books:

1. Utilization of Electrical Energy' by E. O. Taylor – Revised in S.I. Units by V.V.L.Rao, Orient Longman
2. Generation, Distribution and Utilization of Electrical Energy' by C. L. Wadhwa, Eastern Wiley Ltd.
3. 'Utilization of Electric Power and Electric Traction' by J.B. Gupta, S.K. Kataria and sons, Delhi.

Reference Books:

1. Art & Science of Utilization of electrical Energy – by H. Partab, Dhanpat Rai & Sons.
2. A text book on Power System Engineering' by A. Chakraborti, M. L. Soni, P. V. Gupta, U.S.Bhatnagar, Dhanpat Rai and Co.(P) Ltd – Delhi
3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited Publishers, 1996.
4. Utilization of Electrical Power – by R.K. Rajput, Laxmi publications.

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Subject Code	Title of the Subject	L	T	P	C
17A80202b	**Costing of Electrical Systems (Elective – III)**	2	2	0	3

Course Objectives:

1. Domestic and Industrial wiring estimation
2. Coasting and Contracting types
3. Estimate the Transmission line based on IE Rules.
4. Estimate the Overhead distribution and underground distribution systems materials and accessories based on IE Rules.

Course Outcomes:

CO1 Understand basic concepts of estimate of quantity and cost of the material for a electrical project.
CO2 Analyze the detail estimate and costing of Residential and commercial Electrical Installations.
CO3 Apply Residential, commercial and Industrial Electrical Installation and Prepare detail estimate and costing of a transmission line/Overhead and underground distribution project.
CO4 Develop estimates for repairs and maintenance of electrical devices and equipment.

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	2	2	2	3	2	-	1	1	2	3	3	3
CO2	1	3	3	2		2	3	1	-	1	2	2	3	3	3
CO3	1	3	3	2	1	1	2	2	-	1	-	2	3	3	3
CO4	1	3	3	2	2	1	2	1	-	-	-	1	3	3	3

UNIT - I: Electrical Wiring

Types of wires Different types of wiring system and wiring procedure Merits, demerits and comparison of different types of wiring, Different types and specifications of wiring materials, Accessories and wiring tools Domestic and industrial panel wiring I.E. rules for wiring, including Electricity supply act-1948 Different types of wiring circuits.

UNIT - II: Estimating, Costing and Contracting

Estimation and estimation tools. Electrical Schedule of rates, catalogues, Survey and source selection, Recording estimates, Quantity and cost of material required. Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Types of contract system. Tendering procedure and preparation of simple tender, Earnest Money Deposit, Security Deposit Schedule of rates (S.O.R.)

UNIT – III: Estimating and Costing of Domestic and Industrial wiring

Layout for domestic Wiring, Load calculation, Cable selection Earthing Selection of switchgear. Overall Estimating and costing, Layout for industrial Wiring, Load calculation, Cable selection, Earthing Selection of switchgear. Overall Estimating and costing.

UNIT - IV: Estimation of Overhead Transmission line

Transmission lines, Line supports, Factors governing height of pole, Conductor materials, size of conductor for overhead, Transmission line: cross arms, pole brackets and clamps, guys and stays, conductors configuration spacing and clearances, span lengths, overhead line insulators, insulator materials lightning arrestors, erection of supports, setting of stays, Earthling of lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between supports conductors, I.E. rules pertaining to LV transmission line.

UNIT - V: Estimation of Distribution line Underground Distribution System

Describe Method of installation of service connection (1-phase and 3-phase), observing I.E. rules, Overhead distribution system. Materials and accessories required for the overhead distribution system. Estimate for 440 V, 3-phase, 4 wires or 3 wires overhead distribution system. Types of service connections, Method of installation of service connection (1-phase and 3-phase), I.E. rules pertaining to overhead lines and service connection. Underground distribution system. Materials and accessories required for underground distribution system. Estimate for 440 V, 3-phase, 4 wires or 3 wires underground distribution system. I.E. rules pertaining to underground system and service

Text Books:

1. Electrical Design, estimating & Costing aina, K. B. and Bhattacharya,S.K New Age International (p) Limited, New Delhi.
2. Electrical Estimating & costing Uppal, S L New Age International (p) New Delhi.

Reference Books:

1. Electrical Installation Estimating & Costing Gupta, J.B. S. K. Kataria & Sons, New Delhi.
2. Relevant IS Code for-service line connection, laying of cable, wiring installation NBC National Building Code- Vol. –IV.
3. E. rules for wiring, Electricity supply act-1948. Bureau of Indian Standards Electricity supply act-1948.

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Subject Code	Title of the Subject	L	T	P	C
17A80202c	**High Voltage Engineering (Elective – III)**	2	2	0	3

Course Objectives:

1. Various Dielectric Materials like solids, liquids and gases and their properties like breakdown strength, practices that causes breakdown etc.
2. Generation and Measurement of high voltages and currents in both AC and DC.
3. Generation and Measurement of Impluse Voltages.
4. Various High Voltage testing techniques.

Course Outcomes:

CO1 Understand the concept of breakdown of solid, liquid and gaseous dielectrics and analyze the breakdown in detail.
CO2 Analyze the methods of generation of high voltage AC and DC.
CO3 Apply different techniques for measurement of high voltage AC and DC.
CO4 Design various high voltage and high current measuring circuits

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	2	2	1	-	1	-	-	-	2	2	3	3
CO2	2	1	3	2	2	1	-	1	-	-	-	2	3	3	3
CO3	1	1	3	2	2	1	-	1	-	-	-	2	2	3	2
CO4	1	1	3	2	-	1	-	1	-	-	-	2	2	3	3

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UNIT – I: Break Down In Gaseous, Liquid & Solid Dielectrics

Introduction to HV Technology, Need for Generating High Voltages in Laboratory. Industrial Applications of High Voltage, Electrostatic Precipitation, Separation. Gases As Insulating Media, Collision Process, Ionization Process, Townsend's Criteria Of Breakdown in Gases, Paschen's Law, Liquid As Insulator, Pure and Commercial Liquids, Breakdown in Pure and Commercial Liquids.

Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Breakdown of Solid Dielectrics in Practice, Breakdown in Composite Dielectrics, Solid Dielectrics Used in Practice.

UNIT – II: Generation of HV AC AND DC Voltages

HV AC-HV Transformer: Need for Cascade Connection and Working of Transformers Units Connected in Cascade. Series Resonant Circuit- Principle of Operation and Advantages - Tesla Coil - HV DC- Voltage Doubler Circuit, Cockroft- Walton Type High Voltage DC Set - Calculation of High Voltage Regulation, Ripple and Optimum Number of Stages for Minimum Voltage Drop.

UNIT – III: Generation of Impulse Voltages

Introduction to Standard Lightning and Switching Impulse Voltages - Analysis of Single Stage Impulse Generator-Expression for Output Impulse Voltage - Multistage Impulse Generator Working of Marx Impulse Generator, Rating of Impulse Generator - Components of Multistage Impulse Generator - Triggering of Impulse Generator By Three Electrode Gap Arrangement - Trigatron Gap and Oscillograph Time Sweep Circuits, Generation of Switching Impulse Voltage - Generation of High Impulse Current.

UNIT – IV: Measurement of High Voltages

Electrostatic Voltmeter-Principle, Construction and Limitation - Chubb and Fortescue Method for HV AC Measurement - Generating Voltmeter- Principle, Construction - Series Resistance Micro Ammeter for HV DC Measurements - Standard Sphere Gap Measurements of HVAC, HVDC And Impulse Voltages - Factors Affecting The Measurements - Potential Dividers-Resistance Dividers Capacitance Dividers Mixed RC Potential Dividers. Measurement of High Impulse Currents-Rogowsky Coil.

UNIT – V: High Voltage Testing Techniques

Dielectric Loss and Loss Angle Measurements Using Schering Bridge - Transformer Ratio Arms Bridge. Need for Discharge Detection and PD Measurements Aspects - Factors Affecting The Discharge Detection, Discharge Detection Methods-Straight and Balanced Methods. Tests on Isolators, Circuit Breakers, Cables, Insulators and Transformers.

Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 4th Edition, 2004.
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.

Reference Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition, 2000.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Technology by L. L. Alston, OXFORD University Press, Second Edition, 2009.

4. High Voltage Engineering Problems & Solutions, R. D. Begamudre, New Age International Publishers, First Edt., 2010

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Subject Code	Title of the Subject	L	T	P	C
17A80203a	**Neural Networks & Fuzzy Logic Applications (Elective – IV)**	2	2	0	3

Course Objective:

1. Importance of AI techniques in engineering applications.
2. Artificial Neural network and Biological Neural Network concepts.
3. ANN approach in various Electrical Engineering problems.
4. Fuzzy Logic and Its use in various Electrical Engineering Applications.

Course Outcomes:

CO1 Understand the Importance of AI Techniques.
CO2 Analyze the ANN Techniques
CO3 Apply ANN in various applications.
CO4 Design fuzzy logic controller for controlling different types of machines

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	-	1	-	-	2	3	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	2	3	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	2	3	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	2	3	-	3	3	3

SYLLABUS

UNIT - I: Introduction to Artificial Intelligence

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems.

UNIT - II: Artificial Neural Networks

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and

Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks.

UNIT - III: ANN Applications

ANN approach to: Electrical Load Forecasting Problem - System Identification - Control Systems - Pattern Recognition.

UNIT - IV: Fuzzy Logic

Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design.

UNIT - V: Fuzzy Logic Applications

Fuzzy Logic Implementation for Induction Motor Control - Switched Reluctance Motor Control - Automatic Voltage Regulation - Fuzzy Logic Controller in Level control.

Text Books:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.

References:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, "Intelligent System - Modeling, Optimization & Control, CRC Press, 2009.

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Subject Code	Title of the Subject	L	T	P	C
17A80203b	**Reliability Engineering and It's Applications to Power Systems (Elective-IV)**	2	2	0	3

Course Objectives:

1. To learn about the basic reliability concepts, density and distribution functions, random variables and networks.
2. To know about different reliability functions and time dependent reliability evaluation of different networks.
3. To know about Markov modelling and component repairable models for frequency and duration.
4. To study about the reliability applications to generation, transmission and distribution systems.

Course Outcomes:

CO1 Understand the basic reliability concepts, density and distribution functions and network modeling.
CO2 Analyze various energy and loss indices in generating systems.
CO3 Apply concept of Markov modeling and component repairable models for frequency and duration.
CO4 Develop reliability models using frequency and duration techniques and generate various reliability models.

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	3	-	3	-	-	3	-	3	3	3	3
CO2	3	3	2	3	3	-	3	-	-	3	-	3	3	3	3
CO3	3	3	2	3	3	-	3	-	-	3	-	2	3	3	3
CO4	3	3	1	3	3	-	3	-	-	3	-	3	3	3	3

SYLLABUS

UNIT - I: Basics of Probability Theory, Distribution & Network Modelling

Basic Probability Theory – Rules for Combining Probabilities of Events – Bernoulli's Trials – Probability Density and Distribution Functions – Random variables – Binomial Distribution – Expected Value and Standard Deviation of Binomial Distribution. Analysis of Series, Parallel, Series-Parallel Networks – Complex Networks – Decomposition Method.

UNIT - II: Reliability Functions

Reliability Functions f(T), F(T), R(T), H(T) and Their Relationships – Exponential Distribution – Expected Value and Standard Deviation of Exponential Distribution – Bath Tub Curve – Reliability Analysis of Series Parallel Networks Using Exponential Distribution – Reliability Measures MTTF, MTTR, MTBF.

UNIT - III: Markov Modelling and Frequency & Duration Techniques

Markov Chains – Concept of Stochastic Transitional Probability Matrix, Evaluation of Limiting State Probabilities – Markov Processes One Component Repairable System – Time Dependent Probability Evaluation Using Laplace Transform Approach – Evaluation of Limiting State Probabilities Using STPM– Two Component Repairable Models. Frequency and Duration Concept – Evaluation of Frequency of Encountering State, Mean Cycle time, For One, Two Component Repairable Models – Evaluation of Cumulative Probability and Cumulative Frequency of Encountering of Merged States.

UNIT - IV: Applications to Generating Systems

Generation System Reliability Analysis: Reliability Model of a Generation System– Recursive Relation for Unit Addition and Removal – Load Modeling - Merging of Generation Load Model – Evaluation of Transition Rates for Merged State Model – Cumulative Probability, Cumulative Frequency of Failure Evaluation – LOLP, LOLE, LOEE – Examples.

UNIT - V: Applications to Network

Transmission & Distribution System Reliability Analysis: System and Load Point Reliability Indices – Weather Effects on Transmission Lines, Weighted Average Rate and Markov Model. Basic Techniques - Radial Networks – Evaluation of Basic Reliability Indices, Performance Indices – Load Point and System Reliability Indices – Customer Oriented, Loss and Energy Oriented Indices -Examples.

Text Books:

1. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.
2. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
3. Assessment of Power System Reliability: Methods and Applications by Marko Čepin, Springer Publications, 2011.

Reference Books:

1. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York, reprinted in India by B.S.Publications, 2007.

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Subject Code	Title of the Subject	L	T	P	C
17A80203c	Power System Deregulation (Elective – IV)	2	2	0	3

Course Objectives:

1. To learn about key issues of restructured power systems and its financial matters.
2. To get knowledge on cost analysis, information on system operator and its duties.
3. To know about ATC, TTC and different ancillary services.
4. To learn about different cost allocation method in the power systems.

Course Outcomes:

CO1 Understand the need for restructuring of Power Systems
CO2 Analyze cost analysis, information on system operator and its duties.
CO3 Apply Synchronous Generators as Ancillary Service Providers.

CO4 Develop various cost allocation methods.

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	3	-	3	-	-	3	-	3	3	3	3
CO2	3	3	2	3	3	-	3	-	-	3	-	3	3	3	3
CO3	3	3	2	3	3	-	3	-	-	3	-	2	3	3	3
CO4	3	3	1	3	3	-	3	-	-	3	-	3	3	3	3

SYLLABUS

UNIT - I: Key Issues in Electric Utilities

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT - II: Open Access Same-Time Information System (OASIS) & Market Power

Structure of OASIS - Posting of Information – Transfer capability on OASIS. Market Power: Introduction - Different types of market Power – exercising of Market Power - Examples.

UNIT - III: Available Transfer Capability (ATC) & Electricity Pricing

Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow. Electricity Pricing: Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

UNIT - IV: Power System Operation in Competitive Environment

Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets – Operational Planning Activities of a GENCO.

UNIT - V: Transmission Cost Allocation Methods & Ancillary Services Management

Introduction - Transmission Cost Allocation Methods : Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods. Ancillary Services Management: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

Text Books:

1. Kankar Bhattacharya, Math H.J. Boller and Jaap E.Daalder, Operation of Restructured Power System, Kulwer Academic Publishers, 2001.
2. Mohammad Shahidehpour and Muwaffaq alomoush, Restructured Electrical Power Systems, Marcel Dekker, Inc., 2001.

Reference Books:

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England.
2. Regulations of CERC, www.cercind.gov.in

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Subject Code	Title of the Subject	L	T	P	C
	Electrical Machine Design (Elective – V)	2	2	0	3

Course Objectives:

1. To study about various electrical engineering materials used for design of electrical machines.
2. How to design of DC machine.
3. How to design of Transformer.
4. How to design of Induction motor.
5. How to design of Synchronous machine.

Course Outcomes:

CO1 Understand major considerations in Electrical Machine Design
CO2 Analyze the main dimensions of the synchronous machines design.
CO3 Apply the methods to find the dimensions of Transformer.
CO4 Design the construction of Induction motor.

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	-	1	1	2	2	-	2	3	3	3
CO2	1	2	2	-	1	-	1	1	2	2	-	2	3	3	3
CO3	1	2	2	-	1	-	1	1	2	2	-	2	3	3	3
CO4	1	2	2	-	1	-	1	1	2	2	-	2	3	3	3
CO5	1	2	2	-	1	-	1	1	2	2	-	2	3	3	3

SYLLABUS

UNIT - I: Introduction

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.

UNIT - II: DC Machines

Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading - Magnetic Circuits Calculations - Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes–performance prediction using design values.

UNIT- III: Transformers

Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT - IV: Induction Motors

Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.

UNIT - V: Synchronous Machines

Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

Text book:

1. Electrical Machine design by AK Sahaney.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) IV-Year II-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A80204b	Grid Integration of Distributed Generation (Elective – V)	2	2	0	3

Course Objectives:

1. To study about various types of power generation resources to be connected in distributed generation system.
2. To know the architecture of smart grid with integrated distribution generation with various plants.
3. To get the knowledge on smart grid and how will gain the efficient power to the distributed end.
4. To get the knowledge of Smart grid to evolve a perfect power system.

Course Outcomes:

CO1 Understand about the distribution generation system connected with various power generation plants.
CO2 Analyze Load flow studies in meshed systems
CO3 Apply integration of distribution generation with various plants to the smart grid.
CO4 Overview of the perfect power system configurations.

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	3	-	3	-	2	3	-	3	3	3	3
CO2	2	3	2	3	3	-	3	-	2	3	-	3	3	3	3
CO3	1	3	2	3	3	-	3	-	2	3	-	2	3	3	3
CO4	2	3	1	3	3	-	3	-	2	3	-	3	3	3	3

SYLLABUS

UNIT – I: Introduction to Distributed Generation

The development of the electrical power system - Value of distributed generation and network pricing – Reasons for distributed generation - The future development of distributed generation - Distributed generation and the distribution system - Technical impacts of generation on the distribution system - Economic impact of distributed generation on the distribution system - Impact of distributed generation on the transmission system - Impact of distributed generation on central generation.

UNIT – II: Distributed Generation Plant

Combined heat and power plants - Renewable energy generation - Small-scale hydro generation - Wind power plants - Offshore wind energy - Solar photovoltaic generation

UNIT – III: Distributed Generators and their connection to the system

Distributed generators - Synchronous generators - Induction generators - Doubly fed induction generator - Full power converter (FPC) connected generators - System studies - Load flow studies in a simple radial system - Load flow studies in meshed systems - Symmetrical fault studies - Unbalanced (asymmetrical) fault studies - Case studies - Steady-state voltages under peak and minimum loading - Electromagnetic transient studies.

UNIT – IV: DC Distribution

AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

UNIT – V: Smart Grid to Evolve a Perfect Power System

Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.
Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

Text Books:

1. "Distributed Generation" by N.Jenkins, J.B. Ekanayake & G. Strbac
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Janaka Ekanayake, Kithsiri Liyanage,Jianzhong.Wu, Akihik Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

References:

1. IEEE 1547. IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems; 2003.
2. James Momoh, "Smart Grid Fundamentals of Design and Analysis"- Wiley, IEEE Press, 2012.
3. Horlock J.H. Cogeneration: Combined Heat and Power Thermodynamics and Economics. Oxford: Pergamon Press; 1987.

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COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) IV-Year II-Sem – R17 Regulation – w.e.f. 2017-18 Academic Year

Subject Code	Title of the Subject	L	T	P	C
17A80204c	**Energy Auditing & Demand Side Management (Elective – V)**	2	2	0	3

Course Objectives:

1. To learn about energy consumption and situation in India.
2. To learn about Energy Auditing.
3. To aware of Energy Measuring Instruments.
4. To understand the Demand Side Management.

Course Outcomes:

CO1 Understand the concepts of energy auditing.
CO2 Analyze efficiency of motors and improvement of power factor.
CO3 Apply various energy measuring techniques for finding instrument parameters.
CO4 Develop the Energy Economic analysis and Demand side management.

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	-	2	-	-	2	-	1	3	3	3
CO2	2	3	3	3	3	-	1	-	2	2	1	2	3	3	3
CO3	2	3	3	3	3	-	2	-	-	2	1	2	3	3	3
CO4	2	3	3	3	3	-	1	-	2	3	1	3	3	3	3

SYLLABUS

UNIT – I: Introduction to Energy Auditing

Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation. Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

UNIT – II: Energy Efficient Motors & Power Factor Improvement

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance - over motoring - motor energy audit. Power factor – methods of improvement, location of capacitors, Pf with non-linear loads, effect of harmonics on p.f, p.f motor controllers.

UNIT – III: Lighting and Energy Measuring Instruments

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Measuring Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's

UNIT – IV: **Energy Economic Analysis**

The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems.

UNIT – V: Demand Side Management

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning. Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs.

Text Books:

1. Industrial Energy Management Systems, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
3. Electrical Power distribution, A S. Pabla, TMH, 5th edition, 2004
4. Demand Side Management, Jyothi Prakash, TMH Publishers.

References:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
4. Energy management hand book by W.C.Turner, John wiley and sons
5. Energy management and good lighting practice : fuel efficiency- booklet12-EEO
6. Recent Advances in Control and Management of Energy Systems, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
7. Energy Demand – Analysis, Management and Conservation, Ashok V. Desai, Wiley Eastern, 2005.
8. Hand book on energy auditing - TERI (Tata Energy Research Institute)

JNTUA CEA Curriculum
B. Tech Course Structure (R19)

ELECTRICAL & ELECTRONICS ENGINEERING

Semester - 0 (Theory - 8, Lab -7) Common for All Branches of Engineering for 3 weeks				
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

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.	19A15201	Applied Physics	BS	2-1-0	3
3.	19A10501	Problem Solving & Programming	ES	3-1-0	4
4.	19A15501	Communicative English-I	HS	2-0-0	2
5.	19A12401	Electrical & Electronics Engineering Workshop	LC	0-0-2	1
6.	19A15202	Applied Physics Lab	BS	0-0-3	1.5
7.	19A10506	Problem Solving & Programming Lab	ES	0-0-3	1.5
8.	19A15502	Communicative English Lab-I	HS	0-0-2	1
				Total	**18**

Semester - 2

S.No	Course No	Course Name	Category	L-T-P	Credits
1	19A10201	Electrical Circuits-I	PC	2-1-0	3
2	19A10202	Electrical Power Generating Systems	PC	3-0-0	3
3	19A15102	Differential Equations and Vector Calculus	BS	3-0-0	3
4	19A15303	Chemistry	BS	2-1-0	3
5	19A10503	Data Structures	ES	2-1-0	3
6	19A10303	Engineering Workshop	LC	0-0-2	1
7	19A10304	Engineering Graphics	ES	1-0-3	2.5
8	19A15304	Chemistry Lab	BS	0-0-3	1.5
9	19A10507	Data Structures Lab	ES	0-0-3	1.5
				Total	**21.5**

JNTUA COLLEGE OF ENGINEERING ANANTAPUR
ELECTRICAL & ELECTRONICS ENGINEERING
*****
Proposed Course Structure from 2nd Year to 4th Years

Semester – 3 (Theory - 6, Lab –3)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A20604**	Complex Variables & Transforms	BSC	2-1-0	3
2.	**19A20201**	Electrical Circuits-II	PCC	2-1-0	3
3.	**19A24201**	Signals and Systems	PCC	2-1-0	3
4.	**19A20202**	DC Machines & Transformers	PCC	2-1-0	3
5.	**19A20203**	Engineering Electromagnetics	PCC	2-1-0	3
6.	**19A24202**	Semiconductor Devices and Circuits	PCC	1-1-0	2
7.	**19A20901**	Universal Human Values	HE	2-0-0	2
8.	**19A20204**	DC Machines & Transformers Lab	PCC	0-0-3	1.5
9.	**19A24203**	Semiconductor Devices and Circuits Lab	PCC	0-0-3	1.5
10.	**19A20205**	Electrical Circuits and Simulation Lab	PCC	0-0-3	1.5
11.	**19A28801**	Biology for Engineers	MC	3-0-0	0
				Total	**23.5**

Semester –4 (Theory - 6, Lab –2)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A20206**	Transmission System Analysis And Design	PCC	2-1-0	3
2.	**19A20207**	Power Electronics	PCC	2-1-0	3
3.	**19A20208**	AC Machines	PCC	2-1-0	3
4.	**19A20209**	Control Systems	PCC	2-1-0	3
5.	**19A24204**	Digital Electronic Circuits and Logic Design	PCC	2-1-0	3
6.	**19A25501**	Fundamentals of Python Programming	ESC	2-0-0	2
7.	**19A20210**	Control Systems and Simulation lab	PCC	0-0-3	1.5
8.	**19A20211**	Power Electronics and Simulation lab	PCC	0-0-3	1.5
9.	**19A25502**	Fundamentals of Python Programming Lab	ESC	0-0-2	1
10.	**19A10804**	Environmental Science	MC	3-0-0	0
				Total	**21**

Semester –5 (Theory - 6, Lab –3)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A50201**	Micro Processor and Micro Controllers	PCC	3-0-0	3
2.	**19A50202**	Electrical and Electronic Measurements	PCC	3-0-0	3
3.	**19A50203**	Analog Electronic Circuits	PCC	2-0-0	2
4.	**19A50204** **19A50205** **19A50206**	• Electrical Distribution System Analysis and Automation • DC Drives • Advanced Control Systems	PEC-I	3-0-0	3
5.	**19A50207** **19A50208** **19A50209** **19A50513**	• Energy Storage Systems • Electrical Engineering Materials • Illumination Technology • Introduction to Application Development Through JAVA	OEC-I	3-0-0 3-0-0 3-0-0 2-0-2	3 3 3 3
6.	**19A55501**	English Language Skills	HSMC	3-0-0	3
7.	**19A50210**	AC Machines Lab	PCC	0-0-3	1.5
8.	**19A55402**	English Language Skills Lab	HSMC	0-0-3	1.5
9.	**19A50211**	Electronic circuits Lab	PCC	0-0-2	1
10.	**19A50212**	Socially Relevant Project	PR	0-0-1	0.5
11.	**19A55404**	Constitution of India	MC	3-0-0	0
				Total	**21.5**

Semester –6 (Theory - 6, Lab –2)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A60201**	Power System Analysis	PCC	3-0-0	3
2.	**19A60202**	Digital Signal Processing	PCC	3-0-0	3
3.	**19A60203**	Power System Protection	PCC	3-0-0	3
4.	**19A60204** **19A60205** **19A60206**	• Analog and Digital IC Applications • Programmable Logic Controllers • Introduction to Embedded System Design	PEC-II	3-0-0	3
5.	**19A60207** **19A60208** **19A60209**	• Renewable Energy Sources • Instrumentation • Industrial Electrical Systems	OEC-II (MOOC)	3-0-0	3
6.	**19A65401** **19A65402** **19A65403**	Humanities Elective-I • Managerial Economics and Financial Analysis • Entrepreneurship and Incubation • Business Ethics and Corporate Governance	HSMC	3-0-0	3
7.	**19A60210**	Electrical & Electronic Measurements Lab	PCC	0-0-3	1.5
8.	**19A60211**	Micro Processor and Micro Controllers Lab	PCC	0-0-3	1.5
9.	**19A60212**	Socially Relevant Project	PR	0-0-1	0.5
10.	**19A55401**	Research Methodology	MC	3-0-0	0
				Total	**21.5**

Semester –7 (Theory - 5, Labs -2 &Project–1)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A70201**	Power System Operation & Control	PCC	3-0-0	3
2.	**19A70202**	Utilization of Electrical Energy	PCC	3-0-0	3
3.	**19A70203** **19A70204** **19A70205**	• HVDC and FACTS • AC Drives • Digital Control Systems	PEC-III	3-0-0	3
4.	**19A70206** **19A70207** **19A70208**	• System Reliability Concepts • Electric Vehicle Engineering • Design of Photovoltaic Systems	OEC-III	3-0-0	3
5.	 **19A75401** **19A75402** **19A75403**	Humanities Elective-II • Management Science • Organizational Behavior • Business Environment	HSMC	3-0-0	3
6.	**19A70209**	Power Systems & Simulation Lab	PCC	0-0-3	1.5
7.	**19A70210**	Digital Signal Processing Lab	PCC	0-0-3	1.5
8.	**19A70211**	Project (Stage-I)	PR	0-0-3	1.5
9.	**19A70212**	Seminar		0-0-1	0.5
10.	**19A70213**	Industrial Training/Skill Development/Research Project*	PR	-------	02
				Total	**22**

*** Marks shall be awarded in 7thsemester, but started at end of 6thsemester and complete before beginning of 7thsemester.**

Semester –8 (Theory - 2, Project–1)					
S.No.	**Course No.**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	**19A80201** **19A80202** **19A80203**	• Power Quality • Switched Mode Power Converters • Intelligent Control Techniques	PEC-IV	3-0-0	3
2.	**19A80204** **19A80205** **19A80206**	• Introduction to Hybrid & Electric Vehicles • Battery Management systems • Smart Electric Grid	OEC-IV	3-0-0	3
3.	**19A80207**	Project (Stage-II)	PR	0-0-14	7
				Total	**13**

- **Minor degree for 20 credits including Labs and Project**
- **Hon's degree for additional 20 credits**

UNIVERSITY ANANTAPUR ELECTRICAL & ELECTRONICS ENGINEERING

*****

Socially Relevant Projects

1. Energy Auditing
2. Solar Water Pumping Systems
3. Automatic Traffic Light Control Systems
4. Building Electrical Safety Measures
5. Electrical Protection Systems in Agricultural Fields

Note: Similar such projects as listed above can be chosen.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

College of Engineering Autonomous Anantapur

ELECTRICAL & ELECTRONICS ENGINEERING

*****

Minor Degree in Electrical Engineering

S.No.	Course No.	Course Name	L	T	P	Credits
1.		Fundamentals of Electrical Circuits	3	0	0	3
2.		AC Machines	3	0	0	3
3.		Control Systems (Other than ECE branch)/Power Electronics(for ECE branch)	3	0	0	3
4.		Transmission system Analysis and Design	3	0	0	3
5.		Electrical & Electronic Measurements	3	0	0	3
6.		Minor Discipline Project	-	-	-	5
Total						20

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

College of Engineering Autonomous Anantapur

ELECTRICAL & ELECTRONICS ENGINEERING

*****

Honors Degree in Electrical Engineering

S.No.	Course No.	Course Name	L	T	P	Credits
1.		Adaptive Control Systems	3	0	0	3
2.		Applications of Power Electronics to Power Systems	3	0	0	3
3.		DC Micro Grid	3	0	0	3
4.		Power System Wide Area Monitoring and Control	3	0	0	3
5.		Restructured Power Systems	3	0	0	3
		Mini Project				5
Total						20

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT OF MATHEMATICS ******
I B.TECH – I SEMESTER
(All Branches)

Subject Code	Title of the Subject	L	T	P	C
19A15101	**Linear Algebra and Calculus**	3	1		4

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 to develop the confidence and ability to handle various real world problems and their applications.

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

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

Unit 1:Matrices **10 hrs**

Rank of a matrix by echelon form, solving homogeneous and non-homogeneous system of 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, eigenvalues and eigenvectors, diagonal form and different factorizations of a matrix; (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 **6 hrs**

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 (L3)
- analyze the behaviour of functions by using mean value theorems (L3)

Unit 3: Multivariable calculus **8 hrs**

Partial derivatives, total derivatives, chain rule, Euler's theorem, 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 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, changing to polar coordinates, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals in 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 (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Apply multiple integrals to find volume, surface area (L5)

Unit 5:Special 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)
- use of special functions in evaluating definite integrals (L4)

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
9. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT OF PHYSICS ******
I B.TECH – I SEMESTER
(ECE, CSE, EEE Branches)

Subject Code	Title of the Subject	L	T	P	C
19A15201	APPLIED PHYSICS	2	1		3

	COURSE OBJECTIVES
1	To make a bridge between the physics in school and engineering courses.
2	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
3	To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
4	To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and semiconductors in the functioning of electronic devices.
5	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
6.	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 nanomaterials, their properties and applications in modern emerging technologies are to be elicited.

	COURSE OUTCOMES
CO1	**Explain** the need of coherent sources and the conditions for sustained interference (L2). **Identify** the applications of interference in engineering (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)
CO2	**Explain** various types of emission of radiation (L2). **Identify** the role of laser in engineering applications (L3). **Describe** the construction and working principles of various types of lasers (L1). **Explain** the working principle of optical fibers (L2). **Classify** optical fibers based on refractive index profile and mode of propagation (L2). **Identify** the applications of optical fibers in medical, communication and other

	fields (L2). **Apply** the fiber optic concepts in various fields (L3).
CO3	**Describes** the dual nature of matter (L1). **Explains** the significance of wave function (L2). **Identify** the role of Schrodinger's time independent wave equation in studying particle in one-dimensional infinite potential well (L3). **Identify** the role of classical and quantum free electron theory in the study of electrical conductivity (L3). **Classify** the energy bands of semiconductors (L2). **Outline** the properties of charge carriers (L2). **Interpret** the direct and indirect band gap semiconductors (L2). **Identify** the type of semiconductor using Hall effect (L2). **Identify** applications of semiconductors in electronic devices (L2)
CO4	**Explain** the concept of dielectric constant and polarization in dielectric materials (L2). **Summarize** various types of polarization of dielectrics (L2). **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics (L2). **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2). **Explain** the applications of dielectric and magnetic materials (L2). **Apply** the concept of magnetism to magnetic devices (L3)
CO5	**Explain** how electrical resistivity of solids changes with temperature (L2). **Classify** superconductors based on Meissner's effect (L2). **Explain** Meissner's effect, BCS theory& Josephson effect in superconductors (L2). **Identify** the nano size dependent properties of nanomaterials (L2). **Illustrate** the methods for the synthesis and characterization of nanomaterials (L2). **Apply** the basic properties of nanomaterials in various Engineering branches (L3).

Mapping between Course Outcomes and Programme Outcomes

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

Unit-I: Physical Optics

Interference-Principle of superposition –Interference of light – Conditions for sustained interference- 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 spectrum.

Polarization-Polarization by double refraction-Nicol's Prism--Half wave and Quarter wave plates-Engineering applications of polarization.

Unit-II: 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 – Applications - Block diagram of fiber optic communication with detailed explanation of source and detector – Applications.

Unit III: Quantum Mechanics, Free Electron Theory and Semiconductors

Quantum Mechanics: Dual nature of matter – Schrodinger's time independent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory – Sources of electrical resistance – Equation for electrical conductivity – Quantum free electron theory– Fermi-Dirac distribution- Band theory of Solids.

Semiconductors: Introduction - Direct and Indirect band gap semiconductors- Drift and Diffusion currents- Einstein's relation - Continuity equation -Hall effect- Hall coefficient - Applications of Hall effect - Applications of semiconductors in electronics.

Unit-IV: Dielectric and Magnetic Materials

Dielectric Materials-Introduction-Dielectric polarization-Dielectric polarizability, Susceptibility and 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-Weiss theory of ferromagnetism (qualitative)- Hysteresis - soft and hard magnetic materials-Applications.

Unit – V: Superconductors and Nanomaterials

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, mechanical, electrical and magnetic- Synthesis of nanomaterials: Top-down:Ball Milling, Bottom-up:Chemical Vapour Deposition – Applications of nanomaterials.

Text books:

1. M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy" A Text book of Engineering Physics"- S.Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
2. K Thyagarajan " Engineering Physics", Mc Graw Hill Publishing Company Ltd., 2016
3. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education, 2018
4. T Pradeep "A Text book of Nano Science and Nano Technology"- Tata Mc Graw Hill, 2013
5. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
6. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
7. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill
8. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT ELECTRICAL AND ELECTRONICS ENGINEERING ******
I B.TECH – I SEMESTER(R-19)

Subject Code	Title of the Subject	L	T	P	C
19A10501	**Problem Solving and Programming**	3	1	0	4

Course Objectives:

1. Introduce the internal parts of a computer, and peripherals.
2. Introduce the Concept of Algorithm and use it to solve computational problems
3. Identify the computational and non-computational problems
4. Teach the syntax and semantics of a C Programming language
5. Demonstrate the use of Control structures of C Programming language
6. Illustrate the methodology for solving Computational problems

Course Outcomes:

1. Construct his own computer using parts (L6).
2. Recognize the importance of programming language independent constructs (L2)
3. Solve computational problems (L3)
4. Select the features of C language appropriate for solving a problem (L4)
5. Design computer programs for real world problems (L6)
6. Organize the data which is more appropriated for solving a problem (L6)

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

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)

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", 2nd 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES ******
I B.TECH – I SEMESTER(R-19)

Subject Code	Title of the Subject	L	T	P	C
19A15501	Communicative English I	2	0	0	2

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

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	-	-	-	3	-	-	-	-	3	3	-	-	-	-	-
CO2	-	-	-	3	-	-	-	3	-	3	-	-	-	-	-

CO3	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT ELECTRICAL AND ELECTRONICS ENGINEERING ******
I B.TECH – I SEMESTER(R-19)

Subject Code	Title of the Subject	L	T	P	C
19A12401	Electrical & Electronics Engineering Workshop	0	0	2	1

Course Objectives :
1. To know about different tools, abbreviations and symbols in Electrical Engineering
2. To learn about types of measuring instruments to measure electrical quantities
3. To gain knowledge on different types of earthing and earth resistance
4. To study different types of wiring

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

List of Exercises / Experiments:
1. Study of Introduction to Electrical tools, symbols and abbreviations
2. Study of types of sizes of wires and making “T” joint and straight joint for wires
3. Measurements of Electrical quantities (like Voltage, Current, Power, Power factor in RLC circuits)
4. Study of measurements of Energy (using Single phase and Three phase Energy meter) by connecting different loads
5. Study of earthing and measurement of earth resistance
6. Study and performance of residential wiring (using Energy meter, Fuses, Switches, Indicator, Lamps, etc.)
7. Study of Fluorescent lamp wiring
8. Study of various electrical gadgets (CFL and LED)
9. Study of PV Cell
10. Study of Induction motor and Transformer
11. Assembly of choke or small transformer
12. Study of trouble shooting of electrical equipments (fan, iron box, mixer-grinder, etc.)
13. Introduction to basics of Electronic components: Solder practice, Multi meter, Power supply
14. Measurement of wire guages using guage meter
15. Identification of color code, resistors, ICs, Transistors, capacitors, diodes, SCRs, IGBTs etc.

References:

1. Lab manual of Electrical Engineering by TTTI, Chennai.

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Course Outcomes:

1. Able to demonstrate knowledge on different tools, abbreviations and symbols used in Electrical Engineering
2. Able to measure different electrical quantities using measuring instruments
3. Able to demonstrate how to trouble shoot the electrical equipments (like fan, grinder, motor, etc.)
4. Able to do wiring and earthing for residential houses

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
****** DEPARTMENT OF PHYSICS ******
I B.TECH – I SEMESTER
(ECE, CSE, EEE Branches)

Subject Code	Title of the Lab	L	T	P	C
	APPLIED PHYSICS LAB			3	1.5

COURSE OBJECTIVES	
1	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.

COURSE OUTCOMES	
CO1	**Operate** optical instruments like microscope and spectrometer (L2)
CO2	**Estimate** the desired physical parameters by performing the concerned experiments (L2)
CO3	**Plot** the concerned physical parameter to know their related variations (L3)
CO4	**Identify** the role of various physical phenomenon in relation with the experimental concepts (L3)

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**								**1**			
CO3	**3**	**1**		**2**											
CO4	**3**	**3**		**3**	**2**						**1**	**1**			

List of Physics Experiments

1. Determination of thickness of thin object by wedge method
2. Determination of radius of curvature of lens by Newton's rings

3. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method
4. Determination of dispersive power of the prism
5. Determination of dielectric constant and Curie temperature of a ferroelectric material
6. B-H curve
7. Determination of numerical aperture of an optical fiber
8. Laser: Determination of wavelength using diffraction grating
9. Laser: Determination of particle size
10. To determine the resistivity of semiconductor by four probe method
11. Energy gap of a material using p-n junction diode
12. Magnetic field along the axis of a current carrying coil – Stewart-Gee's Method
13. Hall effect : Determination of mobility of charge carriers in semiconductor
14. Measurement of resistance of a semiconductor with varying temperature
15. To determine the self inductance of the coil (L) using Anderson's bridge

Note: Out of twelve experiments, two experiments will be performed using virtual laboratory.

Data Books Required: Nil

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

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COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

I B. Tech - II SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A10506	**Problem Solving and Programming Laboratory**	0	0	3	1.5

Course outcomes: Student should be able to

1. Construct a Computer given its parts (L6)
2. Select the right control structure for solving the problem (L6)
3. Analyze different sorting algorithms (L4)
4. Design solutions for computational problems (L6)
5. Develop C programs which utilize the memory efficiently using programming constructs like pointers.

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

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 ← b ← c ← d

6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.

7. Implement the C program which computes the sum of the first n terms of the series
   Sum = 1 – 3 + 5 -7 + 9

8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.

9. Design an algorithm and implement using a C program which finds the sum of the infinite series
   $1 - x^2/2! + x^4/4! - x^6/6! + \ldots$

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.

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

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COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

I B. Tech - II SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A15502	**Communicative English Lab I**	0	0	2	1

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.

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

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

I B. Tech - II SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
	ELECTRICAL CIRCUITS - I	2	1	0	3

COURSE OBJECTIVES:

To make the student learn about:

1.	Basic characteristics of R,L,C parameters, their Voltage and Current Relations and Various combinations of these parameters.
2.	The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference.
3.	Series and parallel resonances, bandwidth, current locus diagrams.
4.	Network theorems and their applications.
5.	Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree.

COURSE OUTCOMES:

After completing the course, the student should be able to do the following:

CO1	Understand the network reduction techniques, different basic laws, concepts related to magnetic circuits, network topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree.
CO2	Analyze the steady state performance of R,L and C in series and parallel combination.
CO3	Design and develop the LOCUS diagrams for R, L and C series and parallel combination.
CO4	Apply the network theorems suitably for electrical circuits.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

The course outcomes of the course are mapped to the program outcomes with a level of emphasis being either strongly correlated (2) and moderately correlated (1).

SYLLABUS:

UNIT- 1 INTRODUCTION TO ELECTRICAL & MAGNETIC CIRCUITS

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements (For Different Input Signals-Square, Ramp, Saw Tooth, Triangular). Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

UNIT OUTCOMES:

After completing the unit, the student should be able to do the following:

1. Able to understand the basic circuit elements for different input signals.
2. Analyze the network reduction techniques.
3. Apply different basic laws to solve the electric circuits.

UNIT- II SINGLE PHASE A.C CIRCUITS

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, J-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) With Sinusoidal Excitation- Phasor diagrams - Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

UNIT OUTCOMES:

After completing the unit, the student should be able to do the following:

1. Understand the average and rms values for different periodic waveforms.
2. Analyze the steady state performance of R,L,and C in series ,parallel &series-parallel system.
3. Understand the concept of p.f,reactance,impedance,susceptance,admittance.

UNIT- III LOCUS DIAGRAMS & RESONANCE

Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

UNIT OUTCOMES:

After completing the unit, the student should be able to do the following:

1. Unserstand and develop the locus diagrams for Series R-L, R-C, R-L-C and Parallel Combination.
2. Analyse the concept of resonance for series and parallel circuits.

UNIT- IV NETWORK THEOREMS

Superposition and Reciprocity Theorems, Thevenin's, Norton's, Maximum Power Transfer, Millman's Theorems, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

UNIT OUTCOMES:

After completing the unit, the student should be able to do the following:

1. Understand the concept of different Theorems.
2. Apply the concept of theorems to different circuits to find the Thevenin's, voltage ,resistance,,RMS power etc.

UNIT- V NETWORK TOPOLOGY

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks with Dependent & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis, Super Node and Super Mesh for D.C Excitations.

UNIT OUTCOMES:

After completing the unit, the student should be able to do the following:

1.Understand the concept of network topology.
2.Apply the tieset,cutest for different electrical circuits.
3.Apply the mesh & nodal analysis for D.C. excitations.

TEXT BOOKS:

1. Engineering circuit analysis by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company.
2. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill.
3. Circuit Theory (Analysis & Synthesis) by A. Chakrabarti, Dhanpat Rai & Sons

REFERENCE BOOKS:

1. Network Analysis by M.E Van Valkenberg, Prentice Hall (India), 3rd Edition.
2. Electrical Engineering Fundamentals by V. Del Toro, Prentice – Hall International.
3. Electric Circuits by N.Sreenivasulu, REEM Publications
4. Electric Circuits- Schuam Series
5. Electrical Circuit Theory and Technology by John Bird, Routledge, Taylor & Fransis
6. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR II SEM

Subject Code	Title of the Subject	L	T	P	C
	ELECTRICAL POWER GENERATING SYSTEMS	3	0	0	3

Course Objectives:

1.	To understand the principle and operation of various power generations.
2.	To Investigate the line diagram and components of various power generations
3.	To enable the process involved in solar, wind energy generation and their characteristics
4.	To enable the process involved in biogas, geothermal and ocean energy generation

Course Outcomes:

CO1	Understand the principles of power generation. Analyze the construction, working and operating principle, and essential components of Thermal power generating station with their relative merits and demerits.
CO2	Analyze the construction, working and operating principle, and essential components of Hydro and Nuclear power generating stations.
CO3	Analyze the different methods and characteristics of solar and wind power generating systems.
CO4	Analyze the different methods and operation of Biogas, Geothermal and Ocean power generating systems.

Mapping of Course outcomes with Program outcomes:

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

Syllabus:

UNIT-I THERMAL POWER GENERATING SYSTEMS

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers, Cogeneration, Auxiliaries-for boiler, for generators.

UNIT OUTCOMES: After completion of unit, student will be able to understand the principle and operation of TPS and its components.

UNIT-II HYDRO & NUCLEAR POWER GENERATING SYSTEMS

Hydro Power: Selection of Site, Classification, Layout, Principle of operation, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT OUTCOMES: After completion of unit, student will be able to understand the principle and operation of Hydro and Nuclear Power Plants and its components.

UNIT -III SOLAR PV SYSTEMS

Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, PV Cell, V-I Characteristics, P-V characteristics, Equivalent circuit, Concepts of MPPT, Different methods of Energy storage, Applications of PV in street lighting, water pumping.

UNIT OUTCOMES: After completion of unit, student will be able to understand the principle and operation of Solar Power Generation and their characteristics.

UNIT-IV WIND POWER GENERATING SYSTEMS

Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics, Betz's law, Wind turbine controls (Pitch, Yaw and Stroll).

UNIT OUTCOMES: After completion of unit, student will be able to understand the principle and operation of Wind Power Generation and their characteristics.

UNIT-V BIOGAS, GEOTHERMAL AND OCEAN POWER GENERATING SYSTEMS

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.
Geothermal Power Generation: Principle of Geothermal Energy, Methods of Harnessing.
Ocean Power Generation: Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants.

UNIT OUTCOMES: After completion of unit, student will be able to understand the principle and operation of Biogas, Geothermal and Ocean Power Generations and their operation.

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.

3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

REFERENCE BOOKS:

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha& S. Banerjee – Oxford University Press, 2013.
5. NPTEL resources
6. Solar Photovoltaics: Fundamentals, Technologies and Applications by Chetan Singh Solanki, PHI, Third Edition, 2015.
7. Solar Energy: Principles of Thermal Collections and Storage by S.P. Sukhatme and J.K. Nayak, Tata McGraw Hill, Third Edition, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF MATHEMATICS
I B.TECH – II SEMESTER
(Common to all branches of Engineering except CSE)

(THEORY)

Subject Code	Title of the Subject	L	T	P	C
19A53201	**Differential Equations and Vector Calculus**	2	0	-	3

Course Objectives:

1) To enlighten the students in the techniques to solve differential equations.
2) To enable the students to use differential equations in various real world applications of engineering.

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)

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

UNIT 1: Linear differential equations of higher order 8hrs

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 (L3)
- solve the linear differential equations with constant coefficients by appropriate method (L3)

UNIT 2: Applications of Linear Differential Equations 8hrs

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 (L3)
- formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT 3: Partial Differential Equations 8 hrs

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Solutions to homogenous and non-homogenous higher order linear partial differential equations.

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)

UNIT4: Vector differentiation 8hrs

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)

Textbooks:

3. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

4. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
DEPARTMENT OF CHEMISTRY
I B.TECH – II SEMESTER (common to EEE, ECE & CSE)
(THEORY)

Subject Code	Title of the Subject	L	T	P	C
19A53201	Chemistry	2	1	-	3

COURSE OBJECTIVES	
1	To familiarize engineering chemistry and its applications
2	To train the students on the principles and applications of electrochemistry and polymers
3	To introduce instrumental methods, molecular machines and switches

COURSE OUTCOMES	
CO1	**apply** Schrodinger wave equation to hydrogen and particle in a box, **illustrate** the molecular orbital energy level diagram of different molecular species, **explain** the band theory of solids for conductors, semiconductors and insulators **discuss** the magnetic behaviour and colour of complexes.
CO2	**apply** Nernst equation for calculating electrode and cell potentials, **differentiate** between pH metry, potentiometric and conductometric titrations, **explain** the theory of construction of battery and fuel cells, **solve** problems based on cell potential
CO3	**explain** the different types of polymers and their applications, **explain** the preparation, properties and applications of Bakelite, Nylon-66, and carbon fibres, **describe** the mechanism of conduction in conducting polymers, **discuss** Buna-S and Buna-N elastomers and their applications
CO4	**explain** the different types of spectral series in electromagnetic spectrum, **understand** the principles of different analytical instruments, **explain** the different applications of analytical instruments
CO5	**explain** the band theory of solids for conductors, semiconductors and insulators, **explain**supramolecular chemistry and self assembly, **demonstrate** the application of Rotaxanes and Catenanes as artificial molecular machines

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

Unit 1: Structure and Bonding Models: (10 hrs)

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2 , applications to hydrogen, particle in a box and their applications for conjugated molecules, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order, crystal field theory – salient features – splitting in octahedral and tetrahedral geometry, magnetic properties and colour, band theory of solids – band diagrams for conductors, semiconductors and insulators, role of doping on band structures.

Unit 2: Electrochemistry and Applications: (10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode) electrochemical cell, Nernst equation, cell potential calculations, numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc- MnO_2 battery (Laclanche cell), Secondary cells – lead acid and lithium ion batteries- working of the batteries including cell reactions. Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Unit 3: Polymer Chemistry:(10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – Bakelite, urea-formaldehyde, Nylon-6,6, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, mechanism of conduction and applications.

Unit 4: Instrumental Methods and Applications: (10 hrs)

Electromagnetic spectrum. Absorption of radiation: Principle and applications of pH metry, potentiometry, conductometry, UV-Visible**,** IR and Basic concepts of Chromatography techniques and their applications

Unit 5: Advanced Engineering Materials:(10 hrs)

(i) Concepts and terms of supra molecular chemistry, complementarity, Basic Lock and Key principle, examples of Supramolecules, Applications of Supra molecules (sensors, catalysts, medical and molecular switches)

ii) Semiconducting and Super Conducting materials-Principles and some examples

iii) Electrical Insulators or Dielectric materials: Definition and classification, Characteristics of electrical insulators and applications of electrical insulating materials

(iv) Nanochemistry: Introduction, classification of nanomaterials properties and applications of Fullerenes, Carbon nano tubes and Graphines nanoparticles.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR II SEM

Subject Code	Title of the Subject	L	T	P	C
	Data Structures	3	0	0	3

Course Objectives:
1. To teach the representation of solution to the problem using algorithm
2. To explain the approach to algorithm analysis
3. To introduce different data structures for solving the problems
4. To demonstrate modeling of the given problem as a graph
5. To elucidate the existing hashing techniques

Course Outcomes:

Students should be able to

1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyse the Algorithms (L4)
5. Develop Algorithm for Sorting large files of data (L3)

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

Unit – 1: Introduction

Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, How fast can we sort, Merge sort, Heap sort

Learning Outcomes: Student should be able to
1. Analyze the given algorithm to find the time and space complexities.(L4)
2. Select appropriate sorting algorithm (L4)
3. Design a sorting algorithm (L6)

Unit – 2: Stack, Queue and Linked lists

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

Learning outcomes: Student should be able to

1. Evaluate expressions (L5)
2. Develop the applications using stacks and queues (L3)
3. Construct the linked lists for various applications (L6)
4.

Unit – 3 :Trees

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, AVL Trees.

Learning outcomes

1. Explain the concept of a tree (L2)
2. Compare different tree structures (L4)
3. Apply trees for indexing (L3)

Unit – 4 : Graphs and Hashing

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure

Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

Learning outcomes: Student should be able to

6. Recognize the importance of Graphs in solving real world problems (L2)
7. Apply various graph traversal methods to applications (L3)
8. Design a minimum cost solution for a problem using spanning trees (L6)
9. Select the appropriate hashing technique for a given application (L5)
10. Design a hashing technique (L6)

Unit – 5: Files and Advanced sorting

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization.

Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

Learning outcomes: Student should be able to

1. Organize data in the form of Files (L6)
2. Apply sorting on large amount of data (L3)

Text Books:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2007.
2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.

Reference Text Books:

1. D. Samanta, “Classic Data Structures”, 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Peter Bras, “Advanced Data Structures”, Cambridge University Press, 2016
3. Richard F.Gilberg, Behrouz A.Forouzan, “Data Structures A Pseudo code Approach with C”, Second Edition, Cengage Learning 2005.

I B.TECH – II SEMESTER(R-19)

SubjectCode	TitleoftheSubject	L	T	P	C
19A10303	**Engineering Workshop**	3	0	0	3

Course Objective:
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 wheelertyre.

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:
After completion of this labthe student will be able to

1. Apply wood working skills in real world applications.
2. Build different parts with metal sheets in real world applications.
3. Apply fitting operations in various applications.
4. Apply different types of basic electric circuit connections.
5. Demonstrate soldering and brazing.
6.Understanding the principle of automobile wheel balancing and alignment.

I B.TECH – II SEMESTER(R-19)

SubjectCode	TitleoftheSubject	L	T	P	C
19A10304	**Engineering Graphics**	1	0	3	2.5

UNIT-I
Introduction to EngineeringDrawing, Principles of Engineering Graphics and their significance.
Curves used in practice:
Conic sections – Ellipse, Parabola, Hyperbola & Rectangular Hyperbola(general method)
Cycloid, Epicycloid and Hypocycloid – Normal and Tangent
Involutes – Normal and Tangents

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.

UNIT –III
Projection of solids inclined to one plane and inclined to both planes by rotational method – Prism, Cylinder, Pyramid, Cone.

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

UNIT –V
Orthographic projections: Conversion of Pictorial views to orthographic views – Conventions.

Isometric projection: Isometric views of lines, plane figures, simple solids – orthographic views into isometric views.

TEXT BOOKS:

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

REFERENCES:

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

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
****** DEPARTMENT OF CHEMISTRY ******
I B.TECH – II SEMESTER(common to EEE, ECE & CSE)
(ENGINEERING CHEMISTRY LAB)

Subject Code	Title of the Lab	L	T	P	C
19A53202	Chemistry lab	-	-	4	2

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

COURSE OUTCOMES	
CO1	**determine** the cell constant and conductance of solutions
CO2	**prepare** advanced polymer materials
CO3	**measure** the strength of an acid present in secondary batteries
CO4	**analyse** the IR and NMR of some organic compounds

Mapping between Course Outcomes and Programme Outcomes

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

LIST OF EXPERIMENTS

1. Conductometrictitration of strong acid vs strong base
2. Conductometrictitration of weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Estimation of Ferrous Iron by Dichrometry.
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a polymer
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR
11. Separation of Organic mixtures by paper chromatography.
12. Preparation of Nano materials

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

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ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR II SEM

Subject Code	Title of the Subject	L	T	P	C
	Data Structures Lab	0	0	3	1.5

Course Objectives:

1. To introduce to the different data structures
2. To elucidate how the data structure selection influences the algorithm complexity
3. To explain the different operations that can be performed on different data structures
4. To introduce to the different search and sorting algorithms.

Course Outcome:at the end of the course students should be able to

1. Select the data structure appropriate for solving the problem (L5)
2. Implement searching and sorting algorithms (L3)
3. Design new data types (L6)
4. Illustrate the working of stack and queue (L4)
5. Organize the data in the form of files (L6)

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

Laboratory Experiments

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.

8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales person problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table data type and support different operations on it.

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II B. Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20604	**Complex variables and Transforms**	2	1	0	3

Course Objective:

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:

After the completion of course, students will be able to

1. understand the analyticity of complex functions and conformal mappings.
2. apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
3. understand the usage of Laplace Transforms, Fourier Transforms and Z transforms.
4. evaluate the Fourier series expansion of periodic functions.

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

Unit-I: Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes:

Studentswill be able to

1. understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.
2. find the Laplace transforms of general functions using its properties.
3. understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).
4. apply Laplace transforms to solve Differential Equations.

Unit-II: Fourier series

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.

Learning Outcomes:

Students will be able to

1. understand finding Fourier series expression of the given function.
2. determine Fourier coefficients (Euler's) and identify existence of fourier series of the given function.
3. expand the given function in Fourier series given in Half range interval.
4. apply Fourier series to establish Identities among Euler coefficients.
5. find Fourier series of wave forms.

Unit-III: Fourier transforms& Z Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem .

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

Learning Outcomes:

Students will be able to

1. find Fourier Sine and cosine integrals.
2. understand Fourier transforms.
3. apply properties of Fourier transforms.
4. understand Z transforms.
5. apply properties of Z transforms.
6. apply Z transforms to solve difference equations.

Unit-IV: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.

Learning Outcomes:

Students will be able to

1. understand functions of Complex variable and its properties.
2. find derivatives of complex functions.
3. understand the analyticity of complex functions .
4. understand the conformal mappings of complex functions.

Unit-V: 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).

Learning Outcomes:

Students will be able to

1. understand the integration of complex functions.
2. apply Cauchy's integral theorem and Cauchy's integral formula.
3. understand singularities of complex functions.
4. evaluate improper integrals of complex functions using Residue theorem.

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. 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.

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ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20201	**ELECTRICAL CIRCUITS- II**	2	1	0	3

Course Objectives:

1	To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits
2	How to determine the transient response of R-L, R-C, R-L-C series circuits for d.c and a.c excitations
3	To know the applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources
4	Study of Different types of filters, equalizers and PSPICE for Circuit Analysis

Course Outcomes:

CO1	Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits
CO2	To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for d.c and a.c excitations
CO3	Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known
CO4	Design of filters, equalizers and PSPICE programs for Circuit Analysis

Mapping of Course outcomes with Program outcomes:

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

Syllabus:

Unit-I: TRANSIENT ANALYSIS

D.C Transient Analysis: Initial Conditions in network - Initial Conditions in elements -Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.
A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.
Learning Outcomes:

- Able to understand Concepts of transient response of series circuits in both DC and Ac excitations .

- Able to analyse the differential equations and Laplace transforms of RLC circuits.

Unit-II:THREE PHASE A.C. CIRCUITS

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Application of Millman's Theorem - Star Delta Transformation Technique – for balanced and unbalanced circuits – Advantages of Three Phase System.

Learning Outcomes:
- Able to understand Concepts of three phase circuits for balanced and unbalanced conditions.
- Able to analyzethe active power and reactive power for balanced and unbalanced conditions.

Unit-III: FOURIER TRANSFORMS

Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

Learning Outcomes:
- Able to understand concepts of Fourier transforms, properties,line spectra and phase plane analysis.
- Able to analyze Electrical Circuits to Non Sinusoidal Periodic Waveforms.

Unit-IV: TWO PORT NETWORKS

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations. Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

Learning Outcomes:
- Able to understand concepts of two port network parameters.
- Able to calculate impedance, admittance, transmission and hybrid parameters.

Unit-V:FILTERS & PSPICE FOR CIRCUITS

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.

PSPICE for Circuit Analysis – Description of Circuit elements - nodes and sources - Input and Output variables – Modeling of the above elements – Types of DC analysis.

Learning Outcomes:
- Able to understand concepts of filters, equalizers.
- Able to design filters and attenuators.
- Able to analyze the circuits in PSPICE.
- Able to modeling of circuits in PSPICE.

TEXT BOOKS:

4. “Engineering circuit analysis” by William Hayt and Jack E.Kemmerly, Mc Graw Hill Company,8th Edition(4 August 2013).
5. “Network Analysis” by M.E Van Valkenberg, Prentice Hall (India), Revised 3rd Edition (15 April 2019).

REFERENCE BOOKS:

1. “Circuit Theory (Analysis & Synthesis)” by A. Chakrabarti, Dhanpat Rai & Sons, Seventh - Revised edition (2018).
2. “Fundamentals of Electric Circuits” by Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th edition (1 July 2013).
3. “Electrical Engineering Fundamentals” by V. Del Toro, Prentice – Hall International, 2nd edition (1989).
4. “Electric Circuits” by N.Sreenivasulu, REEM Publications(2012).
5. “Electric Circuits”- Schuam Series,5th edition (1 July 2017).
6. “Electrical Circuit Theory and Technology” by John Bird, Routledge, Taylor &Fransis, 6th Edition, March 3, 2017.
7. “Circuits & Networks” by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill, 5thedition (1 July 2017).

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ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A24201	**Signals and Systems**	2	1	0	3

Course Objectives:

1	To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
2	To present Fourier tools through the analogy between vectors and signals.
3	To teach concept of sampling and reconstruction of signals.
4	To analyze characteristics of linear systems in time and frequency domains.
5	To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes:
After completion of the course, student will be able to

CO1	Understand the mathematical description and representation of continuous-time and discrete-time signals and systems. Also understand the concepts of various transform techniques. (L1)
CO2	Apply sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct back, different transform techniques to solve signals and system related problems. (L2)
CO3	Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods. (L3)
CO4	Classify the systems based on their properties and determine the response of them. (L4).

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

Syllabus

Unit I:Introduction to Signals & Systems

Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality, mean square error, Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.

Learning Outcomes:

- Understand different types of signals and systems. (L1)
- State principles of vector spaces and concept of Orthogonality. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Analyze the periodic signals by applying Fourier series. (L3)

Unit II : Continuous Time Fourier Transforms

Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

Learning Outcomes:

- Identify system properties based on impulse response and Fourier analysis. (L1)
- Analyze the spectral characteristics of signals. (L3)
- Illustrate signal sampling and its reconstruction. (L2)
- Apply Fourier transform to solve problems. (L2)

Unit III: **Discrete Time Fourier Transforms**

Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems, Illustrative Problems.

Learning Outcomes:

- Understand the properties of the discrete-time Fourier transform. (L1)
- Analyze the spectral characteristics of signals using Fourier transform. (L3)
- Evaluate the Fourier transform of Discrete-time signals. (L2)

Unit IV: **Signal Transmission through Linear Systems**

Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems.

Learning Outcomes:

- Understand the impulse response, transfer characteristics of LTI system and various filters. (L1)
- Analyse filter characteristics and physical realisation of LTI system. (L3)
- Apply the relation between bandwidth and rise time & energy and power spectral densities in various applications. (L2)

Unit V:**Laplace and Z Transforms**

Definition, ROC, Properties, Inverse Laplace transforms, the S-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

Definition, ROC, Properties, Poles and Zeros in Z-plane, The inverse Z-Transforms, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems.

Learning Outcomes:

- Understand the limitations of Fourier transform and need for Laplace transform and develop. (L1)
- Apply transform techniques to analyse discrete-time signals and systems. (L2)
- Evaluate response of linear systems to known inputs by using Laplace transforms. (L2)
- Analyze the continuous-time and discrete-time signals and systems using Laplace and Z-transforms.(L3)

Text Books:

1. "Signals and Systems",A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edition, 2009.
2. "Signals & Systems",Simon Haykin and Van Veen, Wiley, 2nd Edition, 2005.

References:

1. "Principles of Linear Systems and Signals",BP Lathi, Oxford University Press, 2nd Edition, 2015.
2. "Signals and Systems A primer with MATLAB",Matthew N.O. Sadiku and Warsame H. Ali, CRC Press, 2016.
3. "Schaum's Outline of Signals and Systems", Hwei Hsu, Fourth Edition, TMH, 2019.
4. NPTEL Lectures on Signals and Systems by Prof.K.S.Venkatesh,IIT Kanpur.
5. NPTEL Lectures on Signals and Systems by Prof.Aditya K Jagannatham, IIT Kanpur

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II B.Tech – I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20202	**DC MACHINES & TRANSFORMERS**	2	1	0	3

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO 1	Understand the concepts of magnetic circuits.
CO 2	Understand the operation of DC machines.
CO 3	Analyse the differences in operation of different DC machine configurations.
CO 4	Analyse single phase and three phase transformers circuits.

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

UNIT-I Basic Principles

Magnetic Material Properties and Applications:

Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.

Principles of electromechanical energy conversion:

Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems

Learning Outcomes:

- Able to understand the electromechanical energy conversion system
- To understand about various magnetic materials, properties and Applications

UNIT-II DC Generators

Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators.

Parallel operation of DC Generators:DC shunt and series generators in parallel, equalizing connections

Learning Outcomes:

- Able to understand the construction, operation and armature windings of a DC generator
- Able to analyze the characteristics of DC generators

UNIT-III DC Motors

Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors (Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency. Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.

Learning Outcomes:

- Able to analyze speed control of DC motors, testing methods and parallel operation of DC machines
- Analyze the characteristics of DC motors

UNIT-IV

Single Phase Transformers

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams(no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

Learning Outcomes:

- Able to understand the construction, operation and parallel operation of transformer
- To predetermine the efficiency and regulation of a transformer

UNIT-V

Three Phase Transformers

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers- Cooling of transformers, Distribution transformer, Power transformer- Comparison between distribution transformer and power transformer.

Learning Outcomes:

- Able to understand and analyze the phase conversions
- Analyze the tap changing of transformers

Text Books:

1. "Electrical Machinery", P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition (1977).
2. "Electric Machines", I. J. Nagrath and D. P. Kothari, McGraw Hill Education,Fifth edition (23 June 2017).

References:

1. "Electric Machinery",A. E. Fitzgerald and C. Kingsley, New York, McGraw Hill Education, 6th edition (September 1, 2005).
2. "The Performance and design of DC machines", A. E. Clayton and N. N. Hancock, CBSPublishers, 1st edition (2004).
3. "The Performance and design of AC machines", M. G. Say, CBS Publishers, 3rd edition (2002).
4. NPTEL Lectures on Electrical machines by Prof. G. Bhuvaneswari, IIT Delhi.
5. NPTEL Lectures on Electrical Machines-I by Prof Tapas Kumar Bhattacharya IIT Kharagpur.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech – I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20203	**ENGINEERING ELECTROMAGNETICS**	2	1	0	3

Course Objectives:

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

Course Outcomes: After completion of the course, the student will be able to:

CO 1	Understand the concept of electrostatics
CO 2	Understand the concepts of Conductors and Dielectrics
CO 3	Understand the fundamental laws related to Magneto Statics
CO 4	Understand the concepts of Magnetic Potential and Time varying Fields

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

UNIT-I ELECTROSTATICS

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law-Application of Gauss Law-Maxwell's First Law – Numerical Problems.

Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

Learning outcomes:

- Able to Determine electric field and potentials using Coulomb's law & Gauss law.
- Analyze Potential differences for different configurations.
- Able to classify static electric magnetic fields in different engineering situations.
- Able to Determine the Concepts of Electric dipole, Electrostatic Energy and Energy density.

UNIT- II CONDUCTORS AND DIELECTRICS

Behavior of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

Learning outcomes:

- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.
- Analyze the Concepts of Conduction and Convection currents.
- Able to Calculate Energy stored and energy density in a static electric fields.

UNIT-III MAGNETO STATICS

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems.

Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

Learning outcomes:

- Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law.
- Able to understand Maxwell's equations.
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops.

UNIT – IV MAGNETIC POTENTIAL

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

Learning outcomes:

- Understand scalar magnetic potential and vector magnetic potential and its applications.
- Able to calculate the magnetic forces and torque produced by currents in Magnetic Field.
- Ability to calculate self and mutual Inductances.
- Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic field.

UNIT-V TIMEVARYING FIELDS

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.

Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance**.**

Learning outcomes:

- Acquires knowledge on time varying fields & Faraday's law for Electromagnetic induction
- Analyze the Concepts Maxwell's Equations in Different Forms.
- Understand the Concepts Calculation of Pointing vector & Theorem.
- Analyze the Concepts of Wave Theory

TEXT BOOKS:

1. “Principles of Electromagnetics”, Sadiku, Kulkarni, OXFORD University Press, 6th Edition,2015
2. “Engineering Electromagnetics”, William.H.Hayt, Mc.Graw Hill, 2010.

REFERENCE BOOKS:

1. “Electromagnetics”by J.D.Kraus,Mc.Graw Hill Inc, 5th edition,1999.
2. “Field & Electromagnetic waves” by David K. Cheng, 2nd edition, 1989.
3. “ Electromagnetics”, by Mahmood Nahvi , Joseph Edminister (Author) Mc Graw Hill, 5th Edition, 2018.
4. “Electromagnetic Field Theory”, K.A. Gangadhar and P.M. Ramanathan, Khanna Publications, 8th Reprint, 2015.
5. NPTEL Lectures on Engineering Electromagnetics by Prof.Harikrishna Ramachandran, IIT Madras.

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II B.Tech – I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A24202	**SEMICONDUCTOR DEVICES AND CIRCUITS**	1	1	0	2

Course Objectives:

1. To study the characteristics of various types of semiconductor devices.
2. To apply the characteristics of semiconductor devices to develop engineering solutions.
3. To analyze functioning of various types of electronic devices and circuits.

Course Outcomes:

1. CO1. List various types of semiconductor devices (L1)
2. CO2. Study the characteristics of various types of semiconductor devices (L2)
3. CO3. Apply the characteristics of semiconductor devices to develop engineering solutions (L3)
4. CO4. Analyse functioning of various types of electronic devices and circuits (L4)

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

Unit I

P-N junction Diode: Qualitative theory of the p-n junction, p-n junction as a diode, current components in a p-n diode, Volt-Ampere characteristics, Temperature dependence of p-ndiode characteristics, Diode resistance, Qualitative treatment of Transition and Diffusion capacitances. Diode as Rectifier: Half wave and Full wave rectifier, Bridge rectifier, Filters – Inductor and Capacitor Filter. Ripple factor with and without filters.

Unit II

Special Purpose Diodes: Zener versus Avalanche breakdown, Principle of operation, characteristics and applications of Zener diode, Tunnel diode, Photo diode, LED, PIN diode, Schottky barrier diode and Varactor diode. Bi-Polar Junction Transistor: Junction transistor, Transistor current components, Transistor as an amplifier, Input and Output characteristics of BJT in Common Base, Common Emitter and Common Collector configurations. Transistor as a switch.

Unit III

Transistor biasing and Stabilization: The Operating Point, DC & AC load lines, Bias Stability, Fixed Bias, Collector-to-Base Bias, Self-Bias, Bias Stabilization, Bias Compensation, Thermistor and

Sensistor Compensation, Thermal Runaway, Thermal Stability. Small Signal Low-frequency Transistor Models: Transistor Hybrid Model, Determination of the h parameters from the characteristics, Analysis of Transistor amplifierusing h parameters, Comparison of Transistor amplifier configurations.

Unit IV

Low-frequency Transistor Amplifier circuits: Simplified Common-emitter Hybrid Model, Simplified Calculations for the Common-Collector, Common-base and Common-emitter amplifier, Common emitter amplifier by passed and un-bypassed Emitter Resistance, Miller's Theorem, Dual of Miller's Theorem.

Unit V

Field-effect Transistors: The Junction Field-effect Transistor, The Pinch-off Voltage, The JFET Volt-Ampere Characteristics, MOSFET characteristics (Enhancement and depletion mode), The FET and MOSFET Small-signal Model, Biasing of FET and MOSFET, The Common-source Amplifier, The Common-drain Amplifier, A Generalized FET Amplifier, The FET as a Voltage-variable Resistor, The Unijunction Transistor.

Text Books:

1. J.Millman, C. C. Halkias and Satyabrata Jit, "Electronic Devices and Circuits",4th edition, Mc Graw Hill, 2015.
2. S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", 4th edition, McGrawHill, 2017.

References:

1. J.Milliman, C. C. Halkias and Chetan Parikh, "Integrated Electronics", 2nd edition, Mc Graw Hill, 2010.
2. David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford, 2008.

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II B.Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20901	**UNIVERSAL HUMAN VALUES**	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 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 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 OUTCOME:

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.

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

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 HumanValues-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
- Unde rstanding 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 program 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 the harmony in the 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 the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in theNature
- 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 the 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.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

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. FSchumacher. "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)**

MODE OF CONDUCT (L-T-P-C 2-1-0-2)

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.
Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their

analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic humanvalues.

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.**

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II B.Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20204	**DC Machines & Transformers Lab**	-	-	3	1.5

Course Objectives: To conduct various experiments on	
1	DC motors and DC Generators
2	The speed control techniques of DC motors.
3	To conduct various experiments for testing on 1-phase transformers

Course Outcomes:	
CO1	Able to conduct and analyze load test on DC shunt generators
CO2	Able to understand and analyze magnetization characteristics of DC shunt generator
CO3	Able to understand and analyze speed control techniques and efficiency of DC machines
CO4	Able to understand to predetermine efficiency and regulation of single phase Transformers

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

From the following list experiments minimum ten experiments are required to be conducted as compulsory experiments:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Swinburne's test on DC shunt motor,Predetermination of efficiency.
5. Speed control of DC shunt motor (Armature control and Field control method).
6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
7. OC and SC test on single phase transformer
8. Parallel operation of single phase transformers.
9. Sumpner's test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of characteristics.
11. Load test on DC short shunt compound generator. Determination of characteristics.
12. Separation of losses in DC shunt motor.

Reference Book:

1. "Laboratory Manual for Electrical Machines", by D. P. Kothari and B. S. Umre, I.K International Publishing House Pvt. Ltd., 2017

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II B.Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A24203	**SEMICONDUCTOR DEVICES AND CIRCUITS LAB**	-	-	3	1.5

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

All the experiments shall be conducted and there is no choice.

List of Experiments:

1. Draw and study the characteristics of Semi-conductor diode and calculate static and dynamic resistance.
2. Draw and study the characteristics of Zener Diode and study its application as Regulator.
3. Draw and study the input and output characteristics of Transistor in Common Emitter configuration.
4. Draw and study the input and output characteristics of Transistor in Common Base configuration.
5. Draw and study the drain and transfer characteristics of FET in Common Source Configuration.
6. Draw and study the characteristics of UJT.
7. Rectifiers
   a. To simulate the rectifiers and trace their output waveforms with and without filters using PSPICE / Multisim.
   b. To design half wave, full wave & bridge rectifiers with and without filters, using discrete components and calculate ripple factor in each case.
8. Common Emitter Amplifier (Self bias Amplifier)
   a. Design and simulate self- bias Common Emitter amplifier using PSPICE /Multisim and study the Gain and Bandwidth of the amplifier.
   b. Design self- bias Common Emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.
9. Miller’s and Dual of Miller’s theorem
   a. Design and simulate to Prove the Miller’s and dual of Miller’s theorem in CE amplifier.
   b. Design and construct the amplifier with discrete components to prove Miller’s and dual of Miller’s theorem.
10. FET Amplifier
    a. Design and simulate common source FET amplifier using PSPICE /Multisim and study the Gain and Bandwidth of amplifier.

b. Design common source FET amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.

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II B.Tech - I SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20205	**ELECTRICAL CIRCUITS AND SIMULATION LAB**	-	-	3	1.5

Course Objectives:

To make the students learn about:

1	Experimental verification of theorems.
2	Experimental verification of Resonance phenomenon.
3	Drawing current locus diagrams and Practical implementation of active and reactive power measurement techniques.
4	Practical determination of two port network parameters and introduction to P-Spice.

Course Outcomes:

After completing the course, the student should be able to do the following:

CO1	Apply suitable theorems for circuit analysis and verify the results theoretically.
CO2	Experimental determination of two port network parameters and theoretical verification.
CO3	Measure active and reactive power experimentally and verify the theoretical values.
CO4	Experimentally determine self inductance, mutual inductance and coefficient of coupling Practically determine band width, Q-factor and verify with theoretical values.

Mapping of Course outcomes with Program outcomes:

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

From the following list experiments minimum eight experiments from Part-A and minimum two experiments from Part-B are required to be conducted:

PART-A

1) Verification of Thevenin's and Norton's Theorems
2) Verification of Superposition Theorem and Maximum Power Transfer Theorem

3) Verification of Compensation Theorem
4) Verification of Reciprocity , Millmann's Theorems
5) Locus Diagrams of RL and RC Series Circuits
6) Series and Parallel Resonance
7) Determination of Self, Mutual Inductances and Coefficient of Coupling
8) Z and Y Parameters
9) Transmission and Hybrid Parameters
10) Measurement of Active Power for Star and Delta Connected Balanced Loads
11) Measurement of Reactive Power for Star and Delta Connected Balanced Loads
12) Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

PART-B:

1) Simulation of DC Circuits
2) DC Transient Response
3) Mesh Analysis
4) Nodal Analysis

REFERENCES:

1. "Fundamentals of Electric Circuits: Lab Manual", David A. Bell, OUP Canada, 7th Edition,2009.
2. "Introduction to PSPICE using OrCAD for Circuits and Electronics", Muhammad H. Rashid, Pearson Education, 3rd Edition, 2003

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II B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A28801	Biology for Engineers	3	0	0	0

Course Objectives: **To provide basic understanding about life and life Process. Animal an plant systems. To understand what bimolecules, are, their structures are functions. Application of certain bimolecules in Industry.**

- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

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

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. (L1)
- Understand the difference between lower organisms (prokaryotes) from higher organisms (eukaryotes). (L2)
- Understand how organisms are classified. (L3)

Unit II: Introduction to Biomolecules

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)

Unit III: Human Physiology

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA 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 and Eukaryotes (L1)
- How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields.(L3)
- Explain what is cloning. (L4)

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. Basics of 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.(L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

Unit III: Human Physiology

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA 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 and Eukaryotes (L1)
- How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields.(L3)
- Explain what is cloning. (L4)

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. Basics of 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.(L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A20205	TRANSMISSION SYSTEM ANALYSIS AND DESIGN	2	1	0	3

Course Objectives:
The student will be able to:

1	About the various factors that affect the performance of Transmission lines
2	Understand the theory of transmission lines modeling
3	To comprehend the different issues related to overhead lines and underground cables.
4	To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines.

Course Outcomes:
At the end of this course students will be able to:

CO1	Ability to do calculation of resistance, Inductance and Capacitance of Transmission Lines.
CO2	Able to discuss various factors governing the performance of Transmission Line.
CO3	Ability to do calculation of sag for different types of Transmission systems.
CO4	Ability to discuss construction of Underground Cables

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

Syllabus:

Unit-I: Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

Learning Outcomes:
At the end of the unit, students will be able to

- Obtain the transmission line parameters for different types of lines and also for symmetrical and asymmetrical single and three phase, single and double circuit lines.

Unit-II:Modeling of Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current, Need of Shunt Compensation.

Learning Outcomes:
At the end of the unit, students will be able to

- Obtain the classification of transmission lines and A,B,C,D constants for transmission lines, need of shunt compensation.

Unit-III:Insulators, Corona and Mechanical Design of lines

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

Learning Outcomes:
At the end of the unit, students will be able to

- Understand different types of Insulators, effects of corona and sag and tension Calculations.

Unit-IV:Power System Transients

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

Learning Outcomes:
At the end of the unit, students will be able to

- Obtain the knowledge about transients and the concept of Bewley's Lattice Diagrams.

Unit-V: Power Cables

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Learning Outcomes:

At the end of the unit, students will be able to

- Obtain the calculations of Insulation resistance, Capacitance of a single and 3 core belted cables and grading of cables.

Text Books:

1. "Power System Analysis" by W.D.Stevenson, J.J. Grainger McGrawhill, 2nd edition (December 28, 2015).
2. "Electrical power systems" - by C.L.Wadhwa, New Age International (P) Limited, Publishers, 7th edition (1 January 2016).

Reference Books:

1. "A Text Book on Power System Engineering" by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, DhanpatRai& Co Pvt. Ltd (2008).
2. "Power System Engineering" by D.P. Kothari and I.J. Nagrath, 3rd Edition, McGraw Hill Publications.
3. "Power System Analysis" by HadiSaadat, McGraw-Hill Inc.,US; Subsequent edition (1 March 1998)
4. "Power System Analysis and Design" by J. Duncan Glover, Cengage Learning Custom Publishing, 5th edition (14 January 2011).
5. **Power System Analysis and Design by B.R.Gupta, S Chand & Company, Re-issue edition (8 August 2005).**
6. **NPTEL Lectures on Power System Generation, Transmission and Distribution (Encapsulated from earlier Video) by Prof. D.P. Kothari IIT Delhi**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A20207	**POWER ELECTRONICS**	2	1	0	3

Course Objectives:
The student will be able to:

1	Understand the differences between signal level and power level devices.
2	Analyze controlled rectifier circuits.
3	Analyze the operation of DC-DC choppers.
4	Analyze the operation of voltage source inverters.

Course Outcomes:
At the end of this course students will be able to:

CO1 Remember and understand of about basic operating principles of various power semiconducting switching devices

CO2 Apply the concepts of power electronics techniques Understand high efficiency and high reliability power conversion methods.

CO3 Analyses of the of various power electronics converter their control and to solve the problems and demonstrate the use of these techniques through good power skills.

CO4 Design and develop of some of power electronics converter methods. Able to apply principles and methods to practical applications.

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

UNIT-I: Power switching devices

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes:
At the end of the unit, students will be able to

- Understand the basic power semiconductor devices their construction, principle of working and their characteristics.
- Understand in detail about SCR i.e., its characteristics, series and parallel connection of SCR's, specification, its ratings and various commutation methods.
- Apply the above concepts to solve numerical problems.

UNIT-II: Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor-Numerical problems.

Learning Outcomes:

At the end of the unit, students will be able to

- Understand the concepts of phase control technique, midpoint and bridge connections of half and full controlled converters with various loads for both 1Ø and 3Ø phase converters, effect of source inductance and dual converters.
- Analyze and evaluate voltages and currents, active and reactive power inputs to converter with and without freewheeling diode for 1Ø and 3Ø converters.
- Apply the above concepts to solve numerical problems.

UNIT-III: DC-DC converters

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage, Buck-Boost converter (Principle of operation only).

Learning Outcomes:

At the end of the unit, students will be able to

- Understand the concepts of various control strategies, types of choppers and analyze their principle operation, waveforms of voltages and currents at different loads.
- Apply the above concepts to solve numerical problems.

UNIT-IV: Inverters

Single phase Voltage Source inverters – operating principle - Steady State Analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

Learning Outcomes:

At the end of the unit, students will be able to

- Understand the construction, working of single phase voltage inverters with their waveforms in various operating modes when different loads are applied and the different modulating techniques available.
- Understand the construction, working of three phase voltage inverters with their waveforms in various operating modes when different loads are applied, harmonic components and the different modulating techniques available.
- Apply the above concepts to solve numerical problems.

UNIT-V: AC Voltage Controllers &Cyclo Converters:

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Learning Outcomes:

At the end of the unit, students will be able to

- Understand the concept of AC voltage controllers
- Understand the concept of Cyclo Converters

TEXT BOOKS:

1. “Power Electronics: Circuits, Devices and Applications” by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. “Power Electronics” by P.S.Bimbhra, Khanna Publishers, 4th Edition, 2010.

REFERENCE BOOKS:

1. “Power Electronics” by M. D. Singh & K. B. Kanchandhani, Tata McGraw Hill Publishing Company, 1998.
2. “Power Electronics, A first Course” by Ned Mohan, Wiley, 2011.
3. “Fundamentals of Power Electronics” by Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004.
4. “Power Electronics” by VedamSubramanyam, New Age International (P) Limited, 1996.
5. “Power Electronics” by V.R.Murthy , OXFORD University Press, 1st Edition, 2005.
6. “Power Electronics” by P.C.Sen, Tata McGraw-Hill Education, 1987.
7. NPTEL Lectures on Power Electronics by Prof. Kishore Chatterjee and Prof.B.G.Fernandes, IIT Bombay.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A20208	AC Machines	2	1	0	3

Course Objectives:
The students will be able to:

1	Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
2	Understand the methods of starting of Induction motors.
3	Understand the methods of starting of Synchronous motors.
4	Understand the parallel operation of Alternators.

Course Outcomes:
At the end of this course, students will be able to:

CO1	Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.
CO2	Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.
CO3	Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.
CO4	Analyze the various methods of starting in both induction and synchronous machines.

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

UNIT-I: Fundamentals of AC machine windings

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.

Learning Outcomes:
By the end of the unit, student will be able to:

- Understand the fundamentals of various parts used, different types of windings, distribution factor, air gap mmf distribution, constant and pulsating magnetic fields, addition of pulsating magnetic fields and revolving magnetic field.

- Analyze Magnetic and pulsating fields produced by spatially displaced windings and when the windings are spatially shifted by an angle.
- Apply above concepts to solve numerical problems.

UNIT-II: Induction Machines

Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram-performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the construction, types, equivalent circuit, torque slip characteristics and various losses present in an induction machine.
- Analyze the phasor diagram, efficiency, starting and maximum torque, effect of parameter variation on torque speed characteristics
- Apply above concepts to solve numerical problems.

UNIT-III; Single-phase induction motors

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase motors, reluctance single phase motors, stepper motors, BLDC motors.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand induction generator operation, self-excitation, doubly fed induction machines, various methods of starting, braking and speed control of induction motors.
- Understand the constructional features, principle involved, equivalent circuit of single-phase induction motor and various starting methods and its applications.
- Apply above concepts to solve numerical problems.

UNIT-IV: Synchronous generators

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation- EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the constructional features, emf generated, equivalent circuit, armature reaction, voltage regulation, characteristics, two reaction theory of synchronous machine.
- Analyze the phasor diagrams, parallel operation of alternators, synchronization and load division of synchronous generators.
- Apply above concepts to solve numerical problems.

UNIT-V: Synchronous motors

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, Predetermination of V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the principle of operation, methods of starting, concept of hunting, synchronous condenser and power factor correction of synchronous motors.
- Analyze the phasor diagram, determination of V and inverted V curves and power circles of synchronous motor.
- Apply above concepts to solve numerical problems.

Text Books:

1. "Electric Machinery", A. E. Fitzgerald and C. Kingsley, McGraw Hill Education, 6th edition (September 1, 2005).
2. "Electrical Machinery", P. S. Bimbhra, Khanna Publishers, 7th Edition (1977).

References:

1. "The Performance and design of AC machines", M. G. Say, CBS Publishers, 3rd edition (2002).
2. "Electric Machines", I. J. Nagrath and D. P. Kothari, McGraw Hill Education, 5th edition (23 June 2017).
3. "Alternating current machines", A. S. Langsdorf, McGraw Hill Education, 1984.
4. "Principles of Electric Machines and Power Electronics", P. C. Sen, John Wiley & Sons, 2007.
5. NPTEL Lectures on Electrical Machines-II by Prof .Tapas Kumar Bhattacharya, IIT Kharagpur.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech – II SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A20209	CONTROL SYSTEMS	2	1	0	3

Course Objectives:

To make the students learn about:

1	Merits and demerits of open loop and closed loop systems; the effect of feedback
2	The use of block diagram algebra and Mason's gain formula to find the overall transfer function
3	Transient and steady state response, time domain specifications and the concept of Root loci
4	Frequency domain specifications, Bode diagrams and Nyquist plots
5	State space modelling of Control system

Course Outcomes:

After completing the course, the student should be able to:

CO1	Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics, state space analysis
CO2	Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
CO3	Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
CO4	Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications.

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

UNIT – I CONTROL SYSTEMS CONCEPTS

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

Learning Outcomes: At the end of the unit, the student will be able to

- Write the differential equations for mechanical and electrical systems
- Obtain the transfer function from block diagrams, servo motors and signal flow graphs

UNIT-II TIME RESPONSE ANALYSIS

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze the time domain specifications
- Calculate the steady state errors
- Understand about Proportional, Integral and Derivative controllers along with combinations

UNIT – III STABILITY ANALYSIS IN TIME DOMAIN

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze the concept of stability in time domain
- Apply the concept of Routh's stability and Root locus in time domain

UNIT – IV FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.
Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

Learning Outcomes: At the end of the unit, the student will be able to

- *Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots*
- *Design Compensators for various systems*
- Deducing transfer functions from Bode Plots
- Understand difference between Phase and Gain margins

UNIT – V STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the concept of state space, controllability and observability
- Obtain the transfer function from sate space and vice versa
- Understand the state transition method of solving time invariant state equations

TEXT BOOKS:

1. "Modern Control Engineering" by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. "Control Systems Engineering" by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

REFERENCE BOOKS:

1. "Control Systems Principles & Design" by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2. "Automatic Control Systems" by B. C. Kuo and FaridGolnaraghi, John wiley and sons, 8th edition, 2003.
3. "Feedback and Control Systems", Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. "Control System Design" by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. "Feedback Control of Dynamic Systems" by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010. \
6. NPTEL Lectures on Control Systems by Prof.C.S.Shankar Ram, IIT Madras.

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ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech - II SEM (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A24204	**Digitial Electronic Circuits and Logic Design**	2	1	0	3

Course Objectives:

- To understand common forms of number representation in logic circuits.
- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand the concepts of combinational logic circuits and sequential circuits.
- To understand the Realization of Logic Gates Using Diodes & Transistors.

Course Outcomes:

Upon completing this course, the student will be able to

- Understand the numerical information in different forms and Boolean Algebra theorems.
- Postulates of Boolean algebra and to minimize combinational functions.
- Design and analyze combinational and sequential circuits.
- Known about the logic families and realization of logic gates.

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

UNIT I

Boolean Algebra:

Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

Realization of Logic Gates Using Diodes & Transistors:

Use of Diode and Transistor as switch; AND, OR and NOT Gates using Diodes and Transistors, Concept of noise margin, fanout, propagation delay; TTL, Schottky TTL, Tristate; CMOS Logic, Interfacing TTL with CMOS

UNIT II

Number Systems:

Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.

Minimization of Boolean functions:

Karnaaugh Map Method - Up to five Variables, Don’t Care Map Entries, Tabular Method.

UNIT III

Combinational Logic Circuits:

Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations, Design of combinational circuits-Encoders and decoders, Multiplexer and demultiplexers.

UNIT IV

Sequential Circuits Fundamentals:

Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Registers and Counters:

Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

UNIT V

Sequential Machines:

Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N – Counters, Finite state machine-capabilities and limitations, Mealy and Moore models.

Text Books:

1. Switching and Finite Automata Theory –ZviKohavi&Niraj K. Jha, 3rd Edition, Cambridge, 2010
2. Digital Design- Morris Mano, PHI, 4th Edition,2006.

References:

1. Modern Digital Electronics – R. P. Jain, 3rd edition, Tata McGraw-Hill, 2007.
2. Digital Integrated Electronics, Taub and Shilling, McGraw Hill.
3. Digital Fundamentals 9e, Thomas L Floyd, Pearson.
4. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A25501	Fundamentals of Python Programming		0	0	2

Course Objectives:

- To teach the fundamentals of Python
- To elucidate problem-solving using a Python programming language
- To introduce a function-oriented programming paradigm through python
- To train in the development of solutions using modular concepts
- To introduce the programming constructs of python

Course Outcomes: After completion of the course a successful student is able to

- List the basic constructs of Python
- Design programs for data structure list and manipulating strings
- Apply object orientation concepts, use data structure dictionaries
- Organize data in the form of files

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

Unit – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

Learning Outcomes: Student should be able to

- List the basic constructs of Python (L1)
- Solve the problems by applying modularity principle (L3)

Unit – II

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.
Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,

Learning Outcomes: Student should be able to

- Apply the conditional execution of the program (L3)
- Apply the principle of recursion to solve the problems (L3)

Unit - III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.
Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.

Learning Outcomes: Student should be able to

- Design programs for manipulating strings (L6)

Unit – IV
Lists: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.
Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.

Learning Outcomes: Student should be able to
- Apply object orientation concepts (L3)
- Use data structure lists and tuples (L3)

Unit – V

Files: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.
Classes and Objects: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.
Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus planning.

Learning Outcomes: Student should be able to

- Organize data in the form of files (L6)
- Plan programs using object orientation approach (L6)

Text books:

- Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.

Reference Books:

- Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
- Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
- R. NageswaraRao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019

Course Outcomes: Student should be able to

- Explain the features of Python language (L2)
- Select appropriate data structure for solving a problem (L4)
- Design object oriented programs for solving real-world problems (L6)

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II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A20210	**CONTROL SYSTEMS & SIMULATION LAB**	0	0	3	1.5

COURSE OBJECTIVES

Objectives: This course introduces

1	Determination of transfer functions of various systems and control of it by different methodologies.
2	To provide knowledge in the analysis and design of controllers and compensators.
3	The characteristics of servo mechanisms which are helpful in automatic control systems.
4	To know the stability analysis using MATLAB.

COURSE OUTCOMES

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

CO1	Get the knowledge of feedback control and transfer function of DC servo motor.
CO2	Model the systems and able to design the controllers and compensators.
CO3	Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and can implement them to practical systems and MATLAB
CO4	Determine the performance and time domain specifications of first and second order systems.

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

From the following list experiments minimum Eight experiments from Part-A and minimum two experiments from Part-B are required to be conducted:

Part-A

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC Machine.

6. Effect of P, PD, PI, PID Controller on a second order system.
7. Lag and lead compensation – Magnitude and phase plot.
8. Temperature controller using PID.
9. Characteristics of magnetic amplifiers.
10. Characteristics of AC servo motor.

Part-B

1. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
2. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB.
3. State space model for classical transfer function using MATLAB – Verification.
4. Verification of controllability and observablity of a given system using MATLAB.

REFERENCE BOOKS:

1. MATLAB and its Tool Books user's manual –Mathworks, USA.
2. "Modeling and Simulation using MATLAB – Simulink", Dr. Shailendra Jain, Wiley (1 January 2013) 2nd edition.
3. "Essential MATLAB for Engineers and Scientists"by Brian Hahn and Daniel T. Valentine, Academic Press, 5th edition (1 February 2013).
4. "Getting Started with MATLAB" by RudraPratap, Oxford University Press, Seventh edition (2019).

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II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A20211	**POWER ELECTRONICS AND SIMULATION LAB**	0	0	3	1.5

Course Objectives:

By the end of the course the student will be able to:

CO1	Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
CO2	Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
CO3	Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
CO4	Create and analyze various power electronic converters using PSPICE software.

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

From the following list experiments minimum Eight experiments from Part-A and minimum two experiments from Part-B are required to be conducted:

Part- A

1. Study of Characteristics of SCR, MOSFET & IGBT.
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering.
3. Single Phase AC Voltage Controller with R and RL Loads.
4. Single Phase fully controlled bridge converter with R and RL loads.
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E).
6. DC Jones chopper with R and RL Loads.
7. Single Phase Parallel, inverter with R and RL loads.
8. Single Phase Cycloconverter with R and RL loads.
9. Single Phase Half controlled converter with R load.
10. Three Phase half controlled bridge converter with R-load.
11. Single Phase series inverter with R and RL loads.
12. Single Phase Bridge converter with R and RL loads.
13. Single Phase dual converter with RL loads.

Part-B

1. PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
2. PSPICE simulation of resonant pulse commutation circuit and Buck converters and chopper.
3. PSPICE simulation of single phase Inverter with PWM control.

REFERENCE BOOKS:

1. "Power Electronics Laboratory: Theory, Practice and Organization" (Narosa series in Power and Energy Systems) by O.P. Arora, Alpha Science International Ltd., 2007.
2. "Simulation of Electric and Electronic circuits using PSPICE" – by M.H.Rashid, M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.

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II B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A25502	**Fundamentals of Python Programming Lab**	0	0	2	1

Course Objectives:

1. To train solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To illustrate the features of Python language

Course outcomes: Student should be able to

1. Design solutions to mathematical problems (L6)
2. Organize the data for solving the problem (L6)
3. Develop Python programs for numerical and text based problems (L3)
4. Select appropriate programming construct for solving the problem (L5)
5. Illustrate object oriented concepts (L3)

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

Laboratory Experiments

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator

2. Write a function that draws a grid like the following:

```
+----+----+
|    |    |
|    |    |
|    |    |
|    |    |
+----+----+
|    |    |
|    |    |
|    |    |
|    |    |
+----+----+
```

3. Write a function that draws a Pyramid with # symbols

```
      #
    # # #
  # # # # #
# # # # # # #
      .
      .
      .
```

Up to 15 hashes at the bottom

4. The letters of the alphabet can be constructed from a moderate number of basic elemlents, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.

5. The time module provides a function, also named time that returns the current Greenwich Mean Time in “the epoch”, which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
>>>time.time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.

6. Given n+r+1 <= 2^r .n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above.

7. Write a program that evaluates Ackermann function

8. The mathematician SrinivasaRamanujan found an infinite series that can be used to generate a numerical approximation of 1/ **π** :

9. Write a function called estimate_pi that uses this formula to compute and return an estimate of **π.**

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than 1e-15 (which is Python notation for 10^{-15}). You can check the result by comparing it to math.pi.

10. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.

11. Given a text of characters. Write a program which counts number of vowels, consonants and special characters.

12. Given a word which is a string of characters. Given an integer say 'n'. Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.

13. Write program which performs the following operations on list's. Don't use built-in functions

a) Updating elements of a list

b) Concatenation of list's

c) Check for member in the list

d) Insert into the list

e) Sum the elements of the list

f) Push and pop element of list

g) Sorting of list

h) Finding biggest and smallest elements in the list

i) Finding common elements in the list

14. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.
15. Write a program that takes a string and prints the letters in decreasing order of frequency.
16. Write a program that reads a word list from a file (see Section 9.1) and prints all the sets of words that are anagrams.

    Here is an example of what the output might look like:

    ['deltas', 'desalt', 'lasted', 'salted', 'slated', 'staled']

    ['retainers', 'ternaries'] ['generating', 'greatening']

    ['resmelts', 'smelters', 'termless']
17. Consider all the files on your PC. Write a program which checks for duplicate files in

    your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.
18. Write a program illustrating the object oriented features supported by Python.
19. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
20. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)

Reference Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. Paul Barry, “Head First Python a Brain Friendly Guide” 2nd Edition, O’Reilly, 2016
3. DainelY.Chen “Pandas for Everyone Python Data Analysis” Pearson Education, 2019

II B.TECH – II SEMESTER(R-19)

SubjectCode	TitleoftheSubject	L	T	P	C
19A10804	**Environmental Science**	3	0	0	3

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 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:

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 –

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 ErachBharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palani Swamy – Pearson education
(3) Environmental Studies by Dr.S.AzeemUnnisa, 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 byJ.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.

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III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50201	**MICROPROCESSORS AND MICROCONTROLLERS**	3	0	0	3

Course Objectives:

1. Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
2. Understand the Interfacing of 8086 with various advanced communication devices
3. Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
4. To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
5. To understand Xilinx programming and understanding of Spartan FPGA board

Course Outcomes:

CO1 Understand the concepts of internal architecture, organization and Pin diagram of 8086,Functional block diagram of 8051 microcontroller, Basic architectural features, Physical memory of TMS320LF2407 DSP Controller, Xilinx, XC3000 and 4000 Series, Configurable Logic Blocks (CLB) , Input /Output Block (IOB) ,Programmable Interconnect Point (PIP), Spartan 3E and Virtex II pro FPGA boards.

CO2 Apply knowledge of various addressing modes and instruction set to write simple programs, data transfer instructions of the 8086 microprocessor and 8051 microcontroller, Xilinx 4000 Series.

CO3 Analyze the concepts of Minimum and Maximum mode of operation with Timing diagrams of 8086 microprocessor, Addressing modes and assembler directives of 8086,data transfer information through serial & parallel ports, properties of Microprocessors & Microcontrollers, DSP controllers.

CO4 Design and Develop simple programming exercises of 8086 microprocessor, 8051 microcontroller interfacing with other devices and its applications, FPGA based Xilinx-HDL Programming.

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	2								3	3	3
CO2	1	3	3	3	2							1	3	3	3
CO3	1	2	3	3	2							1	3	3	3
CO4	1	3	3	2	1							2	3	3	3

UNIT-I: INTRODUCTION TO MICROPROCESSORS

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams.

Learning Outcomes:

- To know about 8086 as one of digital computer platforms
- To know about Architecture and functions of 8086
- To understand about instruction set
- To know about pin and timing diagrams
- To know about processors CISC and ARM

UNIT II: ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

Learning Outcomes:

- To understand the programming features of assembly language as one of digital computer platforms
- To know about evaluation of expressions, strings
- To understand about interfacing with A/D-D/A converters
- To understand about interrupt structures and various service routines in 8086
- To know about data transfer scheme

UNIT III: 8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

Learning Outcomes:

- To understand about 8051 Microcontroller as one of the digital computer platforms
- To know about instruction sets of 8051
- To know about data transfer manipulations
- To understand and write programming using 8051
- To know about a few applications of 8051 like servo motor, stepper motor

UNIT IV: Introduction DSP Controller

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

Learning Outcomes:

- To know about features of DSP controller C2xx as one of the DCPs
- To know about various instruction sets, control registers of C2xx DSP core
- To know about mapping of external devices to the DSP core
- To know about assembly programming using the instruction sets of TMS320LF2407 DSP controller

UNIT V: FPGA

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

Learning Outcomes:

- To know about FPGA as one of the digital computer platforms
- To know about various types of FPGA
- To know about programmable inter connect points
- To understand about Xilinx-HDL programming
- To know about applications of FPGA with a case study

TEXT BOOKS

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085, Penram Intl. Publishing, 6th Edition, 2013

2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw - Hill Publications, 3rd Edition, 2013.

REFERENCE BOOKS

1. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
2. Microprocessor, Nilesh B Bahadure, PHI, 2010.

3. The 8051 Micro Controller Architecture, Programming and Applications by Kenneth J Ayala, Pearson International publishing (India).
4. Hamid A. Tolyat, DSP Based Electro Mechanical Motion Control, CRC press, 2004.

5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Web Sources: https://nptel.ac.in/courses/108/105/108105102/

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III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50202	**ELECTRICAL & ELECTRONIC MEASUREMENTS**	3	0	0	3

Course Objectives: The student has to acquire knowledge about:

1 The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
2 The measurements of RLC parameters using bridge principles.
3 The principles of magnetic measurements.
4 The principle of working of CRO and its applications.

Course Outcomes:

CO1 Remember and understand the various working principles of instruments and equipments used for the measurement of various parameters like Voltage, Current, Power, Energy, P.F, Resistance, Inductance and Capacitance.

CO2 Apply the concepts to Extend the range of ammeters and voltmeters, measurement of various parameter by DC and AC bridge and different characteristics of periodic and aperiodic signals using CRO.

CO3 Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.

CO4 Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

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

UNIT- I MEASURING INSTRUMENTS

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range. Numerical Problems

Learning Outcomes: At the end of the unit, the student will be able to

1. Understand the operation of different instruments.
2. Know the different types of errors and their compensation
3. Distinguish between MC and MI type of instruments
4. Know how control of torque is required in measurements
5. Solve numerical examples and interchangeability of ammeters as voltmeters and vice-versa

UNIT – II MEASUREMENT OF POWER, POWER FACTOR AND ENERGY

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter.Numerical examples

Learning Outcomes: *At the end of the unit, the student will be able to*

1. Understand the working principles and construction of different types of Energy meters
2. Calculate the different parameters of the meters
3. Distinguish between low and high power factor ranges in watt meters
4. Know about occurrence of errors and need for compensation for precise and accurate measurement
5. Distinguish between 3-ϕ power factor meters and Energy meters

UNIT – III INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples-Numerical Examples

Learning Outcomes: *At the end of the unit, the student will be able to*

1. Understand the principles and working of various measuring instruments used to detect electrical circuit parameters R,L,C
2. Design the various voltage and current measuring instruments for the various electric / magnetic field applications
3. Distinguish between CTs and PTs
4. Distinguish between DC and AC potentiometers
5. Identify errors in measurements and to mitigate them for desired precision and accuracy

UNIT – IV D.C & A.C BRIDGES

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge.-Numerical Examples

Learning Outcomes: *At the end of the unit, the student will be able to*

1. Understand the bridge configurations and their applications for various ranges of resistance measurement
2. Compute the unknown parameters of Inductance using the bridges
3. Compute the unknown parameters of Capacitance using the bridges
4. Be able to select appropriate bridge configuration for measurement of R,L and C
5. Identify errors in measurements and to mitigate them for desired precision and accuracy

UNIT – V CRO AND DIGITAL METERS

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns. Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer

Learning Outcomes: *At the end of the unit, the student will be able to*

1. Understand the operation of CRO and its parts
2. Know about various applications of CRO
3. Understand various Lissajous patterns
4. Know about Digital voltmeters and Distinguish between analog and digital meters
5. Know about measurement of speed using Tachometer and to distinguish between analog and digital ones

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpatRai& Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.

REFERENCE BOOKS:

1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.

Web Sources: https://nptel.ac.in/courses/108/105/108105153/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A50203	ANALOG ELECTRONICS CIRCUITS	2	0	0	2

Course Objectives:

1 To give understanding of various types of amplifier circuits such as large signal and tuned amplifiers.
2 To familiarize the concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
3 To explain clippers, clampers, switching characteristics of transistors.
4 To construct various multivibrators using transistors.

Course Outcomes:

Upon completion of the course, the students will be able to:
CO1 Design and realize different classes of power amplifiers and tuned amplifiers useable for audio and radio applications.
CO2 Utilize the concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations.
CO3 Understand the applications of diode as integrator, differentiator, clippers, clampler circuits..
CO4 Understand switching characteristics of diodes and transistors.
CO5 Design mutivibrator circuits for various applications.

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

UNIT –I: POSITIVE & NEGATIVE FEEDBACK IN AMPLIFIERS Classification of amplifiers, Concepts of feedback – Classification of feedback amplifiers – General characteristics of negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems. Condition for oscillations. RC and LC type Oscillators – Frequency and amplitude stability of oscillators – Generalized analysis of LC oscillators, Quartz, Hartley, and Colpitts Oscillators – RC-phase shift and Wien-bridge oscillators.

Learning Outcomes:

- Knowledge about Classification of feedback amplifiers and characteristics of negative feedback amplifiers
- Understand the RC and LC type Oscillators and Generalized analysis of LC oscillators

UNIT – II: LARGE SIGNAL AMPLIFIERS Class A Power Amplifier, Maximum Value of Efficiency of Class – A Amplifier, Transformer Coupled Amplifier, Push Pull and Complimentary Symmetry Class B and Class AB Power Amplifiers – Principle of operation of class –C Amplifier, Transistor Power Dissipation, Heat Sinks.

Learning Outcomes:

- Knowledge about Class A Power Amplifier, Class B and Class AB Power Amplifiers
- Analyze thePush Pull and Complimentary Symmetry Class B and Class AB Power Amplifiers and class – c Amplifier.

UNIT – III: TUNED AMPLIFIERS Introduction, Q-Factor, Small Signal Tuned Amplifiers, Effect of Cascading single Tuned amplifiers on Bandwidth, Effect of Cascading Double Tuned amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of Tuned amplifiers.

Learning Outcomes:

- Knowledge about Small Signal Tuned Amplifiers
- Analyze the Effect of Cascading single Tuned amplifiers on Bandwidth

UNIT – IV

Linear Wave Shaping: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator. Non-Linear Wave Shaping: Diode clippers, Transistor clippers, Clipping at two independent levels. Clamping Operation, Clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem, Practical Clamping Circuits.

Learning Outcomes:

- Knowledge about High pass and low pass RC circuits
- Analyze the Diode clippers, Transistor clippers, Clamping Operation

UNIT- V: Switching Characteristics of Devices: Diode as a Switch, Piecewise Linear Diode Characteristics, Diode Switching times, Transistor as a Switch, Break down voltages, Transistor in Saturation, Temperature variation of Saturation Parameters, Transistor-switching times. Multivibrators: Analysis and Design of Bistable, Monostable, AstableMultivibrators and Schmitt trigger using Transistors.

Learning Outcomes:

- Knowledge about Switching Characteristics of Devices
- Analyze theDesign of Bistable, Monostable, AstableMultivibrators and Schmitt trigger using Transistors.

TEXT BOOKS:

1. Electronic Devices and Circuits, David A. Bell – 5 thEdition, Oxford.
2. Millman‟s Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. PrakashRao, 2 Ed., 2008, TMH.

REFERENCES:

1. Integrated Electronics, Jacob Millman, Christos C Halkias, TMH
2. Introductory Electronic Devices and Circuits (Conventional flow version) – Robert T. Paynter, 7th Edition, 2009, PEI.
3. Microelectronic Circuits – Sedra / Smith – 5 th Edition – Oxford, 2009
4. Electronic Devices and Circuit Theory, Robert L.Boylestad, Louis Nashelsky, 9th Edition, Pearson Education.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A50204	**ELECTRICAL DISTRIBUTION SYSTEM ANALYSIS & AUTOMATION (PEC-I)**	3	0	0	3

Course Objectives:
- To know about fundamental aspects of distribution system
- To understand principle of distribution substations
- To know about classification of various loads
- To understand difference between conventional load flow studies of power system and distribution system load flow
- To know about evaluation of voltage droop and power loss calculations
- To know about distribution automation and management system, SCADA

Course Outcomes:

- To know and understand the basics of distribution systems and substations principles of SCADA, Automation distribution system and management
- understand To understand about modelling of various loads
- To perform distribution load flow solutions
- To evaluate power loss and feeder cost

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

UNIT-I: DISTRIBUTION SYSTEM FUNDAMENTALS

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

Learning Outcomes:
- To understand various distribution system classifications
- To know more about primary feeders rating, types
- To know about substation location, bus schemes, etc.
- To know about factors effecting the primary feeder loading

UNIT-II: DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS

Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. **Loads:** Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.

Learning Outcomes:
- To know about uniformly distributed loading in distribution substations
- To know about non-uniform distributed loading in distribution substations
- To know about classification of various types of loading
- To understand about modelling of various types of loads and shunt capacitor

UNIT-III: DISTRIBUTION SYSTEM LOAD FLOW

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

Learning Outcomes:
- To know about various distribution line models
- To know about step voltage regulator
- To know about line drop compensator
- To evaluate distribution load flow pattern using sweeping algorithms

UNIT-IV: VOLTAGE DROP AND POWER LOSS CALCULATION

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems

Learning Outcomes:
- To know about analysis of various distribution system configurations
- To know how to calculate percent power loss calculations
- To know about methods of calculating distribution feeder cost
- To understand about economic justification of capacitors
- To understand about installation of capacitors at various locations

UNIT-V: DISTRIBUTION AUTOMATION

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces.

Learning Outcomes:

- To know about basic concept of automation of distribution systems
- To know about various distribution management /automation systems and functions
- To know about Supervisory Control And Data Acquisition System
- To know about automation of feeders, substations, etc.
- To understand about database structures and interfacing

Text Books:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, Turan Gonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Books:

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.

Web Sources: https://nptel.ac.in/courses/108/107/108107112/

Course Outcomes:

- To understand basics of distribution systems and substations
- To understand about modelling of various loads
- To perform distribution load flow solutions
- To evaluate power loss and feeder cost
- To know the principles of SCADA, Automation distribution system and management

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50205	DC Drives (PEC-I)	3	0	0	3

Course Objectives: To get the student exposed to:

1 Understand the basic concepts of DC Motor fundamentals, mechanical systems.

2 Understand the concept of converter control

3 Design various chopper control techniques.

4 Understand the concept of closed loop control of DC Drives

5 Design digital control of DC Drives.

Course Outcomes: Student should be able

CO1 Understand the basics of high speed DC Motor Drives.
CO2 Understand the various characteristics of mechanical systems
CO3 To analyze different modes of operation of converters and control strategies
CO4 To understand basics of Chopper control and analysis
CO5 To know about closed loop and digital control strategies of DC drives

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

UNIT-I: DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS: Introduction to high speed drives and modern drives. Characteristics of mechanical system – dynamic equations, components of torque, types of load;

Learning Outcomes:

- To understand the basic concepts of high speed drives
- To understand the basic concepts of modern drives
- To understand the basic concepts of mechanical systems
- To understand the basic concepts of types of loads and characteristics

UNIT-II: CONVERTER CONTROL: Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

Learning Outcomes:

- Understand the concept of phase control of separately excited DC motor.
- Understand the concept of breaking mechanisms of DC motor.
- Understand the performance characteristics of 1-phase and 3-phase converters
- To distinguish between various modes of operation

UNIT-III : CHOPPER CONTROL: Introduction to time ratio control and frequency modulation; Class A,B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control – Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

Learning Outcomes:

- Understand the concept of Chopper Control
- Design of Chopper.

UNIT-IV: CLOSED LOOP CONTROL: Modelling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feedback elements - Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed DC drive.

Learning Outcomes:

- Understand Equivalent circuit, transfer function of self, separately excited DC motor.
- Designing of current and speed loops, P, PI and PID controllers.

UNIT-V: DIGITAL CONTROL OF D.C DRIVE: Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing.

Learning Outcomes:

- Understand the concept of PLL and micro controlled DC drives.
- Design of Speed detection and gate firing.

TEXT BOOKS

1. Gopal K Dubey, Power Semiconductor controlled Drives, Prentice Hall Inc., New Jersey, 1989.
2. R. Krishnan, Electric Motor Drives –Modeling, Analysis and Control, Prentice-Hallof India Pvt. Ltd., New Delhi, 2003.

REFERENCES

1. Gobal K.Dubey, Fundamentals of Electrical Drives, Narosal Publishing House, New Delhi, 2001.
2. Bimal K. Bose, Modern Power Electronics and AC Drives, Pearson Education Pvt. Ltd., NewDelhi, 2003.
3. VedamSubramanyam, Electric Drives – Concepts and Applications, Tata McGraw-Hill publishing company Ltd., New Delhi, 2002.
4. P.C Sen, Thyristor DC Drives, John wiely and sons, New York, 1981
5. Power Electronics By M. D. Singh and K.B. Khanchandani, 2nd Edition, Tata McGraw Hill, 2008.

Web Sources:

1. https://nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108/108/108108077/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A50206	**Advanced Control Systems (PEC-I)**	3	0	0	3

Course Objectives: This course introduces

- To give an overview of system analysis and design based on state space.
- Design of state feedback control and observer.
- The properties of Nonlinearities.
- Stability analysis for linear and nonlinear systems.
- Design of optimal control problem.

Course Outcomes:

1. To understand and develop models for full order and reduced order based observers, phase plane analysis of non-linear control systems basic principles of optimal control and solving discrete and continuous linear state regulator systems
2. To understand and develop models for Lyapunov's stability criterion
3. To know about describing function and analyse systems
4. To develop state variable models and its solution for various systems t understand

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

UNIT – I STATE VARIABLE DISCRIPTION

State space representation of systems – State diagrams for continuous time state models – Solution of state equations – State transmission matrix. controllability and observability for continuous time systems, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms – Numerical problems

Learning Outcomes: At the end of the unit the student will be able to:

- Obtain the State Space Modeling for linear time-invariant systems.
- Know about controllability of a system
- Know about observability of a system
- To understand tests for controllability and observability of a given system.

UNIT – II POLE PLACEMENT OBSERVER

Fundamental theorem of feedback control - Pole assignment by state feedback using Ackermann's formula – Eigen structure assignment problem-Design of full order observer using Ackermann's formula. - Full order Observer based controller design. Reduced order observer design - Numerical problems

Learning Outcomes: At the end of the unit the student will be able to:

- To know about design of pole assignment
- To know about state observer using state feedback
- To know about full order based controller design aspects
- To know about reduced order design aspects

UNIT – III DESCRIBING FUNCTION AND PHASE-PLANE ANALYSIS

Introduction to nonlinear systems, Types of nonlinearities, Concepts of describing functions, describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems – Numerical problems

Learning Outcomes: At the end of the unit the student will be able to:

- Develop the describing function for the nonlinearity present to assess the stability of the system
- To understand about classification of describing functions
- To understand about construction of trajectories
- To know about Phase plane analysis of non-linear control systems

UNIT-IV STABILITY ANALYSIS

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems – Numerical problems.

Learning Outcomes: At the end of the unit the student will be able to:

- To understand about Lyapunov stability
- Develop Lyapunov function for the stability analysis of nonlinear systems
- To understand Lyapunov instability theorems
- To understand and solve direct method of Lyapunov with numerical examples

UNIT –V OPTIMAL CONTROL

Discrete time linear state regulator – Algorithm for the solution, Use of observer in implementing the control law. Continuous time linear state regulator – Matrix Riccati equation. Time invariant linear state regulator – the reduced matrix Riccati equation - An iterative method to solve the reduced matrix Riccati equation – Numerical problems

Learning Outcomes: At the end of the unit the student will be able to get exposed to:

- Introduction to optimal control
- To know about discrete and continuous time linear state regulators
- To understand about Matrix Riccati equation
- To solve numerical problems using the above methods

TEXT BOOKS:

1. Modern Control System Theory by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Modern Control Engineering by K. Ogata, Prentice Hall of India, 3rd edition, 1998

REFERENCE BOOKS:

1. Digital Control and State Variable Methods by M. Gopal, Tata Mc Graw-Hill, 1997.
2. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell, 6th Edition, Pearson, 2010.
3. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003
4. Control Systems, by N. K. Sinha, New Age International, 3rd Edition, 2005.
5. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E.Salgado, Pearson, 2000
6. Feedback Control System Analysis and Synthesis (Electrical & Electronics Engineering), by D'Azzo, Jhon J, Second revised edition, Mc Graw-Hill.

Web Sources: https://nptel.ac.in/courses/108/103/108103007/

Course Outcomes:

- To develop state variable models and its solution for various systems
- To understand and develop models for full order and reduced order based observers
- To know about describing function and analyse systems
- To understand about phase plane analysis of non-linear control systems
- To understand and develop models for Lyapunov's stability criterion

To understand basic principles of optimal control and solving discrete and continuous linear state regulator systems

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50207	**ENERGY STORAGE SYSTEMS (OEC-I)**	3	0	0	3

Course Objectives:

1. To understand the need for energy storage
2. To understand about the fundamentals of ESS
3. To know about types, features and benefits of ESS
4. To know about various management and control including market potential of ESS
5. To study about various applications of ESS

Course Outcomes:

1. To get exposed to latest technology of ESS
2. To understand the Principle, features and benefits of ESS
3. To understand about marketing and management strategies of ESS in working environment in future
4. To distinguish wide variety of applications of EES for practical applications
5. To know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy sources

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

UNIT – I: Fundamentals of ESS

Definitions, Characteristics of ESS, Electricity and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies

Learning Outcomes:

- To know about the fundamentals of ESS
- To know about emerging needs and roles of ESS
- To know about various classifications of ESS
- To understand about roles of energy storage technologies

UNIT – II: Types and features of ESS Technologies

Mechanical storage systems, Electromechanical storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability

Learning Outcomes:

- To understand about various types of ESS technologies
- To understand about standards for ESS
- To learn about power and discharge duration of ESS
- To know about preliminaries of ESS operating cost
- To understand about power quality issues and reactive power capability of ESS

UNIT – III: Storage Benefits
Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits

Learning Outcomes:

- To know various storage benefits
- To distinguish between application specific benefits and identical benefits
- To know about dynamic operating benefits
- To understand about electric service power quality and reliability issues
- To learn about energy benefits from storage systems

UNIT – IV: EES Market and Management
Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity

Learning Outcomes:

- To understand about management of ESS technologies
- To distinguish between internal and external configuration of ESS
- To know about battery SCADA system and storage modularity
- To understand about market potential estimations
- To distinguish between demand change and time-of-use energy cost management

UNIT – V: Applications of EES
Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications

Learning Outcomes:

- To know about various ESS
- To distinguish between power, capacity, energy applications of ESS

- To distinguish between electric supply and ancillary applications
- To distinguish between end user/utility customer applications
- To understand about the importance of distributed energy storage applications

Text Books:

1. James M. Eyer, Joseph J. Iannucci and Garth P. Corey, “Energy Storage Benefits and Market Analysis”, Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board – White paper.

Reference Book:

1. Jim Eyer, Garth Corey, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

Web Courses: https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50208	**ELECTRICAL ENGINEERING MATERIALS (OEC-I)**	3	0	0	3

Course Objectives: To make the students learn about

1. Classification of materials.
2. Properties of materials and its applications.
3. Domestic wiring and earthing

Course Outcomes: After completing the course, the student should be able to:

CO1 Understand the classification of materials, domestic wiring materials and earthing.
CO2 Analyze the properties of different electrical materials
CO3 Apply where the materials are applicable based on properties of materials
CO4 Design and develop Residential wiring, godown wiring and earthing.

	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	3
CO2	3	3	2	3		1	2			1		2	1	3	2
CO3	3	3	2	3		2	2			1		2	2	3	3
CO4	3	2		3		2	2			1		3	2	3	3

UNIT-I Conducting Materials

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting resistivity of electrical materials –electrical/mechanical/thermal properties of copper, aluminium, iron, steel, lead, tin and their alloys – applications.

Learning Outcomes: At the end of the unit, the student will be able to

1. Uunderstand the classification of conducting materials.
2. Analyze the properties of different conducting materials
3. Apply the materials where it is applicable
4. Know about electron configuration of atom

UNIT-II Dielectric and High Resistivity Materials

Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down– electrical and thermal effects, Polarization – electric, ionic and dipolar polarization. Effect of temperature and Frequency on dielectric constant of polar dielectrics. High

Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

Learning Outcomes: At the end of the unit, the student will be able to
1. Understand the classification of dielectric and high resistivity materials.
2. Analyze the properties of dielectric and high resistivity materials
3. Understand about concept of polarization and dipolar polarization
4. Apply the materials where it is applicable

UNIT-III Solid Insulating Materials

Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials - Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

Learning Outcomes: At the end of the unit, the student will be able to
1. Understand about various characteristics of solid insulating materials
2. Understand the classification of solid insulating materials.
3. Analyze the properties of solid insulating materials
4. Apply the materials where it is applicable

UNIT-IV Liquid & Gas Insulating Materials

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – Electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

Learning Outcomes: At the end of the unit, the student will be able to
1. Understand the classification of liquid insulating materials.
2. Analyze the properties of liquid insulating materials
3. Apply the materials where it is applicable
4. Understand about properties and classification of gaseous insulators

UNIT-V Domestic Wiring

Wiring materials and accessories – Types of wiring – Types of Switches - Specification of Wiring – Stair case wiring - Fluorescent lamp wiring- Godown wiring – Basics of Earthing – single phase wiring layout for a residential building.

Learning Outcomes: At the end of the unit, the student will be able to
1. Understand about wiring materials and accessories
2. Understand about earthing and wiring layout of domestic buildings
3. Design and develop Residential wiring
4. Know about go down wiring

Text Books:
1. Electrical Engineering Materials by G.K. Mithal, Khanna publishers, 2nd edition, 1991.
2. A course in Electrical Engineering Materials by R.K. Rajput, Laxmi publications, 2009.

Reference Books:
1. An Introduction to Electrical Engineering Materials by C.S. Indulkar and S. Thiruvengadam,

S Chand & Company, 2008.
2. Electrical engineering Materials by Technical Teachers Training Institute, Madras, McGraw Hill Education, 1st Edition, 2004.
3. A course in Electrical Engineering Materials Physics Properties & Applications by S.P. Seth, Dhanapat Rai& Sons Publications, 2018.

Web Courses: https://nptel.ac.in/courses/113/106/113106032/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50209	**Illumination Technology (OEC-I)**	3	0	0	3

Course Objectives

- To provide an introduction to the fundamentals of illumination engineering and architectural lighting design.
- To impart lighting fundamentals, measurement, and technology and their application in the analysis and design of architectural lighting systems

Course Outcomes:

The students will be able to:

- Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
- Perform calculations on photometric performance of light sources and luminaires for lighting design
- Evaluate different types of lighting designs and applications

	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	3
CO2	3	2	2	3	1		2			1		2	1	3	2
CO3	2	3	2	2	2		2			1		2	2	3	3

Unit I

Introduction of Light : Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semiindirect, Lighting scheme, General and localized

Learning Outcomes:

- To classify types of illumination
- To understand the factors affecting the lightning and methods of lightning

Unit II

Measurement of Light : Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source

Learning Outcomes:

- To understand the definitions of illumination, concepts of polar curves
- To calculate luminance and illumination at different cases

Unit III

Design of Interior Lighting : Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilization and factors affecting it, Illumination required for various work planes, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminance, Selection of utilization factor, reflection factor and maintenance factor, Determination of Lamp Lumen output taking into account voltage and temperature variations, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaire, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.

Learning Outcomes:

- To understand definitions of different factors related to illumination and special features for entrance staircase and industrial building
- To remember Indian standards recommendation and standard practices for illumination levels in various areas
- To evaluate wattage of each lamp, space to mounting height ratio for interior lightning

Unit IV

Design of Outdoor Lighting: Street Lighting: Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaire, Calculation of their wattage, Number and arrangement, Calculation of space to mounting height ratio, Calculation of illumination level available onroad

Learning Outcomes:

- To understand the requirements of good lighting and selection of lamp
- To design outdoor lighting
- To calculate wattage, number and space to mounting height ratio for outdoor lightning

Unit V

Design of Outdoor Lighting: Flood Lighting : Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio, Recommended method for aiming of lamp.

Learning Outcomes:

- To analyze and design outdoor lighting and terms related to different outdoor lightings

Text Books

1. D.C. Pritchard Lighting, Routledge, 2016
2. Jack L. Lindsey, Applied Illumination Engineering , PHI, 1991
3. John Matthews Introduction to the Design and Analysis of Building Electrical Systems, Springer, 1993
4. M.A. Cayless, Lamps and Lighting , Routledge, 1996

References:

1. IS CODE 3646
2. IS CODE 6665

Web Sources: https://nptel.ac.in/courses/108/105/108105061/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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****** DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES ******

IIIB.TECH – I SEMESTER(EEE)

Subject Code	Title of the Subject	L	T	P	C
19A55501	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

<u>Job Interviews</u> –Types of Job Interviews – Characteristics of a job interview - Interview Preparation Techniques –How to overcome Stage fright
<u>Group Discussions(GD)</u>: 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

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.

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50210	**AC MACHINES LAB**	3	0	0	3

COURSE OUTCOMES:

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

CO1 Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
CO2 Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.
CO3 Predetermine the regulation of Alternator by Zero Power Factor method
CO4 X_d and X_q determination of salient pole synchronous machine.
CO5 Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

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

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance &m.m.f methods.
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of X_d and X_q of a salient pole synchronous machine.
10. V and inverted V curves of a 3-phase synchronous motor.

Reference Books:

1. Laboratory Manual for Electrical Machines by D. P.Kothari and B. S. Umre, I.K International Publishing House Pvt. Ltd, 2017.
2. A Laboratory Course in Electrical Machines by D.R. Kohli and S.K. Jain, NEM Chand & Bros.

Virtual Labs:

- **http://vem-iitg.vlabs.ac.in/**
- http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
- http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

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****** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ******
III B. TECH – I/II SEMESTER(R-19)

Subject Code	Title of the Lab	L	T	P	C
19A55402	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

<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								✓				
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.

<u>WEB LINKS</u>

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

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.

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A50211	**Electronic Circuits Lab**	0	0	3	1.5

Course Objectives

1 To perform the analysis, design, and test of various electronic circuits.

2 Use hardware/software tools to characterize the behavior of circuits.

COURSE OUTCOMES

Students will be able to

CO1 Design, simulate and test diode as a rectifier, clipper and clamper.

CO2 analyze, design, simulate and test the low frequency amplifier circuits using BJT.

CO3 analyze, design, simulate and test the cascade, cascade and darlington amplifier circuits.

CO4 write and prepare a lab report that details design procedures and experimental results.

CO5 work in a team using available resources to design circuits to meet a given specification

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	3	2	2	1		3		3	2	3	3	3
CO2	2	3	3	2	3	3	2		3		3	2	3	3	3
CO3	2	3	3	2	3	3	2		3		3	2	3	3	3
CO4	2	3	3	3	2	2			3		3	2	3	3	3
CO5	2	2	3		3	1	2		3		3	2	2	3	1

Note: The students are required to design the electronic circuit and they have to perform the analysis through simulator using Multisim/ Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

LIST OF EXPERIMENTS:

1. Rectifiers

a. To construct half wave, full wave & bridge rectifiers with and without filters - Calculation of ripple factors.

b. Simulation of rectifiers and trace their output waveforms with and without filters.

2. Clipper & Clamper circuits using diodes

a. To design, construct and observe output of Positive, negative, biased and combinational clippers.

b. To design, construct and observe output of i. Positive, negative and biased clampers.

3. Biasing Circuits

a. To design, construct and test different biasing circuits using BJTs,

b. To simulate the biasing circuits and obtain the Q point

4. RC coupled amplifier

a. To design, construct and obtain frequency response of the circuit

b. To measure signal handling capacity, input and output impedance

c. Compare performance practically and through simulation

5. Emitter follower

a. To design, construct and obtain frequency response of the circuit

b. To measure signal handling capacity, input and output impedance

c. Compare practical and simulated results

6. Cascade Amplifier

a. To design, construct and obtain frequency response of a two stage RC coupled amplifier

b. To measure signal handling capacity, input and output impedance

c. Compare performance practically and through simulation

7. Darlington pair To design, construct and obtain frequency response practically and through simulation

8. Cascode amplifiers To design, construct and obtain frequency response practically and through simulation

Equipment required for Laboratory Software:

i. Multisim/ Pspice/Equivalent Licensed simulation software tool ii. Computer Systems with required specifications Hardware:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators

4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats, Decade Capacitance Boxes
6. Ammeters (Analog or Digital), Voltmeters (Analog or Digital)
7. Active & Passive Electronic Components
8. Bread Boards
9. Connecting Wires, CRO Probes etc.

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ELECTRICAL AND ELECTRONICS ENGINEERING

Socially Relevant Projects (19A50212)

6. Energy Auditing
7. Solar Water Pumping Systems
8. Automatic Traffic Light Control Systems
9. Building Electrical Safety Measures
10. Electrical Protection Systems in Agricultural Fields

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****** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ******
(Mandatory course)

III B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A55404	**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

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.

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

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-IVLocal 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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60201	**POWER SYSTEM ANALYSIS**	3	0	0	3

Course Objectives:

To make the students learn about:

- The use of per unit values and graph theory concepts, solving a problem using computer.
- Formation of Y_{bus} and Z_{bus} of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability.

Course Outcomes:

After completing the course, the student should be able to do the following:

- Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations.
- Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results.
- Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability. Demonstrate the use of these techniques through good communication skills.
- Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations.
- Design and select efficient Circuit Breakers to improve system stability. Implement them in resolving various day-to-day issues ina Power System.

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

UNIT -I p. u. system and Y_{bus} formation

Per-Unit representation of Power system elements - Per -Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, Y_{Bus} formation by Direct and Singular Transformation Methods, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to

1. Understand the concepts of Per-Unit equivalent system
2. To know about basic graph theory concepts as applied to power systems
3. To compute the Bus Incidence matrix
4. To formulate Y_{Bus} matrix using different methods.

UNIT -II Formation of Z_{bus}

Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Z_{Bus} for the changes in network (Problems)

Learning Outcomes: At the end of the unit, the student will be able to

1. Analyze the concept of formation of Z_{Bus}
2. To develop algorithm for modification of Z_{Bus}.
3. Determine the Z_{Bus} matrix
4. To compute modified Z_{Bus} for the changes in network.

UNIT –III Power flow Analysis

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

Learning Outcomes: At the end of the unit, the student will be able to

1. Understand about Load flow Solution for Simple Power Systems.
2. To determine the Load flow Solution using Gauss Seidel iterative method
3. To determine the Load flow Solution using NR method in polar form
4. To determine solution of DLF and FDLF
5. To know about comparison of various Load flow solutions

UNIT – IV Short Circuit Analysis

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG and LLLG faults with and without fault impedance, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to

1. Analyze the Calculations of MVA Calculations, Fault levels
2. To understand about Sequence Components.
3. Calculate the fault current using sequence impedances for unsymmetrical faults
4. To determine the fault current for symmetrical faults

UNIT –V Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Learning Outcomes: At the end of the unit, the student will be able to

1. Learn the stability and types of stability
2. Analyze the stability using equal area criterion
3. To understand methods to improve stability
4. Understand and evaluation of fault clearing angle and time

TEXT BOOKS:

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath & D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.

REFERENCE BOOKS:

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

Web Sources: https://nptel.ac.in/courses/108/105/108105067/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech II-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A60202	**DIGITAL SIGNAL PROCESSING**	3	0	0	3

Course Objectives:

1 Understanding the fundamental characteristics of signals and systems.
2 Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling
3 Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform
4 Realization of FIR and IIR digital filters

Course Outcomes:

CO1 Compute the z-transform of a sequence, identify its region of convergence, and compute the inverse z-transform by partial fractions.
CO2 Compute the linear and circular convolutions of discrete-time sequences
CO3 Realize various filters and finding solution for various filter designs
CO4 Understanding of different transformation techniques

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

Syllabus:

Unit-1: INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems.

At the end of the unit student will be able to

- Understand the discrete time signals.(L1)
- Study about stability and causality of linear shift invariant systems.(L2)

Unit-2: DISCRETE FOURIER SERIES AND FAST FOURIER TRANSFORMS

Properties of Discrete Fourier Series, DFS Representation of Periodic Sequences, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences Using DFT, Computation of DFT. Relation between Z-Transform and DFS, Fast Fourier Transforms (FFT)-Radix2 Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT and FFT for Composite N.

At the end of the unit student will be able to

- Understand the concept of DFT and its properties.(L1)
- Find N-Point DFT/FFT for a given signal/sequence.(L2)

Unit-3: REALIZATION OF DIGITAL FILTERS

Z-Transforms: Concept, Properties, Region of Convergence, and Applications; Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant-Coefficient Difference Equations, Basic Structures of IIR Systems, Transposed Forms, Basic Structures of FIR Systems, System Function.

At the end of the unit student will be able to do

- Understands signal block diagram representations of difference equations that realize digital filters(L1)

Unit-4: IIR AND FIR DIGITAL FILTERS

Analog Filter Approximations-Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations, Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR Filters, Illustrative Problems.

At the end of the unit student will be able to

- Realization of different structures for IIR& FIR filters(L2)
- Design of IIR & FIR filters using different techniques. (L4)
- Compare FIR and IIR filters (L5)

Unit-5: MULTIRATE DIGITAL SIGNAL PROCESSING

Basic Sample Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Polyphase Decomposition, Nyquist Filters. Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Signal Compression, Trans multiplexers, Discrete Multitone Transmission of Digital Data.

At the end of the unit student will be able to

- Design of IIR & FIR filters using different techniques. (L4)
- Compare FIR and IIR filters (L5)

Text Books:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 2007.
2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd edition, 2009.

Reference Books:

1. Signals - Discrete Time Signal Processing – Allan V Oppenheim and Systems, Pearson
2. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
3. A Text book on Digital Signal processing – R S Kaler, M Kulkarni, Umesh Gupta, I K International Publishing House Pvt. Ltd., 2009

Web Sources: https://nptel.ac.in/courses/108/106/108106151/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60203	**Power System Protection**	3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about:
- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from them

Course Outcomes: At the end of the course the student should be able to:

- Distinguish between the principles of operation of electromagnetic relays, static relays and microprocessor based relays
- Determine the unprotected percentage of generator winding under fault occurrence, numerical problems for arc interruption and recovery in circuit breakers
- Identify various types of the relays in protecting feeders, lines and bus bars Design the protection system for transformers
- Demonstrate the protection of a power system from over voltages

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

UNIT – I Fuses and Circuit breakers:

Fuses: Definitions, characteristics, types, HRC fuses.

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Current Chopping and Resistance Switching - CB Ratings and Specifications: Types and Numerical Problems. – Auto Reclosures. Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers.

Learning outcomes:
- To understand the purpose and operation of fuses.
- To understand the occurrence of arc and different types of circuit breakers
- To classify among different types of fuses and circuit breakers
- To do numerical examples for selecting ratings of fuses and CBs

UNIT – II Relays

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static

Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

Learning outcomes:

- To understand the operation of different types of relays
- To analyze the importance of zones of protection
- To be able to classify among electromagnetic relays
- To be able to classify among static relays
- To be able to classify among numerical relays

UNIT – III Protection of Generators & Transformers

Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected. **Protection of Transformers:** Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problems.

Learning outcomes:

- To understand various types of faults and abnormal conditions that occur in generators
- To understand various types of faults and abnormal conditions that occur in transformers
- To be able to calculate percentage winding and CT ratios
- To apply different protection schemes for the occurrence of faults in generators
- To apply different protection schemes for the occurrence of faults in transformers

UNIT – IV Protection of Feeders & Lines

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.

Learning outcomes:

- To understand protection schemes of feeders
- To understand protection schemes of bus bars
- To elucidate the protection of transmission lines
- To understand about over current relays
- To know about what is meant by 3-zone protection

UNIT – V Over Voltages in Power Systems

Generation of Over Voltages in Power Systems.-Protection against Lightning over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

Learning outcomes:

- To understand the concept of Generation of over voltages
- To analyze various methods of protection for over voltages in power systems
- To know about Lightning arresters
- To understand about Insulation coordination

TEXT BOOKS:

1. Power System Protection and Switchgear, Badri Ram, D.N Viswakarma, TMH Publications, 2011.
2. Switchgear and Protection, Sunil S Rao, Khanna Publishers, 1992.

REFERENCE BOOKS:

1. Electrical Power Systems, C.L.Wadhwa, New Age international (P) Limited, Publishers, 2012.
2. Transmission network Protection, Y.G. Paithankar ,Taylor and Francis,2009.
3. Power system protection and switch gear, Bhuvanesh Oza, TMH, 2010.

Web Courses: https://nptel.ac.in/courses/108/106/108106151/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60204	**Analog and Digital IC Applications (PEC-II)**	3	0	0	3

(Professional Elective – II)

Course Objectives:

The main objectives of the course are:

1 To introduce the basic building blocks of linear & digital integrated circuits.

2 To learn the linear and non - linear applications of operational amplifiers.

3 To introduce the theory and applications of 555 and PLL.

4 To learn the theory of ADC and DAC

5 To understand different families of digital integrated circuits and their characteristics.

Course Outcomes:

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

CO1 Understand the basic concepts of Op -AMPs, characteristics and specifications.

CO2 Design circuits using operational amplifiers for various applications .

CO3 Develop, apply and analyze circuits for advanced applications using Opamps, PLL, VCO and Analog multipliers.

CO4 Understand different families of digital integrated circuits and their characteristics

CO5 Design various and sequential circuits using digital ICs.

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

SYLLABUS

UNIT -I: Operational Amplifier Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 OpAmp, 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.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different Offsets present in Op amp & nullification circuits.
- Examine performance of Op-Amp in open loop and closed configurations.
- Analyse emitter-coupled differential amplifier.
- Compare ideal and practical Op-Amps.

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.

Learning Outcomes:

- Able to understand IC-555 & IC 565 Applications
- Learn about Characteristics of Band pass, Band reject and All Pass Filters

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.

Learning Outcomes:

- Able to understand Data Converters and basic DAC techniques.
- Learn about Different Types of ADCs - Parallel Comparator Type ADC.

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.

Learning Outcomes:

- Able to understand Data Converters and basic DAC techniques.
- Learn about Different Types of ADCs - Parallel Comparator Type ADC.

UNIT -V: Sequential Logic IC’s 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.

Learning Outcomes:

- Able to understand Sequential Logic IC's and Memories.
- Understand about 74XX & CMOS 40XX Series ICs
- Learn about ROM Architecture, Types of ROMS & Applications.

TEXT BOOKS: 1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.

Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003. 3. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

REFERENCE BOOKS: 1. Op Amps and Linear Integrated Circuits-Concepts and Applications James M. Fiore, Cengage Learning/ Jaico, 2009.

2. Operational Amplifiers with Linear Integrated Circuits by K.Lal Kishore – Pearson, 2009.

3. Linear Integrated Circuits and Applications – Salivahana, TMH.

4. Modern Digital Electronics – RP Jain – 4/e – TMH, 2010.

5. Digital Design Principles and Practices – John. F. Wakerly 3/e, 2005. Operational Amplifiers with Linear Integrated Circuits, 4/e William D.Stanley, Pearson Education India, 2009

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ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60205	**Programmable Logic Controllers (PEC-II)**	3	0	0	3

Course Objectives: To get the student exposed to:

1 Understand the basic functions and types of PLCs
2 Get exposure of Easy Veep software, its applications
3 Classification of PLCs and applications
4 Programming using PLCs
5 Troubleshooting aspects using PLCs

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

CO1 Understand different types of PLCs

CO2 Understand the usage of Easy Veep software

CO3 Understand the hardware details of Allen Bradley PLC

CO4 Programming of PLCs

CO5 Know about few applications of PLCs in different fields of Science and Technology

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

UNIT-I
Introduction:
Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

Learning Outcomes:

- To understand about basic functions of PLCs
- To know about classification of PLCs
- To distinguish between PLCs and Mechanical relays
- To know about Processor and I/O cards

UNIT-II

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

Learning Outcomes:

- To know about Easy Veep software
- To know about Logic diagrams
- To understand about Search engine
- To know about interfacing of PC and PLCs

UNIT-III

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD),Basic programming and applications, Cascade control – subroutine, Different programs.

Learning Outcomes:

- To know about basic features of PLCs
- To know about various instructions of PLC
- To know about various PLC versions
- To understand about Cascade control and subroutines

UNIT-IV

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions – Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

Learning Outcomes:

- To know about various Programming instructions
- To understand Math instructions in PLCs
- To know about Logical instructions
- To understand about Communications with PLC using set up and monitoring

UNIT-V

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Learning Outcomes:

- To know about analog and digital parameters in certain PLCs

- To apply PLCs for control system stability aspects
- To know about troubleshooting techniques
- To identify few applications of PLCs in Science and Technology fields

Text Books:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

References:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Web Courses: https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-21(SM)%20(IA&C)%20((EE)NPTEL).pdf

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60206	**Introduction to Embedded System Design (PEC-II)**	3	0	0	3

COURSE OBJECTIVES

1 To provide an overview of design principles of Embedded System.

2 To provide clear understanding about the role of firmware , operating systems in correlation with hardware systems.

COURSE OUTCOMES

CO1 Expected to understand the selection procedure of Processors in the Embedded domain.

CO2 Design Procedure for Embedded Firmware.

CO3 Expected to visualize the role of Real time Operating Systems in Embedded Systems.

CO4 Expected to evaluate the Correlation between task synchronization and latency issues

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

UNIT I Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Learning Outcomes:

- Able to understand History of Embedded Systems, Classification, Major Application Areas
- Understand knowledge about Purpose of Embedded Systems

UNIT II Typical Embedded System Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Learning Outcomes:

- Able to Typical Embedded System Core
- Understand knowledge about Memory: ROM, RAM, Memory according to the type of Interface and Onboard and External Communication Interfaces.

UNIT III Embedded Firmware Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Learning Outcomes:

- Able to understand Embedded Firmware Reset Circuits
- Understand knowledge about Embedded Firmware Design Approaches and Development Languages.

UNIT IV RTOS Based Embedded System Design Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Learning Outcomes:

- Understand RTOS Based Embedded System Design
- Understand knowledge about Types of Operating Systems, Tasks, Process and Threads..

UNIT V Task Communication Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Learning Outcomes:

- Understand Task Communication Shared Memory
- Understand knowledge about Task Communication/Synchronization

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill
2. Embedded Systems - Raj Kamal, TMH.
3. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

References:

1 Embedded Systems – Lyla, Pearson, 2013
3. Embedded System design : S. Heath (Elsevier)
4. An Embedded Software Primer - David E. Simon, Pearson Education.
5. Embedded microcontroller and processor design: G. Osborn (Pearson)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60207	**Renewable Energy Sources (OEC-II)**	3	0	0	3

Course Objectives: At the end of the course the student will be able to

1. Identify various sources of Energy and the need of Renewable Energy Systems.
2. Understand the concepts of Solar Radiation, Wind energy and its applications.
3. Distinguish between solar thermal and solar PV systems
4. Interpret the concept of geo thermal energy and its applications.
5. Understand the use of biomass energy and the concept of Ocean energy and fuel cells.

Course Outcomes:

1. To distinguish between various alternate sources of energy for different suitable application requirements
2. To differentiate between solar thermal and PV system energy generation strategies
3. To understand about wind energy system
4. To get exposed to the basics of Geo Thermal Energy Systems
5. To know about various diversified energy scenarios of ocean, biomass and fuel cells

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

UNIT -I Solar Energy

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning outcomes:

1. To understand about solar thermal parameters
2. To distinguish between flat plate and concentrated solar collectors
3. To know about thermal storage requirements
4. To know about measurement of solar radiation

UNIT – II PV Energy Systems

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning outcomes:

1. Understand the concept of PV effect in crystalline silicon and their characteristics
2. Understand other PV technologies
3. To know about electrical characteristics of PV cells & modules
4. To know about grid connected PV systems

UNIT - III Wind Energy

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning outcomes:

1. To understand basics of wind energy conversion and system
2. To distinguish between VAWT and HAWT systems
3. To understand about design considerations
4. To know about site selection considerations of WECS

UNIT - IV Geothermal Energy

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning outcomes:

1. Understand the Geothermal energy and its mechanism of production and its applications
2. Analyze the concept of producing Geothermal energies
3. To learn about disadvantages and advantages of Geo Thermal Energy Systems
4. To know about various applications of GTES

UNIT -V Miscellaneous Energy Technologies

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning outcomes:

1. Analyze the operation of tidal energy
2. Analyze the operation of wave energy
3. Analyze the operation of bio mass energy
4. Understand the principle, working and performance of fuel cell technology

5. Apply these technologies to generate power for usage at remote centres

Text Books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

References:

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.

Web Sources: https://nptel.ac.in/courses/121/106/121106014/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60208	**INSTRUMENTATION (OEC-II)**	3	0	0	3

Course Objectives: The student has to acquire knowledge about:

- Measuring system, Common errors, Objectives of Measuring systems
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems
- Measuring various meters and analyzers
- Basic transducers and their usage in various measurements

Course Outcomes: To know about

- Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques
- Various telemetry systems and basic operation of Data acquisition systems, measuring meters and signal analyzers
- Transducers and their measurement of electrical and non-electrical quantities
- The application of the above as a prerequisite topics to SCADA in power systems, state estimation theory, etc.

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

UNIT-I: INSTRUMENT ERRORS

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Spam & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

Learning outcomes:

At the end of the unit student will be able to

- Understand the concept of generalized measurement system.
- Know about the static and dynamic characteristics.
- Solve problems related to statistical Analysis of Random Errors.
- Analyze the test signals and modulation phenomenon.
- Be able to solve Numerical problems

UNIT-II: DATA TRANSMISSION AND TELEMETRY

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General

Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

Learning outcomes:

At the end of the unit student will be able to

- Understand the concepts of different modulations and compare different types of modulations in telemetry system.
- Know about the various telemetry systems and basic operation of Data acquisition systems.
- Distinguish between pulse code and amplitude modulation techniques
- Distinguish between analog and digital Data Acquisition Systems

UNIT-III: SIGNAL ANALYZERS

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers-Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

Learning outcomes:

At the end of the unit student will be able to

- Understand the principles of Wave Analyzers.
- Demonstrate the applications of Wave Analyzers.
- Be able to distinguish between harmonic and spectral wave analyzers
- Distinguish between peak, rms, impedance and Q-factor meters

UNIT-IV: TRANSDUCERS

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

Learning outcomes:

At the end of the unit student will be able to

- Understand the working principle, characteristics of various transducers
- Understand about applications of various transducers
- Distinguish between Resistive, Inductive and Capacitive transducers
- Distinguish between Piezo electric and Photo electric transducers
- Know about use of various transducers in different electrical field applications.

UNIT-V: MEASUREMENT OF NON-ELECTRICAL QUANTITIES

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

Learning outcomes:

At the end of the unit student will be able to

- Learn about measurement the various non-electrical quantities such as pressure, temperature, displacement, velocity
- Understand the concepts of measuring of various non-electrical quantities
- Know about liquid level measurement

- Know about force and torque measurements
- Know the applications of transducers in various industries

TEXT BOOKS:

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India, 2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co., 2012.

REFERENCE BOOKS:

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e., 2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India., 1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3rd re print, 2009.

Web Courses: https://nptel.ac.in/courses/108/105/108105064/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

III B. Tech –II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A60209	**INDUSTRIAL ELECTRICAL SYSTEMS (OEC – II)**	3	0	0	3

Course Objectives:

- To understand the various electrical system components
- To know the residential and commercial electrical systems
- To study the illumination systems
- To discuss about the industrial electrical systems

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the electrical wiring systems for residential, commercial and industrial consumers,representing the systems with standard symbols and drawings, SLD.
- Understand various components of industrial electrical systems.
- Analyze and select the proper size of various electrical system components.

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

UNIT- I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Learning Outcomes:

- To understand LT system components

UNIT- II

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of mainswitch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Learning Outcomes:

- To understand types of wiring, rules and guidelines for installation
- To analyze load calculation, size of wire, rating of switch and distribution board and earthing system calculations

UNIT- III:

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premise, flood lighting.

Learning Outcomes:

- To learn various illumination schemes

UNIT- IV:

Industrial Electrical Systems – I: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Learning Outcomes:

- To understand about industrial electrical systems like HT connectins, substations, transformer selection, loads , switchgear selection and earthining
- To analyze power factor correction, kVAR calculations and Breakers and LT panel components

UNIT- V:

Industrial Electrical Systems – II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Learning Outcomes:

- To understand about DG systems,UPS, Battery banks
- To analyze the sizing of DG, UPS and Battery banks

TEXT BOOKS:

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

REFERENCE BOOKS:

1. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997.
2. Web site for IS Standards.
3. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

Web Courses: https://nptel.ac.in/courses/108/105/108105062/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
****** Department of Humanities & Social Sciences ******

III B. Tech –II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A65401	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (HS-I)**	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

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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1						3									
CO2									3						

CO3												3			
CO4									3						
CO5									3						
CO6									3			3			

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
****** Department of Humanities & Social Sciences ******

III B. Tech –II Sem. (E.E.E

Subject Code	Title of the Subject	L	T	P	C
19A65402	**ENTREPRENEURSHIP& INCUBATION (HS-I)**	**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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1						3									
CO2		1				2			3						

CO3		2				1						3			
CO4		1							3						
CO5		3							3						
CO6							1		3			3			

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
***** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ******

III B. Tech –II Sem. (E.E.E

Subject Code	Title of the Subject	L	T	P	C
19A65403	**BUSINESS ETHICS AND CORPORATE GOVERNANCE (HS-I)**	3	0	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

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

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech II-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A60210	**ELECTRICAL & ELECTRONIC MEASUREMENTS LAB**	0	0	3	1.5

Course Objective: This laboratory deals with the practical exercises for:
- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

Course Outcomes: At the end of the course, the student will be able to:
- Calibrate various electrical measuring instruments
- Accurately determine the values of inductance and capacitance using AC bridges
- Compute the coefficient of coupling between two coupled coils
- Accurately determine the values of very low resistances

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

The following experiments are required to be conducted as compulsory experiments:
1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Schering Bridge & Anderson bridge
7. Measurement of 3-phase reactive power with single-phase wattmeter
8. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:

9. Maxwell's bridge and DeSauty bridge
10. Calibration of LPF wattmeter – by Phantom loading
11. Wheatstone bridge – measurement of medium resistances
12. LVDT and capacitance pickup – characteristics and Calibration
13. Resistance strain gauge – strain measurement and Calibration
14. Transformer turns ratio measurement using AC Bridge

15. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil
16. Generation of Lissajious Pattern using CRO
17. Measurement of voltage & frequency using CRO

Virtual Labs:

- **http://vem-iitg.vlabs.ac.in/**

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III Year B.Tech II-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A60211	**Microprocessor and Microcontrollers Lab**	0	0	3	1.5

Course Objectives: The student will understand about
1. Assembly language programming on 8086 Microprocessors
2. Interfacing of various devices with 8086
3. MASAM Programming
4. Interfacing 8051 Microcontroller with its peripheral devices.

Course Outcomes: The student able to perform:
1. Assembly language programming on 8086 Microprocessors.
2. Interfacing of various devices with 8086.
3. MASAM Programming.
4. Interfacing 8051 Microcontroller with its peripheral devices

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	1	3	1				3	1	1	1	2	3	3
CO2		1	2	3	2		2		3	1	2	2	2	3	3
CO3	2	2	2	3	3		1		3	1	2	2	3	3	3
CO4		2	1	3	2		2		3	1	1	3	3	3	3

PART-A: List of Programs using MASAM/ALP:

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes) .
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086

PART-B: List of experiments using 8086 and 8051 modules:

1. Interfacing ADC and DAC to 8086.
2. Parallel communication between two microprocessors using 8255.
3. Serial communication between two microprocessor kits using 8251.
4. Interfacing to 8086 and programming to control stepper motor.
5. Programming using arithmetic, logical and bit manipulation instructions of 8051
6. Program and verify Timer/Counter in 8051.
7. Program and verify interrupt handling in 8051.
8. UART operation in 8051.
9. Communication between 8051 kit and PC.
10. Interfacing LCD to 8051.

11. Interfacing matrix or keyboard to 8051.

Note: List of programs in PART-A are mandatory and in PART-B at least Eight experiments must be performed

Reference Books:

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

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****** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ******
(Mandatory course)

III Year B.Tech II-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A55401	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

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

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A70201	**POWER SYSTEM OPERATION AND CONTROL (PCC)**	3	0	0	3

Course Objectives:
- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

Course Outcomes:
- To be able to understand to deal with problems in Power System as Power System Engineer
- To be able to Understand to deal with AGC problems in Power System, l the problems in hydro electric and hydro thermal problems
- To understand the complexity of reactive power control problems and to deal with them
- To understand the necessity of deregulation aspects and demand side management problems in the modern power system era.

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

UNIT-I: ECONOMIC OPERATION OF POWER SYSTEMS

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

Learning outcomes:
1. To know about basic Power System Operation and Control strategies
2. To distinguish between generation and co-generation plants
3. To understand economic load dispatch problem without losses of the Power System
4. To understand economic load dispatch problem with losses of the Power System
5. To know about computation of loss coefficients in Power Systems

UNIT-II: HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW

Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling. **Optimal Power Flow:** Optimal power flow problem formulation for loss and cost minimisation, Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems

Learning outcomes:
1. To distinguish between hydro electric and hydro thermal plants
2. To understand about characteristics of thermo-electric and hydro-thermal plants
3. To understand about optimal power flow problem formulation with losses and minimisation of cost
4. OPF problem solving using specified methods
5. To do numerical exercises in solving OPF problems

UNIT-III: AUTOMATIC GENERATION CONTROL

Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples

Learning outcomes:
1. To understand about speed governing mechanism modelling
2. To identify control areas and block diagram representations
3. To identify Load Frequency Control problems with and without control
4. To understand about steady state and dynamic responses of single and two area system with tie-lines
5. To do numerical problems of AGC problems

UNIT-IV: REACTIVE POWER CONTROL

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems

Learning outcomes:
1. To know about understanding of Reactive Power problems in Power Systems
2. To distinguish between compensated and uncompensated lines under no-load and load
3. To distinguish between active and passive compensations
4. To distinguish between shunt and series compensation in Reactive Power Control

5. To do numerical problems and to understand the complexity of reactive power problems in power systems

UNIT-V: OPERATION OF MODERN POWER SYSTEMS

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems

Learning outcomes:

1. To understand the philosophy of power exchange in electricity market
2. To know about transmission system pricing charges
3. To know about distribution system pricing charges
4. To understand the trend of Demand side management
5. To solve numerical problems in above aspects

Text Books:

3. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
4. Power System Engineering, D P Kothari and I J Nagrath, McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019.

References:

1. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.

Web Courses: https://nptel.ac.in/courses/108/101/108101040/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70202	**UILIZATION OF ELECTRICAL ENERGY (PCC)**	3	0	0	3

Course Objectives:

1	To make the students aware about the importance of maximizing the energy efficiency by optimum utilization of electrical energy.
2	To ensure that the knowledge acquired can be applied in various fields such as electric heating, illumination, chemical processes and electric traction.
3	To develop ability amongst the students to analyze the performance of arc furnaces, electric traction, different sources of light, illumination schemes, electric traction.
4	To provide knowledge about above processes and applications of these in practical world.

Course Outcomes:

CO1: Understand the importance of maximizing the energy efficiency by its optimum utilization and mould their practical work in professional world accordingly

CO 2: Understand the performance of simple resistance furnaces, modern welding techniques, illumination schemes and electric traction

CO3: Able to get technical knowledge of various control devices and their use, in practical world

CO 4: Able to design various illumination systems and apply them to real world usage

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	2		2	1		1			1	3	1
CO2	1		3	1	3			1		1			1	3	1
CO3	1		3	1	3			1		1			1	3	1
CO4	1		3	3	3		2	1		1			1	3	1

UNIT – I ILLUMINATION

Definition – Laws of illumination – Polar curves – Calculation of MHCP and MSCP. Lamps: Incandescent lamp, Sodium Vapour lamp, Fluorescent lamp. Requirement of good lighting scheme – Types, Design and Calculation of illumination. Street lighting and Factory lighting – Numerical Problems.

Unit Outcomes:

By the end of this unit, the student will be able to

- Understand and remember the basics of illumination and various types of lamps present.

- Analyze the types, design and calculation of illumination.
- Apply the above concepts to solve numerical problems.

UNIT – II ELECTRICAL HEATING & ELECTRIC WELDING

Advantages. Methods of Electric heating – Resistance, arc, Induction and dielectric heating. Types of electric welding – Resistance, Electric arc, gas welding and Ultrasonic welding, Welding electrodes of various metals, Defects in welding.

Unit Outcomes:

By the end of this unit, the student will be able to

- Understand and remember the basic concepts of electric heating and electric welding and their classification.
- Analyze various methods and different materials used and defects present in welding.
- Apply the above concepts to solve numerical problems.

UNIT – III ELECTROLYTIC PROCESS

Basic principle of Electrolysis, Faradays laws of Electrolysis – Numerical problems, Applications of Electrolysis – Electro deposition-manufacturing of chemicals – anodizing – electro polishing – electro cleaning – electro parting – electro metallurgy, Power supply for Electrolysis.

Unit Outcomes:

By the end of this unit, the student will be able to

- Understand and remember the basic principle involved in electrolysis process.
- Analyze in detail the process involved in electrolysis and the amount of power required for electrolysis.
- Apply and analyze electrolysis process to various applications like electro polishing, cleaning, parting, etc.,
- Apply the above concepts to solve numerical problems.

UNIT – IV ELECTRIC TRACTION

Introduction –Traction Systems, Systems of Electric Traction- Advantages of Electric Traction, Systems of Track Electrification, Desirable features of Traction Motors – Suitability of D.C. series motor, A.C. series motor, 3 phase induction motor and linear induction motor for traction. Electric Braking in traction– Plugging, Rheostatic and Regenarative types – Suitability of different motors for braking, Temperature Rise and Load Equalization.

Unit Outcomes:

By the end of this unit, the student will be able to

- Understand and remember the basic principle involved, different systems available and advantages of electric traction.
- Analyze the desirable features of traction motors and suitability of various motors.

- Apply and analyze various braking methods applicable and suitability of different motors for braking.
- Apply the above concepts to solve numerical problems.

UNIT – V TRACTION MECHANICS

Types of services – urban – sub-urban and main line services, Speed-time curves of different services – trapezoidal and quadrilateral speed-time curves – Numerical Problems, Tractive effort, Power, Specific Energy Consumption- factors affecting Specific Energy Consumption, Mechanics of train movement - Adhesive weight and coefficient of adhesion – Problems.

Unit Outcomes:

By the end of this unit, the student will be able to

- Understand and remember the types of services present and their respective speed-time curves.
- Analyze the concept of tractive effort, Power, Specific Energy Consumption- and factors affecting Specific Energy Consumption,
- Understand and analyze the mechanics of train movement, adhesive weight and coefficient of adhesion.
- Apply the above concepts to solve numerical problems.

TEXT BOOKS:

1. Utilization of Electrical Energy' by E. O. Taylor – Revised in S.I. Units by V.V.L.Rao, Orient Longman
2. Generation, Distribution and Utilization of Electrical Energy' by C. L. Wadhwa, Eastern Wiley Ltd.
3. 'Utilization of Electric Power and Electric Traction' by J.B. Gupta, S.K. Kataria and sons,Delhi.

REFERENCE BOOKS:

1. Art & Science of Utilization of electrical Energy – by H. Partab, Dhanpat Rai & Sons.
2. A text book on Power System Engineering' by A. Chakraborti, M. L. Soni, P. V. Gupta, U.S.Bhatnagar, Dhanpat Rai and Co.(P) Ltd – Delhi
3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited Publishers, 1996.
4. Utilization of Electrical Power – by R.K. Rajput, Laxmi publications.

Web Courses: https://nptel.ac.in/courses/108/105/108105060/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70203	**HVDC AND FACTS (PEC-III)**	3	0	0	3

Course Objectives: To get the student exposed to:

1 High voltage DC transmission systems
2 Flexible AC transmission systems
3 Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

Course Outcomes: Student should be able

CO1 To understand Transmission networks, electronic switching devices conventional control mechanisms, types of HVDC links principle of working and differences between various pulse configurations of various converters.
CO2 To analyze bridge circuits, firing angle controls and characteristics of flexible AC transmission systems.
CO3 To develop Equivalent circuits.

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

UNIT-I: INTRODUCTION

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS.

Learning Outcomes:

- Know about difference between HVDC and FACTS
- Know about limitations of conventional transmission systems
- Know about recent developments in Power Electronic switching devices

UNIT – II: HIGH VOLTAGE DC TRANSMISSION – I

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of bridge circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than 60^0, Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

Learning Outcomes:

- To learn about various HVDC link configurations
- To develop equivalent circuit of HVDC link

UNIT – III: HIGH VOLTAGE DC TRANSMISSION – II

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

Learning Outcomes:

- To learn about various DC link control techniques
- To learn about starting, stopping and reversal of power flow in DC links

UNIT-IV: FLEXIBLE AC TRANSMISSION SYSTEMS-I

Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt Var Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series Var Generation, Principle of Switching Converter type series compensator.

Learning Outcomes:

- To understand principle of working and differences between various pulse configurations of various converters
- To understand the necessity of compensators
- To analyze the configurations of shunt, VAR, series configurations, etc.

UNIT-V: FLEXIBLE AC TRANSMISSION SYSTEMS-II

Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators

Learning Outcomes:

- To know more about advanced Power flow controllers
- To analyze the transmission control strategies
- To know about voltage and phase regulators

Text Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

Reference Books:

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical

Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Web Sources: https://nptel.ac.in/courses/108/104/108104013/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A70204	**AC Drives (PEC-III)**	3	0	0	3

Course Objectives:

1. To understand the basic concepts of phase Controlled Induction Motor Drive
2. To understand the concept of Voltage Source Inverter Fed Induction Motor Drive
3. To design various Rotor Side Control of Slip-Ring Induction Motor
4. To understand the concept of Control of Synchronous Motor Drives
5. To understand the concept of PMSM and BLDC Drives.

Course Outcomes:

1. Understand the basic concepts of AC Motor Drives.
2. Modelling and analysis Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive.
3. Design of speed control of induction motor from rotor end.
4. Design and analysis of synchronous motor drives.
5. Understand Design the concept of BLDC motor PMSM Motor

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

UNIT-I Phase Controlled Induction Motor Drive

Stator Voltage Control of Induction Motor, Phase-Controlled Converter Fed Induction Motor, Power Circuit and Gating, Reversible Phase-Controlled Induction Motor Drive, Torque-Speed Characteristics.

Learning Outcomes:

- Understand the concept of Selection of control of AC motor drive
- To know about various characteristics of phase controlled drives
- To know about power circuit and gating configurations of converter
- To understand about reversible drive

UNIT-II: Voltage Source Inverter Fed Induction Motor Drive

Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive, Variable-Voltage Variable-Frequency Operation of Induction Motor, Constant E/f And V/f Control Schemes, Slip Regulation.

Learning Outcomes:
- Understand the concept of Variable-Frequency operation of Induction Motor
- To understand about variable-voltage, variable-frequency operation of Induction motor
- Understand the concept of Stator Voltage and Frequency Control of Induction Motor
- To understand about PWM fed IM drive

UNIT-III: Rotor Side Control of Slip-Ring Induction Motor
Slip-Power Recovery Schemes, Steady-State Analysis- Range of Slip, Equivalent Circuit, Performance Characteristics; Rating of Converters.
Vector Control of Induction Motor:
Principles of Vector Control, Direct Vector Control, Indirect Vector Control, Implementation – Block Diagram, Estimation of Flux, Flux Weakening Operation.

Learning Outcomes:
- Understand the concept of rotor side control Slip-Ring Induction Motor
- To know about performance characteristics
- To know about direct vector control of IM drive
- To know about indirect vector control of IM drive

UNIT-IV: Control of Synchronous Motor Drives
Synchronous Motor - Control Strategies-Constant Torque Angle Control-Power Factor Control, Constant Flux Control, Flux Weakening Operation, Load Commutated Inverter Fed Synchronous Motor Drive, Motoring and Regeneration, Phasor Diagrams.
Learning Outcomes:

- Understand Synchronous Motor Control Strategies
- Designing of Commutated Inverter Fed Synchronous Motor Drive
- To know about Motoring and Regeneration
- To understand phasor diagrams of Synchronous Motor Drive

Unit-V: PMSM and BLDC Drives
Characteristics of Permanent Magnet, Synchronous Machines With Permanent Magnet, Vector Control of PMSM- Motor Model and Control Scheme, Constant Torque Angle Control, Constant Mutual Flux Linkages, Unity PF Control. Modelling of PM Brushless DC Motor, Drive Scheme, Commutation Torque Ripple, Phase Advancing.

Learning Outcomes:
- Understand the concept of PMSM and BLDC Drives
- Design of motor model and control schemes of BLDC motors.
- To understand characteristics of PMSM
- To understand BLDC motor modelling aspects

TEXT BOOK:

1. R. Krishnan, **Electric Motor Drives Modelling, Analysis & control**, Pearson Education, 2001.
2. B. K. Bose **Modern Power Electronics and AC Drives**, Pearson Publications, 2001.

REFERENCE BOOKS:

1. MD Murphy & FG Turn Bull, Power Electronics control of AC motors, 1st Edition, Pergaman press, 1998.
2. G.K. Dubey, **Fundamentals of Electrical Drives,** Narosa Publications, 1995.
3. S. K. Pillai, A First Course on Electrical Drives, New Age International, 1989.
4. Vedam Subrahmanyam, Electric Drives: Concepts and Applications, 2nd Edition, Mc Graw Hill Education, 2017

Web Sources: https://nptel.ac.in/courses/108/108/108108077/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70205	Digital Control Systems (PEC-III)	3	0	0	3

Course Objectives:
- To understand the fundamentals of digital control systems, z-transforms
- To understand state space representation of the control systems, concepts of controllability and observability
- To study the estimation of stability in different domains
- To understand the design of discrete time control systems, compensators, state feedback controllers, state observers through various transformations

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Obtain discrete representation of LTI systems.
- Analyze stability of open loop and closed loop discrete-time systems.
- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.
-

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

UNIT- I

Discrete Representation of Continuous Systems: Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modeling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

Learning Outcomes:
- To understand the concepts of digital control systems, Sample and hold circuit, Quantization
- To analyze the mathematical modelling of sample and hold circuit, effect of sampling and quantization

UNIT- II

Discrete System Analysis: Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system. Stability of Discrete Time System: Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response.

Learning Outcomes:

- To remember the concepts of Z-Transforms, inverse Z-Transforms and pulse transfer function
- To understand the S-plane and Z-plane
- To analyze the stability analysis using bilinear transformation Jury stability test
- To Design digital control system with dead beat response

UNIT- III

State Space Approach for Discrete Time Systems: State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Learning Outcomes:

- To understand the state space models of discrete systems, state space analysis, controllability and observability
- To analyze the lyapunov stability, controllability, observability and effect of pole zero cancelation

UNIT- IV

Design of Digital Control System: Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Learning Outcomes:

- To understand PID controller
- To design discrete PID Controllers, observers for LTI systems and compensators

UNIT- V

Discrete Output Feedback Control: Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

Learning Outcomes:

- To understand fast output sampling
- To design discrete output feedback control

TEXT BOOKS:

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

REFERENCE BOOKS:

1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”, Addison-Wesley, 1998.
2. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.

Web Sources: https://nptel.ac.in/courses/108/103/108103008/

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year B.Tech I-Sem (EEE)

Subject Code	Title of the Subject	L	T	P	C
19A70206	**SYSTEM RELIABILITY CONCEPTS (OEC-III)**	3	0	0	3

Course Objectives:

To make the students learn about:

- The Basic concepts, rules for combining probabilities of events, failure density and distribution functions.
- Evaluation of network Reliability / Unreliability and types of redundancies.
- Evaluation of network Reliability / Unreliability using conditional probability method.
- Expected value and standard deviation of Exponential distribution and Measures of reliability.
- Evaluation of Limiting State Probabilities of one, two component repairable models.

Course Outcomes:

After completing the course, the student should be able to do the following:

- Understand the concepts for combining Probabilities of events, Bernoulli's trial, and Binomial distribution.
- Network Reliability/Unreliability using conditional probability, path and cutset based approach, complete event tree and reduced event tree methods.
- Understanding Reliability functions and to develop relationship between these functions, expected value and standard deviation of Exponential distribution and measures of reliabilities.
- Analyze the time dependent reliability evaluation of single component repairable model, frequency and duration concepts, Frequency balance approach.
- Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model.

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

UNIT-I: Basic Probability Theory

Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples

Learning Outcomes: *At the end of the unit, the student will be able to*

- To know about basic rules for probabilities of events
- To distinguish between pdf and cdf
- Get detailed information about Probability of failure density and distribution functions
- Obtain the expected value and standard deviation for binomial distribution.

UNIT-II: Network Modeling and Reliability Evaluation

Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cutset based approach – complete event tree and reduced event tree methods - Examples.

Learning Outcomes: *At the end of the unit, the student will be able to know about*

- How to find the Probability of success and failures of network using different approaches for series-parallel configurations.
- Classification of redundancies.
- To find reliability / unreliability of complex systems using different methods
- Comparison of approaches to solve probability index of SISO system

UNIT-III: Time Dependent Probability

Basic concepts – Reliability functions f(t), Q(t), R(t), h(t) – Relationship between these functions – Bath tub curve – Exponential failure density and distribution functions - Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel, Series-Parallel systems - Partially redundant systems - Evaluation of reliability measure – MTTF for series and parallel systems – Examples.

Learning Outcomes: *At the end of the unit, the student will be able to*

- Understand the concepts of time domain functions and relationship between them.
- Obtain the expected value and standard deviation for exponential distribution.
- Obtain the values of probabilistic measures for series and parallel configurations.
- To obtain probabilistic measures for fully redundant and partially redundant configurations

UNIT-IV: Discrete Markov Chains & Continuous Markov Processes

Markov Chains: Basic concepts – Stochastic transitional Probability matrix – time dependent probability evaluation – Limiting State Probability evaluation – Absorbing states.

Markov Processes: Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach - Examples.

Learning Outcomes: *At the end of the unit, the student will be able to*

- Understand the concepts of Stochastic Transitional Probability Matrix, Limiting State Probability
- To know about evaluation for one and two component repairable models.
- Understand the concept of Frequency balance approach.
- To distinguish between Markov chains and Markov processes

UNIT-V: Multi Component & Approximate System Reliability Evaluation

Recursive relation for evaluation of equivalent transitional rates– cumulative probability and cumulative frequency and 'n' component repairable model – Series systems, Parallel systems, Basic probability indices – Series, Parallel systems – Complex Systems– Cutset approach – Examples.

Learning Outcomes: *At the end of the unit, the student will be able to*

- Understand the concepts of recursive relation for evaluation of equivalent transitional rates.
- Obtain the cumulative probability and cumulative frequency for different systems
- To know about computation of basic probability indices for series, parallel configurations
- To know how to evaluate basic probability indices using cut set approach

Text Books:

1. Reliability Evaluation of Engineering Systems by Roy Billinton and Ronald N. Allan, Reprinted in India B. S. Publications, 2007.
2. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.

Reference Books:

1. Introduction to Reliability Engineering by E. E. Lewis by Wiley Publications.
2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000.
3. Reliability and Safety Engineering by Ajit Kumar Verma, Srividya Ajit and Durga Rao Karanki, Springer, Second Edition, 2016.
4. System Reliability Theory Marvin Rausand and Arnljot Hoyland, Wiley Publictions.

Web Sources:

https://nptel.ac.in/content/storage2/courses/112101005/downloads/Module_5_Lecture_3_final.pdf

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70207	ELECTRIC VEHICLE ENGINEERING (OEC-III)	3	0	0	3

Course Objectives:

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

Course Outcomes:

- To understand and differentiate between conventional and latest trends in Electric Vehicles
- To know about various configurations in parameters of EV syste, propulsion and dynamic aspects of EV
- To understand about fuel cell technologies in EV and HEV systems
- To understand about battery charging and controls required of Evs

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

UNIT-I Introduction to EV Systems and Parameters

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes:

- To know about past, present and latest technologies of EV
- To understand about configurations of EV systems
- To distinguish between EV parameters and performance parameters of EV systems
- To distinguish between single and multiple motor drive EVs
- To understand about in-wheel EV

UNIT-II EV and Energy Sources

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

Learning Outcomes:

- To know about various types of EV sources
- To understand about e-mobility
- To know about environmental aspects of EV
- To distinguish between conventional and recent technology developments in EV systems

UNIT-III EV Propulsion and Dynamics

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

Learning Outcomes:

- To know about what is meant by propulsion system
- To understand about single and multi motor EV configurations
- To get exposed to current and recent applications of EV
- To understand about load factors in vehicle dynamics
- To know what is meant acceleration in EV

UNIT-IV Fuel Cells

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

Learning Outcomes:

- To know about fuel cell technology of EV
- To know about basic operation of FCEV
- To know about characteristics and sizing of EV with suitable example
- To get exposed to concept of Hybrid Electric Vehicle using fuel cells
- To know about the comparison of various hybrid EV systems

UNIT-V Battery Charging and Control

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

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

Learning Outcomes:

- To understand about basic requirements of battery charging and its architecture
- To know about charger functions
- To get exposed to wireless charging principle

- To understand about block diagram, modelling of electro mechanical systems of EV
- To be able to design various compensation requirements

TEXT BOOKS:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

REFERENCE BOOKS:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

Web Sources: https://nptel.ac.in/courses/108/102/108102121/

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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70208	**DESIGN OF PHOTOVOLTAIC SYSTEMS (OEC-III)**	3	0	0	3

Course Objectives: To get the student exposed to:

1 Understand the basics of solar PV
2 Get exposure of various PV performance measure terminologies
3 Understand about manufacturing of PV cells & sizing aspects of PV systems
4 Understand about PV system components and apply them in installation practices,& associated trouble shootings
5 Understand about PV system applications & associated safety measures

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

CO1 Understand the principle of direct solar energy conversion to power using PV

CO2 Contrast the performance measures of PV

CO3 Infer on various Solar cells & design aspects of solar PV

CO4 Identify various PV components & construct few systems

CO5 Develop ideas for working on solar PV systems & associated safety practices.

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

Unit 1 : SOLAR CELL FUNDAMENTALS

Principle of solar energy conversion, Photovoltaic effect, Semiconductor properties, energy levels, basic equations. Solar cell structure, parameters of solar cell.

Learning Outcomes:

- To know about the principle of solar energy conversion
- To know about Photovoltaic effect
- To know about Solar cell structure, parameters of solar cell.

Unit 2 : PV MODULE PERFORMANCE

Solar PV modules & arrays, I-V &P-V characteristics, maximum power point ,series parallel combination, cell efficiency, fill factor, role of bypass & blocking diode, factors affecting output of a solar cell.

Learning Outcomes:

- To understand Solar PV modules & arrays, I-V &P-V characteristics
- To understand maximum power point ,series parallel combination
- To know about cell efficiency, fill factor, role of bypass & blocking diode, factors affecting output of a solar cell.

Unit 3 : MANUFACTURING OF PV CELLS & DESIGN OF PV SYSTEMS

Commercial solar cells - Production process of single crystalline silicon cells, multi crystalline silicon cells, amorphous silicon, cadmium telluride, copper indium gallium diselenide cells. Design of solar PV systems, cost estimation, various aspects, system simulation tools.

Learning Outcomes:

- To know about the production process of various PV cells.
- To understand Design of solar PV systems, cost estimation, various aspects, system simulation tools

Unit 4 : SOLAR PV SYSTEMS INSTALLATIONS & TROUBLE SHOOTING

Classification - Central Power Station System, Distributed PV System, Stand alone PV system, grid Interactive PV System, small system for consumer applications, hybrid solar PV system, concentrator solar photovoltaic. System components - PV arrays, inverters, batteries, charge controllers , net metering ,. PV array installation, operation, costs, reliability. Troubleshooting of PV system components.

Learning Outcomes:

- To understand the classification of Solar PV Systems.
- To know the concept of PV array installation.
- To analyse troubleshooting of PV system components.

Unit 5 : PV SYSTEM APPLICATIONS & SAFETY

Building-integrated photovoltaic units, grid connected central power stations, stand-alone devices for distributed power supply in remote and rural areas, Outlook for the Indian PV industry& challenges, Applications: solar home system, solar cars, Solar Charger, aircraft,space solar power satellites. Socio-economic and environmental merits of photovoltaic systems safety in Installation of solar PV systems

Learning Outcomes:

- To understand the outlook for the Indian PV industry & challenges.
- To know the PV system applications.

- To understand photovoltaic systems safety in installation of solar PV systems.

Text Books:

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Jha A.R., "Solar Cell Technology and Applications", CRC Press,2010.
3. John R. Balfour, Michael L. Shaw, Sharlave Jarosek., "Introduction to Photovoltaics", Jones & Bartlett Publishers, Burlington, 2011.

Reference Books:

1. Chetan Singh Solanki "Solar PV technology and system", PHI learning private limited, 2015.
2. Luque A. L. and Andreev V.M., "Concentrator Photovoltaic",Springer, 2007.
3. Partain L.D., Fraas L.M., "Solar Cells and Their Applications", 2nd ed., Wiley, 2010.
4. S.P. Sukhatme, J.K.Nayak., "Solar Energy", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
5. R.K Pachauri "From Sun light to Electricity" TERI, 15th Reprint , 2013

Web Courses: https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee35/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
**** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ****

IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A75401	**MANAGEMENT SCIENCE (HE-II)**	3	0	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

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.

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

CO4											3		1	1	2
CO5												3	1	1	1
CO6											2	3	1	1	2

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
****** DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES ******

IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A75402	**ORGANIZATIONAL BEHAVIOUR(HE-II)**	3	0	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**

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

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

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

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IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A75403	**BUSINESS ENVIRONMENT (HE-II)**	3	0	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

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

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

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.
Bhattacharya (2009), International Business, Excel Publications, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING
IV B. Tech I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70209	**POWER SYSTEMS & SIMULATION LAB**	0	0	3	1.5

Course Objectives: The objectives of this course include

1. To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactances.
2. To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
3. To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
4. To develop the SIMULINK model for single area load frequency problem.

Course Outcomes: After completion of the course the student will able to

CO1 Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactances. Get the practical knowledge on how to draw the equivalent circuit of three winding transformer.
CO2 Get the knowledge on development of MATLAB program for formation of Y and Z buses.
CO3 Get the knowledge on development of MATLAB programs for Gauss-Seidel and Fast Decouple Load Flow studies.
CO4 Get the knowledge on development of SIMULINK model for single area load frequency problem.

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	3	2			2	3		3		2	1	1
CO2	3	1	2	3	2			2	3		3		1	1	1
CO3	3	1	2	3	2			2	3		3		1	1	2
CO4	3	1	2	3	2			2	3		3		1	1	1

List of Experiments

CYCLE - I

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. LG Fault Analysis on an un loaded alternator
3. LL Fault Analysis on conventional phases
4. LLG Fault Analysis
5. LLLG Fault Analysis
6. Determination of Sub transient reactance of silent pole synchronous machine

7. Equivalent circuit of three winding transformer.

CYCLE - II

8. Y_{Bus} formation using MATLAB
9. Z_{Bus} formation using MATLAB
10. Gauss-Seidel load flow analysis using MATLAB
11. Fast decoupled load flow analysis using MATLAB
12. Develop a Simulink model for a single area load frequency problem and simulate the same.

Note: In Cycle-I at least four experiments to be conducted, In Cycle-II at least four programs to tested. Both the cycles put together at least 10 experiments must be carried out.

Virtual Lab:

- **http://vp-dei.vlabs.ac.in/Dreamweaver/list.html**

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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -I Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A70210	**DIGITAL SIGNAL PROCESSING LAB**	0	0	3	1.5

Course Objectives:
The objectives of the course are to make the students learn about:
1 To implement the processing techniques using the instructions of DSP Processor.
2 To implement various filters using MATLAB Programming.

Course Outcomes: The student can be able to perform:
CO1 Programming concepts to implement various digital filters.
CO2 Generation of signals and their processing.
CO3 Interfacing of DSP processor with other peripherals.

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	3	2	3	2				2	2	3	3	3
CO2	2	3		3		3	2				2	3	3	3	3
CO3	2	3		3		3	2				2	3	3	3	3

SIMULATION IN MATLAB

Generation of Signals

1. Linear and circular convolution of two sequences
2. Sampling and effect of aliasing
3. Design of FIR filters
4. Design of IIR filters
5. Calculation of FFT of a signal
6. Decimation by polyphase decomposition.

USING PROCESSOR

Study of various addressing modes of DSP using simple programming examples.

7. Implementation of Linear and Circular Convolution.
8. Sampling of input signal and display.
9. Waveform generation.
10. Implementation of FIR filter

Virtuval Lab:

http://vlabs.iitkgp.ernet.in/dsp/#

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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80201	**POWER QUALITY (PEC-IV)**	3	0	0	3

Course Objectives:

1. To learn about voltage disturbances and power transients that is occurring in power systems.
2. To know about voltage sag and transient over voltages for quality of power supply
3. To understand about harmonics and their mitigation
4. To study about different power quality measuring and monitoring concepts.
5. To know about long duration voltage variations

Course Outcomes:

1. To get knowledge about different power quality issues and to mitigate them
2. Analyze voltage disturbances and power transients that are occurring in power systems.
3. Understand the concept of harmonics in the system and their effect on different power system equipment.
4. Able to understand the principles of regulation of long duration voltage variations
5. To get knowledge about different power quality measuring and monitoring concepts.

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	3	1					1			1		3
CO2	2	2					2	1		1		2	1	2	3
CO3	2	3		3						1	3	3	1	2	3
CO4	2	2			1	3				1	3	3	1		3
CO5	2	3		3						1	3	3	1	2	3

Unit-1: POWER QUALITY ISSUES

Power quality, voltage quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-duration voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

Learning Outcomes:

- To learn about various issues of power quality
- To know about the evaluation procedure of power quality issues
- To distinguish between short duration and long duration over voltages
- To know about voltage fluctuations and power frequency variations
- To learn about CBEMA and ITI curves in power quality issues

Unit-2: VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES

Sources of sags and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags and utility system fault-clearing issues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

Learning Outcomes:

- To understand what is meant by voltage sag
- To know about voltage sag performance estimations
- To know about fundamental principles of protection from sag and to study various protection schemes
- To understand about various devices for over voltage protection
- To know about utility system lightning protections

Unit-3: FUNDAMENTALS OF HARMONICS

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

Learning Outcomes:

- To understand about effects of harmonics
- To distinguish between voltage and current harmonics
- To understand about computation of harmonic indices
- To understand about the filters used for controlling harmonic distortion
- To know about IEEE and IEC standards for various power quality issues

Unit-4: LONG-DURATION VOLTAGE VARIATIONS

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation, End user capacitor applications, flicker.

Learning Outcomes:

- To know about principles of regulating the voltages
- To understand about the necessity of power electronic devices for voltage regulation
- To know how to use capacitors for voltage regulation
- To identify various capacitor placement applications

Unit-5: POWER QUALITY BENCH MARKING AND MONITORING

Benchmarking process, RMS Voltage variation Indices, Harmonic indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards.

Learning Outcomes:

- To know about what is meant by bench marking in power quality issues
- To identify and able to compute voltage variation indices
- To identify and able to compute harmonic indices
- To know about power quality monitoring considerations
- To know about power quality monitoring standards

Text Books:

1. Electrical Power Systems Quality by Roger C. Dugan, Mark F.Mc Granaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ltd, 2012

2. Power quality by C. Sankaran, CRC Press, 2017

Reference Books: .

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons, 2000.

2. Understanding Power quality problems by Math H. J. Bollen, Wiley-IEEE Press, 2000

Web Sources: https://nptel.ac.in/courses/108/107/108107157/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80202	**SWITCHED MODE POWER CONVERTERS (PEC-IV)**	3	0	0	3

Course Objectives:

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

CO1 Understand basic concepts of DC-DC converters
CO2 Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
CO3 Apply various modulation and harmonic elimination techniques over the converters.
CO4 Analyze the state space modelling of various types of converters.
CO5 Design inductor and transformer for various power electronic applications.

Course Outcomes:

CO1 To be able to understand advanced converters of SMPCs and solve the problems and to design of various DC-DC converters
CO2 To understand the performance of resonant converters
CO3 To understand various types and performance characteristics of 1-ϕ and 3-ϕ inverters with single/multi levels
CO4 To understand about power conditioners, UPS and filters
CO5 To know about the applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

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	3	1					1			1		3
CO2	2	2					2	1		1		2	1	2	3
CO3	2	3		3						1	3	3	1	2	3
CO4	2	2			1	3				1	3	3	1		3
CO5	2	3		3						1	3	3	1	2	3

UNIT I DC-DC CONVERTERS

Principles of stepdown and stepup converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand and analyze various types of DC-DC converters
- Understand state space modeling of DC-DC converters

- Distinguish between stepdown and stepup converters
- Apply the above concepts to solve numerical problems

UNIT II SWITCHING MODE POWER CONVERTERS

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand various types of converters
- Know about state space modelling of converters
- Understand about various control circuits & PWM techniques
- Apply the above concepts to solve numerical problems

UNIT III RESONANT CONVERTERS

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand and analyze various types of resonant converters
- Classification of resonant converters
- know about output voltages and its waveforms for various configurations
- Distinguish between series and parallel resonant converters
- Apply the above concepts to solve numerical problems

UNIT IV DC-AC CONVERTERS

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand and analyze different single phase and three phase inverters
- Understand various modulation techniques
- Understand various harmonic elimination techniques
- Understand various types of multilevel inverters with waveforms and their applications
- Apply the above concepts to solve numerical problems

UNIT V POWER CONDITIONERS, UPS & FILTERS

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand different types of power line disturbances, power conditioners, in detail working of UPS and its applications.
- Understand various types of filters with and without capacitors and selection of capacitors.
- Design inductor and transformer for various power electronic applications.
- Apply the above concepts to solve numerical problems.

Text Book:

1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

REFERENCES:

1. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007.

Web Sources: https://nptel.ac.in/courses/108/108/108108036/

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ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80203	**INTELLIGENT CONTROL TECHNIQUES (PEC-IV)**	3	0	0	3

Course Objectives:

1. To get exposed to a few Intelligent Control Techniques
2. To learn about Artificial Neural Network based Estimators
3. To learn about Fuzzy Logic Control System as one of the ICT
4. To learn about a few evolutionary algorithms
5. To implement the various ICTs for linear and non-linear systems as case studies

Course Outcomes:

1. To get familiarity of various Intelligent Control Techniques
2. To be able to design the controllers and estimators using ANN
3. To be able to model and develop control schemes with Fuzzy Logic rule bases
4. To be able to implement an evolutionary algorithm suitable to optimize and design a given system specifications
5. To be able to use MATLAB tool boxes for implementation of various ICTs for system modelling, control schemes and to design estimators

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		1			2	3		3	3	3
CO2	3	3	3	3	3					2	3		3	3	3
CO3	3	3	3	3	3					2	3		3	3	3
CO4	3	3	3	3	3					2	3		3	3	3
CO5	3	3	3	3	3					2	3		3	3	3

Unit-I: Fundamentals of AI

AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

Learning Outcomes:

- To get exposed to fundamentals of AI
- To understand about architecture of Intelligent Control
- To understand about rule based systems
- To learn about knowledge representation and symbolic reasoning system
- To know about the concepts of expert systems

Unit-II: ANN based Controllers and Estimators

Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; Learning and Training the neural network-Supervised and unsupervised learning concepts; BAM networks, Hopfield network; Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.

Learning Outcomes:

- To learn about basic concepts of ANN
- To develop mathematical models for various controllers of single and multilayer perceptrons
- To get exposed to learning and training the Neural Networks
- To distinguish between Supervised and Unsupervised learning concepts
- To be able to design ANN based controllers and estimators

Unit-III: Fuzzy Logic Control System

Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.

Learning Outcomes:

- To learn about fundamentals of Fuzzy Logic Control systems
- To be able to understand knowledge and rule bases in Fuzzy Logic Systems
- To understand about the Fuzzy modelling and control schemes
- To develop the Fuzzy modelling and control schemes for Linear systems
- To develop the Fuzzy modelling and control schemes for non-linear systems

Unit-IV: Evolutionary Algorithms

Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.

Learning Outcomes:

- To learn about basic concepts of evolutionary algorithms
- To learn about ANFIS
- To learn about Fuzzy-Genetic systems
- To learn about Neuro-Genetic systems
- To learn about a few optimization techniques

- To be able to design the systems with suitable evolutionary algorithms for specific requirements

Unit-V: Case Studies

Identification and control of linear and nonlinear dynamic systems using Neural Networks; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox; optimization for controller design in case of constrained and unconstrained optimization issues.

Learning Outcomes:

- To identify case studies related to linear and non-linear dynamic systems
- To be able to implement control strategies with Neural Networks for the identified systems
- To be able to implement controllers using MATLAB Fuzzy Logic tool box
- To be able to implement optimization techniques for controller design with constrained and unconstrained conditions
- To be able to design systems with various tool boxes in MATLAB environment

TEXT BOOKS:

1. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005
2. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", Jaico Publishing House, 1st Edition, 1994
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, WILEY Publications, 2011
4. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008

REFERENCS:

1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd.
2. Laurere Fauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd.

Web Sources: http://www.digimat.in/nptel/courses/video/108104049/L19.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech –II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80204	**INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES (OEC – IV)**	3	0	0	3

Course Objectives:

- Provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybridand electrical vehicles.
- Familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Course outcomes:

After learning the course the students will be able to:

- Explain the working of hybrid and electric vehicles. (l2)
- Choose a suitable drive scheme for developing an hybrid and electric vehicles dependingon resources. (l3)
- Develop the electric propulsion unit and its control for application of electricvehicles.(l3)
- Choose proper energy storage systems for vehicle applications. (l3)
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.(l3)

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

UNIT I: Electric Vehicle Propulsion and Energy Sources

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge anddischarge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system-soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Learning Outcomes:

After successful completion of this unit, the students will be able to

- Summaries the concepts of electrical vehicle propulsion and energy sources. (l2)
- Identify the types of power sources for electrical vehicles.(l3)
- Demonstrate the design considerations for propulsion system. (l2)
- Solve the problems on tractive power and energy required. (l3)

UNIT II: Electric Vehicle Power Plant and Drives

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boostconverter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Learning Outcomes:

After successful completion of this unit, the students will be able to

- Choose a suitable drive scheme for developing an electric vehicles depending onresources.(l1)
- List the various power electronic converters. (l1)
- Describe the working principle dc/dc converters and buck boost convertor. (l2)
- Explain about ac drives. (l2)

UNIT III: Hybrid and Electric Drive Trains

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Learning Outcomes:

After successful completion of this unit, the students will be able to

- Identify the social importance of hybrid vehicles. (l3)
- Discus impact of modern drive trains in energy supplies. (l6)
- Compare hybrid and electric drive trains.(l2)
- Analyze the power flow control and energy efficiency. (l6)
-

UNIT IV: Electric and Hybrid Vehicles - Case Studies

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

Learning Outcomes:

After successful completion of this unit, the students will be able to

- List the various electric and hybrid vehicles in the present market. (l1)
- Discus lightly hybridized vehicle and low voltage systems.(l6)
- Explain about hybrid electric heavy duty vehicles and fuel cell heavy duty vehicles. (l2)

UNIT V: Electric and Hybrid Vehicle Design:

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Learning Outcomes:

After successful completion of this unit, the students will be able to

- Illustrate matching the electric machine and the internal combustion engine. (l2)
- Select the energy storage technology. (l3)
- Select the size of propulsion motor. (l3)
- Design and develop basic schemes of electric and hybrid electric vehicles. (l3)

Text Books :

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRCPress, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

References:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, Wiley- Blackwell, 2018.

Web Sources: https://nptel.ac.in/courses/108/103/108103009/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80205	**Battery Management Systems (OE-IV)**	3	0	0	3

Course Objective:
- The objective of this course is to introduce learner to batteries, its parameters, modelling and charging requirements.
- The course will help learner to develop battery management algorithms for batteries

Course Outcomes: After completion of this course, student will be able to
- Interpret the role of battery management system
- Identify the requirements of Battery Management System
- Interpret the concept associated with battery charging / discharging process
- Calculate the various parameters of battery and battery pack
- Design the model of battery pack

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

Unit I : Introduction:

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

Learning Outcomes:

- To understand cells, batteries and cell connections.
- To analyze the concepts of charging, discharging, over charge and undercharge

Unit II Battery Management System Requirement:

Introduction and BMS functionality, Battery pack topology, Voltage Sensing, Temperature Sensing, Current Sensing, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of-charge estimation, Cell total energy and cell total power

Learning Outcomes:

- To understand BMS functionality, voltage sensing, temperature sensing and current sensing

- To estimate state of charge and cell total energy and power
- To analyze High-voltage contactor control, Thermal control and communication interface

Unit III Battery State of Charge and State of Health Estimation, Cell Balancing:

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

Learning Outcomes:

- To understand aging concepts in batteries, cell balancing and imbalance and circuits for balancing
- To estimate SOC based on Voltage, model, battery health and aging

Unit IV Modelling and Simulation:

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

Learning Outcomes:

- To obtain ECM based on physics, empirical approach.
- To simulate electric vehicle, vehicle range calculations, constant power and voltage and battery packs.

Unit V Design of battery:

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

Learning Outcomes:

- To analyze the design principle of BMS

Text Books

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.
3. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.
4. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010
5. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

Web Sources: https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTHAPURAMU

ELECTRICAL AND ELECTRONICS ENGINEERING

IV B. Tech -II Sem. (E.E.E)

Subject Code	Title of the Subject	L	T	P	C
19A80206	**SMART ELECTRIC GRID (OE-IV)**	3	0	0	3

Course Objectives:

1. To learn about recent trends in grids as smart grid
2. To understand about smart grid architecture and technologies
3. To know about smart substations
4. To learn about smart transmission systems
5. To learn about smart distribution systems

Course Outcomes:

1. To be able to understand trends in Smart grids
2. To understand the needs and roles of Smart substations
3. To understand the needs and roles of Smart Transmission systems
4. To understand the needs and roles of Smart Distribution systems
5. To distinguish between SCADA and DSCADA systems in practical working environment

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		3		2	3		3	3	3	3
CO2	2	3	2	3	2		3		2	3		3	3	3	3
CO3	1	3	2	2	1		3		2	3		2	3	3	3
CO4	2	3	1	2	2		3		2	3		3	3	3	3
CO6	3	2	2	2	1								2	2	2

UNIT-I: Introduction to Smart Grid

Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

Smart Grid Architecture: Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation – Renewable Integration

Learning Outcomes:

- To understand basic definitions and architecture of Smart grid
- To learn about new technologies for smart grid
- To know about fundamental components of smart grid

- To understand key challenges of smart grid
- To understand the need for integration of Renewable energy sources

UNIT-II: Smart grid Technologies

Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

Learning Outcomes:

- To know about basic characteristic features of smart grid technologies
- To understand about definition, types, building blocks of Microgrids
- To know about integration requirements, standards of renewable energy sources in Microgrids
- To understand Load frequency and reactive power control of Microgrid
- To understand about Microgrid through a case study

UNIT-III: Smart Substations

Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

Learning Outcomes:

- To know about protection, monitor and control devices in Smart substations
- To know about the importance of SCADA in substations
- To understand about interoperability and IEC 61850
- To know about role of substations in Smart grid
- To understand about Volt/VAR control equipment inside substation

UNIT-IV: Smart Transmission

Energy Management systems, History, current technology, EMS for the smart grid, Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid, Synchro Phasor Measurement Units (PMUs)

Learning Outcomes:

- To know about Energy Management Systems in smart transmission systems
- To understand about WAMPC
- To know about role of transmission systems in Smart grid
- To know about Synchro Phasor Measurement units

UNIT-V: Smart Distribution Systems

DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage-VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR),faults, objectives and benefits, equipment, implementation

Learning Outcomes:

- To know about DSCADA in Smart Distribution Systems
- To distinguish between current and advanced DMSs
- To know about occurrence of voltage fluctuations
- To understand about VAR control and equipment on distribution feeders
- To know about FDIR objectives and benefits

Text Books:

1. Stuart Borlase, Smart Grids - Infrastructure, Technology and Solutions, CRC Press, 1e, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e, 2013.

Reference Books:

1. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Applications, Springer Edition, 2e, 2017.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

Web Sources: https://onlinecourses.nptel.ac.in/noc19_ee64/preview

JNTUA COLLEGE OF ENGINEERING, ANANTAPURAMU (AUTONOMOUS)
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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Proposed Course Structure for R20 regulation

Induction Program – 3 weeks

Semester-1(Theory-5,Lab -4)					
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.	20A15201	AppliedPhysics Common to EEE, ECE, CSE	BS	3-0-0	3
3.	20A15501	Communicative English Common to EEE, ECE, CSE, CHEM	HS	3-0-0	3
4.	20A10201	Fundamentals of Electrical Circuits	ES	3-0-0	3
5.	20A10301	Engineering Drawing Common to EEE, ECE, CSE	LC	1-0-2	2
6.	20A10302	Engineering Graphics Lab Common to EEE, ECE, CSE	LC	0-0-2	1
7.	20A15202	AppliedPhysics Lab Common to EEE, ECE, CSE	BS	0-0-3	1.5
8.	20A15502	Communicative EnglishLab Common to EEE, ECE, CSE, Chem	HS	0-0-3	1.5
9.	20A10202	Fundamentals of Electrical Circuits Lab	ES	0-0-3	1.5
				Total	**19.5**

Semester–2(Theory–4,Lab –5, 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.	20A15303	Chemistry Common to EEE, ECE, CSE	BS	3-0-0	3
3.	20A10506	C-Programming & Data Structures Common to EEE, ECE	ES	3-0-0	3
4.	20A10402	Electronic Devices & Circuits Common to EEE, ECE	ES	3-0-0	3
5	20A10303	EngineeringWorkshop Common to EEE, ECE, CSE	LC	0-0-3	1.5
6	20A10508	IT Workshop Common to EEE, ECE, CSE	LC	0-0-3	1.5
7.	20A10507	C-Programming & Data Structures Lab Common to EEE, ECE	ES	0-0-3	1.5
8.	20A15304	Chemistry Lab Common to EEE, ECE, CSE	BS	0-0-3	1.5
9.	20A10403	Electronic Devices &Circuits Lab Common to EEE, ECE	ES	0-0-3	1.5
10.	20A10803	Environmental Science Common to EEE, ECE, CSE	MC	3-0-0	0.0
				Total	**19.5**

For 20 Batch only

II Year EEE COURSE STRUCTURE – R20 REGULATIONS

Semester-III					
S.No	**Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20A35102	Complex Variables & Transform Techniques Common to EEE,MECH, ECE	BS	3-0-0	3
2.	20A30201	Electrical Circuit Analysis	PC	3-0-0	3
3.	20A30202	DC Machines & Transformers	PC	3-0-0	3
4.	20A30404	Digital Logic Design	ES	3-0-0	3
5.	20A39101 a 20A39101b 20A39101 c	Humanities Elective-I Common to EEE, ECE, CSE • Managerial Economics and Financial Analysis • Entrepreneurship and Incubation • Business Ethics and Corporate Governance	HS	3-0-0	3
6.	20A30203	Electrical Circuit Analysis Lab	PC	0-0-3	1.5
7.	20A30204	DC Machines & Transformers L ab	PC	0-0-3	1.5
8.	20A30405	Digital Logic Design Lab	ES	0-0-3	1.5
9.	20A30205	Python Programming	SC	1-0-2	2
10.	20A19101	Universal Human Values(Common to EEE, ECE, CSE) (Mandatory credit Course-II)	MC	3-0-0	3
11	20A39901	NSS/NCC/NSO Activities		0-0-2	
				Total	**24.5**

Semester-IV					
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.	20A40409	Analog Electronics	ES	3-0-0	3
3.	20A40201	Power Electronics	PC	3-0-0	3
4.	20A40202	AC Machines	PC	3-0-0	3
5.	20A40203	Electromagnetic Field Theory	PC	3-0-0	3
6.	20A40410	Analog Electronics Lab	ES	0-0-3	1.5
7.	20A40204	Power Electronics Lab	PC	0-0-3	1.5
8.	20A40205	AC Machines Lab	PC	0-0-3	1.5
9.	20A40206	Circuits Simulation & Analysis using PSPICE	SC	1-0-2	2
10.	20A49102	Design Thinking for Innovation(Common to All Braches) (Mandatory non-credit Course-II)	MC	2-0-0	0
				Total	**21.5**
Community Service Internship/Project(Mandatory) for 6 - 8 weeks duration during summer vacation					

Note: Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the College.

Semester–V						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50201	Power System Architecture	3	0	0	3
2.	20A50202	Control Systems	3	0	0	3
3.	20A50203	Digital Computer Platforms	3	0	0	3
4.	20A50204a 20A50204b 20A50204c	**Professional Elective Course – I** **1.** Programmable Logic Controllers 2. Linear & Digital IC Applications 3. Embedded Systems	3	0	0	3
5.	20A50205	**Open Elective Course – I Common to All Branches** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A50206	Control Systems Lab	0	0	3	1.5
7.	20A50207	Digital Computer Platforms Lab	0	0	3	1.5
8.	20A55502	**Skill oriented course - III** Soft Skills (EEE, ECE, CSE)	1	0	2	2
9.	20A50208	Evaluation of Community Service Project				1.5
10.	20A59901	**Mandatory Non-credit Course** Intellectual Property Rights & Patents (EEE, ECE, CSE)	2	0	0	0
Total						**21.5**

Note:

1. 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.
2. 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.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

Semester–VI						
S.No.	**CourseCode**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60201	Power System Analysis	3	0	0	3
2.	20A60202	Measurements & Sensors	3	0	0	3
3.	20A60203	Digital Signal Processing	3	0	0	3
4.	20A60204a 20A60204b 20A60204c	**Professional Elective Course– II** 1. Switch Gear and Protection 2. Nonlinear System Analysis 3. Design of Photovoltaic Systems	3	0	0	3
5.	20A60205	**Open Elective Course – II** **(Common All Branches)** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) Renewable Energy Systems	3	0	0	3
6.	20A60206	Power Systems Lab	0	0	3	1.5
7.	20A60207	Measurements & Sensors Lab	0	0	3	1.5
8.	20A60208	Digital Signal Processing Lab	0	0	3	1.5
9.	20A60209	**Skill oriented course - IV** Applications of soft computing skills in Electrical Engineering	1	0	2	2
10.	20A65901	**Mandatory Non-credit Course** Indian Constitution (EEE, ECE, CSE)	2	0	0	0
Total						**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Semester-VII						
S.No.	**Course Code**	**Course Name**	**L**	T	**P**	**Credits**
1.	 20A70201a 20A70201b 20A70201c	**Professional Elective Course– III** 1. Power System Operation & Control 2. Switched Mode Power Converters 3. Electrical & Electronic Instrumentation	3	0	0	3
2.	 20A70202a 20A70202b 20A70202c	**Professional Elective Course– IV** 1. Electrical Distribution system Automation 2. Restructured Power Systems 3. Intelligent Control Techniques	3	0	0	3
3.	20A70203	**Professional Elective Course– V(MOOCS)** Courses will be offered according to the available courses under SWAYAM for the academic year.	3	0	0	3
4.	 20A75401a 20A75401b 20A75401c	**Humanities Elective – II(Common to All Branches** 1. Management Science 2. Business Environment 3. Organizational Behaviour	3	0	0	3
5.	20A70204	**Open Elective Course – III** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) Battery Management Systems	3	0	0	3
6.	20A70205	**Open Elective Course – IV** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) IOT Applications in Electrical Engineering	3	0	0	3
7.	20A70206	**Skill oriented course – V** Energy Conservation and Auditing	1	0	2	2
8.	20A70207	Evaluation of Industry Internship				3
		Total				**23**

Semester-VIII							
S.No.	**Course Code**	**Course Name**	**Category**	**L**	T	**P**	**Credits**
1.	20A80201	Full Internship & Project work	PR				12
						Total	**12**

HONOURS DEGREE IN <Electrical & Electronics Engineering>

S.No.	Course Code	Course Name	Contact Hours per week		Credits
			L	T	
1	20A02H11	ElectricVehicle Technology & Mobility	3	1	4
2	20A02H12	Battery Management Systems	3	1	4
3	20A02H13	Special Machines for Electric Vehicles	3	1	4
4	20A02H14	Grid Interface of Electric Vehicles	3	1	4
SUGGESTED MOOCs					
5	20A02H15a	Introduction to Hybrid and Electric Vehicles/ Available Courses under SWAYAM (MOOC-I*)	--	--	2
6	20A02H16a	Electric Vehicles and Renewable Energy/ Available Courses under SWAYAM (MOOC-II*)	--	--	2

MINORS

<Minors in Energy Systems>

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A02M11	Energy Audit and Management	3	1	0	4
2.	20A02M12	Energy Management in Building	3	1	0	4
3.	20A02M13	Energy Conversion Systems	3	1	0	4
4.	20A02M14	Energy Scenario and Energy Policy	3	1	0	4
5.	20A02M15a	Energy Resources & Technology / Available Courses under SWAYAM MOOC I*	--	--	--	2
6.	20A02M16a	Waste to Energy Conversion/ Available Courses under SWAYAM MOOC II*	--	--	--	2

*-MOOC must be 12 week duration in SWAYAM/NPTEL

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Electrical & Electronics Engineering

		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	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**	**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)	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

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		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	CyberSecurity (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	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	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.**

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B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15101	Linear Algebra & Calculus	3	0	0	3

(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:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
9. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
10. 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

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Subject Code	Title of the Subject	L	T	P	C
20A15201	Applied Physics	3	0	0	3

(Common to ECE, EEE & CSE)

PREAMBLE

There has been an exponential growth of knowledge in the recent past opening up new areas and challenges in the understanding of basic laws of nature. This helped to the discovery of new phenomena in macro, micro and nano scale device technologies. The laws of physics play a key role in the development of science, engineering and technology. Sound knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments in the field of engineering.

To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi of applied physics has been thoroughly revised keeping in view of the basic needs of engineering branches like ECE, EEE and CSE branches by including the topics like optics, quantum mechanics, free electron theory. Also new phenomenon, properties and device applications of semiconducting, dielectric, magnetic and superconducting materials along with their modern device applications have been introduced.

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
3	To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
4	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
5	To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
6.	Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle

	mechanism of superconductors using the concept of BCS theory and their fascinating applications.

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: Dielectric and Magnetic Materials 8hrs

Dielectric Materials-Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Orientation polarization (Qualitative), Electronic and Ionic polarization – 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.

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)

Unit IV: Quantum Mechanics, Free Electron Theory and Band theory of Solids 10hrs

Quantum Mechanics- Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory-Classical free electron theory – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Origin of resistance – Fermi-Dirac distribution – Density of states – Fermi energy.

Band theory of Solids- Bloch's Theorem (Qualitative) – Kronig-Penney model (Qualitative) – E vs K diagram – Classification of crystalline solids – Effective mass of electron – m^* vs K diagram – Concept of hole.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dual nature of matter (L2)
- **Understand** the significance of wave function (L2)
- **Interpret** the concepts of classical and quantum free electron theories (L2)

- **Explain** the importance of K-P model
- **Classify** the materials based on band theory (L2)
- **Apply** the concept of effective mass of electron (L3)

Unit – V: Semiconductors and Superconductors
10hrs

Semiconductors- Introduction – Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of superconductors.

Unit Outcomes:

The students will be able to

- **Classify** the energy bands of semiconductors (L2)
- **Interpret** the direct and indirect band gap semiconductors (L2)
- **Identify** the type of semiconductor using Hall effect (L2)
- **Identify** applications of semiconductors in electronic devices (L2)
- **Explain** how electrical resistivity of solids changes with temperature (L2)
- **Classify** superconductors based on Meissner's effect (L2)
- **Explain** Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

Text books:

1. Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
3. Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018)
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
3. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers (2018).
4. Engineering Physics by Shatendra Sharma, Jyotsna Sharma, Pearson Education (2018)
5. Engineering Physics by Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press(2016)
6. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill(2014)
7. Engineering Physics by B.K. Pandey and S. Chaturvedi, Cengage Learning(2018)
8. 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)
CO4	**Study** the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electron transportation phenomena by free electron theory and band theory. (L2)
CO5	**Elaborate** the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors. (L5)

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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Subject Code	Title of the Subject	L	T	P	C
20A15501	**COMMUNICATIVE ENGLISH**	**3**	**0**	**0**	**3**

(Common to ECE, EEE, CSE& CHEM)

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

COURSE OBJECTIVES	
1	Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
2	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
3	Help improve speaking skills through participation in activities such as role plays,discussions and structured talks/oral presentations
4	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

COURSE OUTCOMES	
CO1	Retrieve the knowledge of basic grammatical concepts

CO2	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
CO3	Apply grammatical structures to formulate sentences and correct word forms
CO4	Analyze discourse markers to speak clearly on a specific topic in informal discussions
CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
CO6	Create a coherent paragraph interpreting a figure/graph/chart/table

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

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:** Parts of Speech, 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, Paragraph Writing **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:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

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.
- Raymond Murphy's *English Grammar in Use* Fourth Edition (2012) E-book
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011
- Norman Lewis *Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary* (2014)
- *Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words* by David Butler

Web links

- www.englishclub.com
- www.easyworldofenglish.com
- www.languageguide.org/english/
- www.bbc.co.uk/learningenglish
- www.eslpod.com/index.html
- www.myenglishpages.com

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Subject Code	Title of the Subject	L	T	P	C
20A10201	**FUNDAMENTALS OF ELECTRICAL CIRCUITS**	**3**	**0**	**0**	**3**

Course Objectives:

To make the students learn about

- the basic concepts of network topology and to distinguish analogy between electrical and magnetic circuits
- the various laws, reduction techniques and different methods used to analyze networks
- the various theorems and their applications
- the basic concepts and calculation of various powers in Single phase and Three phase AC circuits

Unit- 1 Introduction to Electrical & Magnetic Circuits

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuits -Analysis of Series and Parallel Magnetic Circuits, MMF Calculations

Learning Outcomes: Students should be able to

- remember and understand the basic characteristics of R,L,C parameters, their voltage and current relations in electrical circuits; concepts of self, mutual and coefficient of coupling in magnetic circuits
- understand and analyze the concepts of Kirchhoff's and Faradays laws and to distinguish analogy between electrical and magnetic circuits
- apply various network reduction techniques on simple circuits

Unit- 2 Network Topology

Definitions – Graph – Oriented Graph-Tree, Cutset, Tieset, Basic Cutset, Basic Tieset Matrices for Networks – Loop and Nodal Analysis of Networks with Independent and Dependent Voltage and Current Sources – Incidence Matrices - Duality & Dual Networks

Learning Outcomes: Students should be able to

- understand and remember basic graph theory definitions
- understand and analyze the concepts of nodal analysis, mesh analysis and principle of duality
- apply the various methodologies in solving electrical circuits based on the topology

Unit- 3 Single Phase A.C Circuits

Sinusoidal Alternating Quantities - Average Value, R.M.S, Form Factor and Peak Factor for Different Periodic Wave Forms – Phasor Representation of alternating quantities– Complex and Polar Form of Representation, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Phasor diagrams - Concept of

Reactance, Impedance, Susceptance and Admittance- Apparent Power, Active and Reactive Power - Concept of Power Factor

Learning Outcomes: Students should be able to

- understand and remember the fundamental definitions of 1-ϕ AC circuits and its representation
- understand Steady State Analysis of R, L, C in various combinations with sinusoidal excitation
- understand the classification of power and concept of power factor

Unit- 4 Network Theorems

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem - Millmann's Theorem - Tellegen's Theorem - Compensation Theorem- Substitution Theorem (All theorems for both D.C and A.C Excitation)

Learning Outcomes: Students should be able to

- remember and understand the various theorems and to know their applications in network analysis.
- apply various theorems on simple electrical circuits

Unit- 5 Three Phase A.C. Circuits

Introduction - Analysis of Balanced and Unbalanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems – Representation and Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems - Advantages of Three Phase System

Learning Outcomes: Students should be able to

- remember and understand the concept of three phase AC circuits and the relation between line and phase voltages and currents in star and delta connections.
- understand and analyze the measurement of active and reactive power in balanced and unbalanced circuits

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

Reference Books:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
5. Fundamentals of Electrical Engineering NPTEL Lectures by Prof. Debapriya Das, IIT Kharagpur.

Course Outcomes:

After completing the course, the student should be able to

- distinguish analogy between electrical and magnetic circuits
- determine the dual of the network, develop the various matrices for a given circuit
- determine the current through and voltage across any element in the given circuit by using various methods.
- calculate different powers for both single and three phase AC circuits

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B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10301	Engineering Drawing	1	0	2	2

(Common to ECE, EEE & CSE)

Course Objectives:

- Bring awareness that Engineering Drawing is the Language ofEngineers.
- Familiarize how industry communicates technicalinformation.
- Teach the practices for accuracy and clarity in presenting the technicalinformation.
- Develop the engineering imagination essential for successfuldesign.

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 methodonly,
b) Cycloid, epicycloids andhypocycloid c) Involutes

Learning Outcomes:

At the end of this unit the student will be able to

1. Lettering and dimensioning by freehand (L1)
2. Create geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
3. 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

1. Understand the Projection of the objectives in four quadrants (L2)
2. 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 auxiliaryviewsmethod.

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

1. Draw the development of surfaces of the solids.(L6)
2. Understand to develop the sectional parts of the solids.(L2)

Text Books:

1. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers,2016.

Reference Books:

1. Dr K.Prahlada Rao, Dr. S. Krishnaiah, Prof.A.V.S. Prasad, Engineering Graphics, Amaravati publications. Copy right.2020
2. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right,2009
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers,2000
4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
5. K.C.John, Engineering Graphics, 2/e, PHI,2013
6. 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

1. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

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Subject Code	Title of the Subject	L	T	P	C
20A10302	Engineering Graphics Lab	0	0	2	1

(Common to ECE, EEE & CSE)

Course Objectives:

- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Instruct graphical representation of machinecomponents.

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:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agarwal &C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:
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.

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Subject Code	Title of the Subject	L	T	P	C
20A15202	Applied Physics Lab	0	0	3	1.5

(Common to ECE, EEE & CSE)

Course Objectives:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Note: In the following list, out of 15 experiments, any 12 experiments (minimum 10) must be performed in a semester

List of Applied Physics Experiments

1. Determination of the thickness of the wire using wedge shape method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the thickness of the wire using wedge shape method (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
2. Determination of the radius of curvature of the lens by Newton's ring method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the radius of curvature of the lens (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
   Plots the square of the diameter of a ring with no. of rings (L3)
3. Determination of wavelength by plane diffraction grating method
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the wavelength of the given source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)
4. Determination of dispersive power of prism.
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the refractive index and dispersive power of the given prism (L2)
   Identifies the formation of spectrum due to dispersion. (L2)

5. Determination of wavelength of LASER source using diffraction grating.
   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the wavelength of laser source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)
6. Determination of particle size using LASER.
   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the Particles size using laser (L2)
   Identifies the application of laser (L2)
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)
   Identifies the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications. (L2)

8. Determination of dielectric constant by charging and discharging method.
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimatethedielectricconstantof the given substance. (L2)
   Identifies the significance of dielectric constant in various devices. (L2)
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the magnetic field along the axis of a circular coil carrying current. (L2)
   Plots the intensity of the magnetic field of circular coil carrying current with distance (L3)
10. Measurement of magnetic susceptibility by Gouy's method
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the magnetic susceptibility of the given material. (L2)
   Identifies the significance of magnetic susceptibility in various engineering applications. (L2)
11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the hysteresis loss, coercivity and retentivity of the ferromagnetic material. (L2)
   Classifies the soft and hard magnetic material based on B-H curve. (L2)
   Plots the magnetic field H and flux density B (L3)
12. To determine the resistivity of semiconductor by Four probe method

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the resistivity of a semiconductor. (L2)

Identifies the importance of four probe method in finding the resistivity of semiconductor. (L3)

13. To determine the energy gap of a semiconductor

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the energy gap of a semiconductor. (L2)
Illustrates the engineering applications of energy gap. (L3)
Plots1/T with log R (L3)

14. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the charge carrier concentration and mobility in a semiconductor. (L2)
Illustrates the applications of Hall Effect. (L3)
Plots the voltage with current and voltage with magnetic field (L3)

15. Measurement of temperature coefficient of resistance using thermostat.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the resistance with varying temperature. (L2)
Plots resistance R with temperature T (L3)

Course Outcomes:

The students will be able to

- **Operate** optical instruments like microscope and spectrometer (L2)
- **Determine** thickness of a hair/paper with the concept of interference (L2)
- **Estimate** the wavelength of different colors using diffraction grating and resolving power (L2)
- **Plot** the intensity of the magnetic field of circular coil carrying current with distance (L3)
- **Evaluate** the acceptance angle of an optical fiber and numerical aperture (L3)
- **Determine** the resistivity of the given semiconductor using four probe method (L3)
- **Identify** the type of semiconductor i.e., n-type or p-type using hall effect (L3)
- **Calculate** the band gap of a given semiconductor (L3)

References: 1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

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Subject Code	Title of the Subject	L	T	P	C
20A15502	COMMUNICATIVE ENGLISH LAB	0	0	3	1.5

(Common to ECE, EEE, CSE& CHEM)

Course Objectives

- ➢ students will be exposed to a variety of self instructional, learner friendly modes of language learning
- ➢ students will learn better pronunciation through stress, intonation and rhythm
- ➢ students will be trained to use language effectively to face interviews, group discussions, public speaking
- ➢ students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes

- ➢ CO1: Listening and repeating the sounds of English Language
- ➢ CO2: Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- ➢ CO3: Apply communication skills through various language learning activities
- ➢ CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- ➢ CO5: Evaluate and exhibit acceptable etiquette essential in social and professional settings
- ➢ CO6: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

1. Phonetics
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. Role Play or Conversational Practice
2. JAM
3. Etiquettes of Telephonic Communication

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. Information Transfer
2. Note Making and Note Taking
3. E-mail Writing

Learning Outcomes

At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

Unit4

1. Group Discussions
2. Resume Writing
3. Debates

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. Poster Presentation
3. Interviews Skills

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

Suggested Software

- Orell
- Walden Infotech
- Young India Films

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2).* CUP, 2012.
- A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

- **www.esl-lab.com**
- **www.englishmedialab.com**
- **www.englishinteractive.net**

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Subject Code	Title of the Subject	L	T	P	C
20A10202	FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB	0	0	3	1.5

Course Objectives: Students will be able to

- remember, understand and apply various theorems for circuit analysis and verify practically
- understand and experimentally verify self, mutual inductances and coefficient of coupling
- understand and analyze power measurements in single phase and three phase circuits

Note: From the following list experiments minimum 10 experiments are required to be conducted:

List of Experiments:
1. Verification of KCL and KVL
2. Determination of Self, Mutual Inductances and Coefficient of Coupling
3. Verification of Mesh Analysis
4. Verification of Nodal analysis
5. Verification of Thevenin's and Norton's Theorems
6. Verification of Superposition Theorem for average and rms values
7. Maximum Power Transfer Theorem
8. Verification of Compensation Theorem
9. Verification of Reciprocity, Millmann's Theorems
10. Measurement of Active, Reactive and Apparent Power for Single Phase AC Circuits
11. Measurement of 3-Phase Active Power by One Wattmeter Method
12. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

Course Outcomes: At the end of the course, students should be able to

- verify basic laws of electrical circuits experimentally
- calculate self inductance, mutual inductances and coefficient of coupling of given circuit
- apply various theorems for circuit analysis
- verify active, reactive and apparent power for single phase A.C circuit
- measure active power for a three phase A.C circuit by using one and two wattmeter method

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Subject Code	Title of the Subject	L	T	P	C
20A15102	**Differential Equations and Vector Calculus**	**3**	**0**	**0**	**3**

(Common to All Branches of Engineers except CSE)

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 (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 methodand 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 10hrs

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)

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.

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)

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Subject Code	Title of the Subject	L	T	P	C
20A15303	**CHEMISTRY**	**3**	**0**	**0**	**3**

(common to EEE, ECE & CSE)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

COURSE OUTCOMES	
CO1	**Apply** Schrodinger wave equation to hydrogen atom, **Illustrate** the molecular orbital energy level diagram of different molecular species, **Explain** the band theory of solids for conductors, semiconductors and insulators **Discuss** the magnetic behaviour and colour of complexes.
CO2	**Explain** splitting in octahedral and tetrahedral geometry of complexes **Discuss** the

	magnetic behaviour and colour of coordination compounds **Explain** the band theory of solids for conductors, semiconductors and insulators **Demonstrate** the application of Fullerenes, carbon nano tubes and Graphines nanoparticles
CO3	**Apply** Nernst equation for calculating electrode and cell potentials, **Differentiate** between pH metry, potentiometric and conductometric titrations, **Explain** the theory of construction of battery and fuel cells, **Solve** problems based on cell potential
CO4	**Explain** the different types of polymers and their applications, **Explain** the preparation, properties and applications of PVC, Bakelite**Describe** the mechanism of conduction in conducting polymers, **Discuss** Buna-S and Buna-N elastomers and their applications
CO5	**Explain** the different types of spectral series in electromagnetic spectrum, **Understand** the principles of different analytical instruments, **Explain** the different applications of analytical instruments

<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												

Unit 1: Structure and Bonding Models: (10 hrs)
Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Learning Outcomes:
At the end of this unit, the students will be able to

- **apply** Schrodinger wave equation to hydrogen atom (L3)
- **illustrate** the molecular orbital energy level diagram of different molecular species (L2)
- **explain** the calculation of bond order of O2 and CO molecules (L2)

iscussthe basic concept of molecular orbital theory (L3)

Unit 2: Modern Engineering materials: (10 hrs)

i). Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.
ii). Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.
iii). Nanochemistry: Introduction, classification of nanometerials, properties and applications of Fullerenes, carbon nanotubes and Graphenes nanoparticles
iv). Super capacitors: Introduction, Basic concept-Classification – Applications.

Learning Outcomes:
At the end of this unit, the students will be able to

- **Explain** splitting in octahedral and tetrahedral geometry of complexes (L2).
- **Discuss** the magnetic behaviour and colour of coordination compounds (L3).
- **Explain** the band theory of solids for conductors, semiconductors and insulators (L2)
- **Demonstrate** the application of Fullerenes, carbon nanotubes and Graphines nanoparticles (L2).

Unit 3: Electrochemistry and Applications: (10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni-Cad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Learning Outcomes:

At the end of this unit, the students will be able to

- **apply** Nernst equation for calculating electrode and cell potentials (L3)
- **differentiate** between pH metry, potentiometric and conductometric titrations (L2)
- **explain** the theory of construction of battery and fuel cells (L2)
- **solve** problems based on cell potential (L3)

Unit 4: Polymer Chemistry: (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastic and Thermosetting plastic, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** the different types of polymers and their applications (L2)
- **explain** the preparation, properties and applications of Bakelite, Nylon-6,6, and carbon fibres (L2)
- **describe** the mechanism of conduction in conducting polymers (L2)
- **discuss** Buna-S and Buna-N elastomers and their applications (L2)

Unit 5: Instrumental Methods and Applications (10 hrs)

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law, Principle and applications of UV-Visibleand IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time and pH metry.

Learning outcomes:

After completion of Unit IV, students will be able to:

- **explain** the different types of spectral series in electromagnetic spectrum (L2)
- **understand** the principles of different analytical instruments (L2)
- **explain** the different applications of analytical instruments (L2)

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

Course Outcomes:

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

- **compare**the materials of construction for battery and electrochemical sensors (L2)
- **explain**the preparation, properties, and applications of thermoplastics &thermosetting, elastomers& conducting polymers. (L2)
- **explain** the principles of spectrometry, SLC in separation of solid and liquid mixtures (L2)
- **apply** the principle of Band diagrams in application of conductors and semiconductors (L3)

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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10506	C-PROGRAMMING & DATA STRUCTURES	3	0	0	3

Common to EEE &ECE

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:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes:

1. Analyse the basicconcepts of C Programming language. (L4)
2. Design applications in C, using functions, arrays, pointers and structures. (L6)
3. Apply the concepts of Stacks and Queues in solving the problems. (L3)
4. Explore various operations on Linked lists. (L5)
5. Demonstrate various tree traversals and graph traversal techniques. (L2)
6. Design searching and sorting methods (L3)

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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10402	Electronic Devices and Circuits	0	0	3	1.5

(Common for ECE and EEE branches)

Course Objectives:
- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Unit – 1
Review of Semiconductors:
Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.
Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

Learning outcomes:
1. Remember and understand the basic characteristics of semiconductor diode (L1)
2. Understand iterative and graphical analysis of simple diode circuits (L1)

Unit – 2
Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED).
Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

Learning outcomes:
1. Understand principle of operation of Zener diode and other special semiconductor diodes (L1)

2. Understand the V-I characteristics of BJT and its different configurations (L1)
3. Analyze various applications of diode and special purpose diodes (L3)
4. Design rectifier and voltage regulator circuits (L4)

Unit- 3

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the trans conductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects.

Learning outcomes:

1. Solve problems on various biasing circuits using BJT (L2)
2. Analyze BJT based biasing circuits (L3)
3. Design an amplifier using BJT based on the given specifications (L4)

Unit – 4

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics– i_D - v_{DS}characteristics, i_D – v_{GS}characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point.

Learning outcomes:

1. Understand principle of operation of various types of MOSFET devices (L1)
2. Understand the V-I characteristics of MOSFET devices and their configurations (L1)

Unit – 5

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect.

Learning outcomes:

1. Solve problems on small signal equivalent of MOSFET devices (L2)
2. Analyze various biasing circuits based on different types of MOSFETs (L3)

3. Design an amplifier using BJT based on the given specifications (L4)

Text Books:

1. Adel S. Sedra and KennethC. Smith, “Microelectronic Circuits – Theory and Applications”, 6^{th} Edition, Oxford Press, 2013.
2. Donald A Neamen, “Electronic Circuits – analysis and design”, 3^{rd}Edition, McGraw Hill (India), 2019.

References:

1. J. Milliman and C Halkias, “Integrated electronics”, 2^{nd} Edition, Tata McGraw Hill, 1991.
2. BehzadRazavi, “Microelectronics”, Second Edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits,” 9^{th}Edition, Pearson, 2006.
4. Jimmie J Cathey, “Electronic Devices and Circuits,” Schaum’s outlines series, 3^{rd} Edition, McGraw-Hill (India), 2010.

COURSE OUTCOMES:

After the completion of the course students will able to

CO1: Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.

CO2: Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.

CO3: Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.

CO4: Design of diode circuits and amplifiers using BJTs, and MOSFETs.

CO5: Compare the performance of various semiconductor devices.

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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10303	Engineering Workshop	0	0	3	1.5

(Common to ECE, EEE & CSE)

Course Objective:
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 – Lapjoint
b) Mortise and Tenonjoint
c) Corner Dovetail joint or Bridlejoint

Sheet Metal Working:
Familiarity with different types of tools used in sheet metal working,
Developments of following sheet metal job from GI sheets
a)Taperedtray b)Conicalfunnel
c)Elbowpipe d)Brazing

Fitting:
Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b)Dovetailfit c) Semi-circularfit
d) Bicycle tyre puncture and change of two wheelertyre

Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections
a) Parallelandseries b) Twowayswitch c)Godownlighting d) Tubelight
e) Threephasemotor f) Soldering ofwires

Power tools:
Demonstration of a)Circular Sa w b) Power Planer
c) Zig Saw d) Buffing Machine

Course Outcomes:
After completion of this lab the student will be able to
1. apply wood working skills in real world applications.(L3)
2. build different objects with metal sheets in real world applications.(L3)

3. apply fitting operations in various applications.(L3)
4. apply different types of basic electric circuit connections.(L3)
5. use soldering and brazing techniques.(L2)

Note: In each section a minimum of three exercises are to be carried out.

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Subject Code	Title of the Subject	L	T	P	C
20A10508	IT WORKSHOP	0	0	3	1.5

(Common to , EEE, ECE)

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:

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
6. 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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Subject Code	Title of the Subject	L	T	P	C
20A10507	C-PROGRAMMING & DATA STRUCTURES LAB	**0**	**0**	**3**	**1.5**

Common to EEE,& ECE

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

i) To find the factorial of a given integer.
ii) To find the GCD (greatest common divisor) of two given integers.
iii) To solve Towers of Hanoi problem.

Week 2

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

a) Write a C program that uses functions to perform the following operations:
i) To insert a sub-string in to a given main string from a given position.
ii) To delete n characters from a given position in a given string.

Week 4

a) 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.

b) Write a C program to count the lines, words and characters in a given text.

Week 5

a) Write a C Program to perform various arithmetic operations on pointer variables.

b) 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:

i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

i) Arrays
ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

i) Arrays
ii) Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression
ii) 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:

i) Creating a Binary Tree of integers

ii) 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:

i) Linear search
ii) Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

i) Bubble sort
ii) Selection sort

iii) Insertion sort

Text Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.

3. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15304	CHEMISTRY LAB	0	0	3	1.5

Common to (CE, EEE, ME)

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

COURSE OUTCOMES	
CO1	**determine** the cell constant and conductance of solutions (L3)
CO2	**prepare** advanced polymer materials (L2)
CO3	**determine** the physical properties like surface tension, adsorption and viscosity (L3)
CO4	**estimate** the Iron and Calcium in cement (L3)
CO5	**calculate** the hardness of water (L4)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

List of Experiments:

1. Conductometric titration of strong acid vs. strong base
2. Conductometric titration of weak acid vs. strong base
3. Estimation of Ferrous Iron by Dichrometry.
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite and measurement of its mechanical properties (strength.).
8. Verify Lambert-Beer’s law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterial’s by precipitation
12. Measurement of 10Dq by spectrophotometric method

Course Outcomes:
At the end of the course, the students will be able to

- **determine** the cell constant and conductance of solutions (L3)
- **prepare** advanced polymer Bakelite materials (L2)
- **measure** the strength of an acid present in secondary batteries (L3)
- **analyse** the IR of some organic compounds (L3)

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10403	Electronic Devices and Circuits Lab	0	0	3	1.5

(Common for ECE and EEE branches)

COURSE OBJECTIVES:

1. To verify the theoretical concepts practically from all the experiments.
2. To analyse the characteristics of Diodes, BJT, MOSFET, UJT.
3. To design the amplifier circuits from the given specifications.
4. To Model the electronic circuits using tools such as PSPICE/Multisim.

LIST OF EXPERIMENTS: (**Execute any 12 experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based ***voltage regulator*** against variations of supply and load. Verify the same from the experiment.
5. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required ***h – parameters*** from the graphs.
6. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required ***h – parameters*** from the graphs.
7. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find ***Threshold voltage*** (V_T), g_m, & K from the graphs.
8. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find I_{DSS}, g_m, & V_P from the graphs.

9. Study and draw the Volt Ampere characteristics of UJT and determine ***η**, I_P, I_v, V_P, & V_v* from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Tool like Multisim/ Pspice or Equivalent,
DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

COURSE OUTCOMES:

After the completion of the course students will able to

CO1: Understand the basic characteristics and applications of basic electronic devices. (L1)

CO2: Observe the characteristics of electronic devices by plotting graphs. (L2)

CO3: Analyze the Characteristics of UJT, BJT, MOSFET. (L3)

CO4: Design MOSFET / BJT based amplifiers for the given specifications. (L4)

CO5: Simulate all circuits in PSPICE /Multisim. (L5)

Subject Code	Title of the Subject	L	T	P	C
20A10803	ENVIRONMENTAL SCIENCE	0	0	3	1.5

(Common to ECE, EEE & CSE)

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.

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 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:

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 ErachBharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palani Swamy – Pearson education
(3) Environmental Studies by Dr.S.AzeemUnnisa, 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 byJ.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.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MATHEMATICS
II Year B.Tech. I-Sem (R20)

COMPLEX VARIABLES AND TRANSFORM TECHNIQUES
(20A35102)
(Common to MECH, EEE & ECE)

L	T	P	C
3	0	0	3

20A35102

Course Objective:

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.

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.

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.

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.

CO 4: To develop analytical tools in solving the problems involving

a. Fourier series
b. Laplace transforms
c. 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

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO4	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, ez, cos z, z2) Mobius transformations (bilinear) and their properties.

Learning Outcomes:

Students will be able to

1. understand functions of Complex variable and its properties.

2. find derivatives of complex functions.

3. understand the analyticity of complex functions .

4. 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).

Learning Outcomes:

Students will be able to

1. understand the integration of complex functions.

2. apply Cauchy's integral theorem and Cauchy's integral formula.

3. understand singularities of complex functions.

4. evaluate improper integrals of complex functions using Residue theorem.

Unit-III:Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes:

Studentswill be able to

1. understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.

2. find the Laplace transforms of general functions using its properties.

3. understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).

4. apply Laplace transforms to solve Differential Equations.

Unit-IV:Fourier series

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.

Learning Outcomes:

Students will be able to

1. understand finding Fourier series expression of the given function.
2. determine Fourier coefficients (Euler's) and identify existence of fourier series of the given function.
3. expand the given function in Fourier series given in Half range interval.
4. apply Fourier series to establish Identities among Euler coefficients.
5. find Fourier series of wave forms.

Unit-V: Fourier transforms& Z Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

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

Learning Outcomes:

Students will be able to

1. find Fourier Sine and cosine integrals.
2. understand Fourier transforms.
3. apply properties of Fourier transforms.
4. understand Z transforms.
5. apply properties of Z transforms.
6. apply Z transforms to solve difference equations.

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. 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.

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">ELECTRICAL CIRCUIT ANALYSIS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A30201</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Fundamentals of Electrical Circuits</td><td>Semester</td><td colspan="4">III</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
To know the applications of Fourier transforms to electrical circuits excited by non sinusoidal sources.
Study of Different types of filters, equalizers.</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">At the end of the course, students will be able to
Remember and understand the basics of locus diagrams and concept of resonance, Band factor and Q-factor; two- port network parameters, inter conversion of parameters, transformed variables in two-port networks and transient analysis.
Apply the concepts two port network parameters on electrical circuits, Fourier transforms to electrical circuits excited by non-sinusoidal sources and to determine the transient response of R-L, R-C, R-L-C series circuits for d.c and a.c excitations.
Analyse locus diagrams when R, L, C connected in series and parallel combinations, the three-phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
Design circuit for filters and equalizers.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">Locus Diagrams & Resonance</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Series and Parallel R -L, R-C, R-L-C Combination with Variation of Various Parameters and its locus diagrams – Resonance - Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.</td></tr>
</table>

Unit Outcomes:

The student will be able to

• Learn about basic concepts of Locus diagrams with different parameter variations of Electrical circuit elements

• Learn about occurrence of resonance with the presence of electrical circuit elements under certain operating conditions

UNIT - II	**Two Port Networks**	9 Hrs

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables – Interconnection of two port networks.

Unit Outcomes:

The student will be able to

• Understand and estimate the network parameters of T & π configurations of DC circuits or resistive elements

• Understand how Laplace transforms studied in mathematics courses, can be applied to identifying energy storage elements in electrical circuits

UNIT - III	**Transient Analysis**	12 Hrs

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions of elements and network - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Initial Conditions of elements and network - Solution Method Using Differential Equations and Laplace Transforms.

Unit Outcomes:

The student will be able to • Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in DC excitations • Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in sinusoidal excitations

UNIT - IV	**Fourier Transforms**	10 Hrs
Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms - Application to Electrical Circuits. **Unit Outcomes**: The student will be able to • Know how to apply Fourier transforms studied in Mathematics to Electrical circuits for non-sinusoidal periodic and non-periodic input waves • Understand properties of Fourier series and Transforms		
UNIT - V	**Filters**	9 Hrs
Filters – Low Pass – High Pass, Band Pass and Band Stop – RC, RL filters– Derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers. **Unit Outcomes**: The student will be able to • Understand about what is a Filter, Classification, where they can be used, etc. • Understand about attenuators and equalizers used in electronic high frequency circuits		
Textbooks:		

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9th Edition, 2019. 2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.
Reference Books:
1. M.E. Van Valkenberg, “Network Analysis”, 3rd Edition, Prentice Hall (India), 1980. 2. V. Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall International, 2009. 3. Charles K. Alexander and Matthew. N. O. Sadiku, “Fundamentals of Electric Circuits” Mc Graw Hill, 5th Edition, 2013. 4. MahamoodNahvi and Joseph Edminister, “Electric Circuits” Schaum’s Series, 6th Edition, 2013. 5. John Bird, Routledge, “Electrical Circuit Theory and Technology”, Taylor & Francis, 5th Edition, 2014.
Online Learning Resources:
• https://onlinecourses.nptel.ac.in/noc21_ee99/preview • https://onlinecourses.nptel.ac.in/noc21_ee14/preview

Course Code	DC MACHINES & TRANSFORMERS		L	T	P	C
20A30202			3	0	0	3
Pre-requisite	**Fundamentals of Electrical circuits and Magnetic circuits**	**Semester**	**III**			
Course Objectives:						

Student will be able to

- Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
- understand the constructional details of DC machines and Transformers
- Analyze the performance characteristics of DC machines and transformer
- Evaluate efficiency, regulation and load sharing of DC machines and transformers, Design of Equivalent circuit of transformer

Course Outcomes (CO):

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits, principle and operations of DC machines, starters, single and three phase transformers
- Analyze armature reaction, parallel operation, speed control and characteristics of DC machines. Also analyze the performance characteristics with the help of OC and SC tests of transformer
- Evaluate generated EMF, back EMF, speed, efficiency and regulations of DC machines and efficiency and regulation of transformer, load sharing of parallel connected transformers
- Design winding diagrams of DC machines and equivalent circuit of transformer.

UNIT - I	**Principles of electromechanical energy conversion**	10 Hrs

Energy in magnetic system - Field energy and mechanical force - Multi-excited magnetic field systems - Forces/torques in systems with permanent magnets - Energy conversion via electric field - Dynamical equations of electro mechanical systems

Unit Outcomes:

• Able to understand the electromechanical energy conversion system • To understand about various magnetic materials, properties and Applications		
UNIT - II	**DC Generators**	9Hrs
Constructional details of DC machine - Principle of operation of DC generator - Armature windings and its types - EMF equation - Armature reaction - Effect of brush lead - Demagnetizing and Cross magnetizing ampere turns - Compensating windings – Commutation – EMF induced in a coil undergoing commutation - Methods of improving commutation - OCC and load characteristics of different types of generators - Parallel operation of DC Generators - DC shunt and series generators in parallel - Equalizing connections **Unit Outcomes**: • Able to understand the construction, operation and armature windings of a DC generator • Able to analyze the characteristics of DC generators		
UNIT - III	**DC Motors**	10 Hrs
Force on conductor carrying current - Back emf and its significance – Types of motors -Torque and power developed by armature - Speed control of DC motors (Armature control and Flux control methods) - Necessity of starters - Constructional details of 3-point and 4-point starters - Characteristics of DC motors, Losses in DC machines - Condition for maximum efficiency. **Testing of DC machines:** Brake test, Swinburne’s test, Hopkinson's test, Fields test, Retardation test. **Unit Outcomes**: • Able to analyze speed control of DC motors, testing methods and parallel operation of DC machines • Analyze the characteristics of DC motors		

UNIT - IV	**Single Phase Transformers**	10 Hrs
Principle, construction and operation of single-phase transformers - Equivalent circuit - Phasor diagrams(no load and on load) - Magnetizing current - Effect of nonlinear B-H curve of magnetic core material - Harmonics in magnetization current - Losses and efficiency - Open circuit and short circuit tests - Voltage regulation - Sumpner's test -Separation of hysteresis and eddy current losses - Parallel operation of single-phase transformers - Autotransformers - construction, principle, applications and comparison with two winding transformer. **Unit Outcomes:** • Able to understand the construction, operation and parallel operation of transformer • To predetermine the efficiency and regulation of a transformer		
UNIT - V	**Three Phase Transformers**	9 Hrs
Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection - Tap-changing transformers - No-load and on-load tap changing of transformers - Three-winding transformers - Cooling of transformers. **Unit Outcomes:** • Able to understand and analyze the phase conversions • Analyze the tap changing of transformers		
Textbooks:		
1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011. 2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2010.		
Reference Books:		
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2020. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 3rd Edition, 2004.		

3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 3rd Edition, 2002.
Online Learning Resources:
• https://onlinecourses.nptel.ac.in/noc21_ee71/preview • https://onlinecourses.nptel.ac.in/noc21_ee24/preview

II B.Tech I Sem (E.E.E) **L T P C**

3 0 0 3

DIGITAL LOGIC DESIGN (20A30404)

Course Objectives:

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.
- To model combinational and sequential circuits using HDLs.

Course Outcomes (CO):

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.
CO2: Make use of the concepts to solve the problems related to the logic circuits.
CO3: Analyze the combinational and sequential logic circuits.
CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices
CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.

UNIT - I

Number Systems, Boolean algebra and Logic Gates

Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions.

UNIT - II

Minimization of Boolean functions and Combinational Logic Circuits

The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers.

UNIT - III

Sequential Logic Circuits

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register.

UNIT - IV

Finite State Machines and Programmable Logic Devices

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flipflops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector.

UNIT - V

Hardware Description Language

Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs, Introduction to Verilog - structural Specification of logic circuits, behavioural specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop; using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.

Textbooks:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill

Reference Books:

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. ZviKohavi and Niraj K.Jha, "Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2ndEdition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
20A39101 a	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**	3	0	0	3

Common to All Branches

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.

(Humanities Elective –I)

Subject Code	Title of the Subject	L	T	P	C
20A39101b	**ENTREPRENEURSHIP& INCUBATION**	3	0	0	3

Common to All Branches

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.

(Humanities Elective-I)
(w.e.f Academic Year 2020-21)

Subject Code	Title of the Subject	L	T	P	C
20A39101 c	**BUSINESS ETHICS AND CORPORATE GOVERNANCE**	3	0	0	3

Common to All Branches

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,MarketingManagement - 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, 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

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

Course Code	ELECTRICAL CIRCUIT ANALYSIS LAB		L	T	P	C
20A30203			0	0	3	1.5
Pre-requisite	**Electrical circuits**	**Semester**	**III**			

Course Objectives:

- Understand and experimentally verify various resonance phenomenon.
- Understand and analyze various current locus diagrams.
- Apply and experimentally analyze two port network parameters

Course Outcomes (CO):

At the end of the course, students will be able to

CO1: Remember, understand and apply various theorems for circuits' analysis and verify practically.

CO2: Understand and experimentally verify various resonance phenomenon.

CO3: Understand and analyze various current locus diagrams and active, reactive power measurements in three phase circuits.

CO4: Apply and experimentally analyze two port network parameters

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'

2. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'

3. Series & Parallel Resonance

4. Determination of Z & Y Parameters

5. Determination of Transmission & Hybrid Parameters

6. Series and Parallel connection of two port networks

7. Cascaded Connection of two port networks 8. Determination of Coefficient of coupling 9. Transient Response of RL an RC series circuits 10. Transient Response in R-L-C Series & Parallel circuits. 11. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). 12. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits. 13. Frequency response of LP and HP filters 14. Frequency response of BP and BR filters 15. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals.
References:
David A. Bell, Fundamentals of Electric Circuits: Lab Manual, OUP Canada, 7th Edition, 2009.
Online Learning Resources/Virtual Labs:
• **http://vlabs.iitkgp.ernet.in/asnm/index.html** • **https://vlab.amrita.edu/?sub=1&brch=75** • **http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php**

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">DC MACHINES & TRANSFORMERS LAB</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A30204</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>DC Machines and Transformer</td><td>Semester</td><td colspan="4">III</td></tr>
</table>

Course Objectives:

To conduct various experiments on

- DC motors and DC Generators
- The speed control techniques of DC motors.
- To conduct various experiments for testing on 1-phase transformers

Course Outcomes (CO):

- Remember, understand various basic tests like brake test, load test, Swinburne test, separation of losses, open circuit and short circuit tests.
- Apply the above tests on transformers, DC shunt motors and DC long and short compound generators.
- Analyze the magnetization characteristics of DC shunt generator, parallel operation of single phase transformers
- Evaluate various characteristics for the tests performed.

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and

critical speed.

2. Load test on DC shunt generator. Determination of characteristics.

3. Brake test on DC shunt motor. Determination of performance curves.

4. Swinburne's test on DC shunt motor, Predetermination of efficiency.

5. Speed control of DC shunt motor (Armature control and Field control method).

6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.

7. OC and SC test on single phase transformer

8. Parallel operation of single phase transformers.

9. Sumpner's test on single phase transformers.

10. Load test on DC long shunt compound generator. Determination of characteristics.

11. Load test on DC short shunt compound generator. Determination of characteristics.

12. Separation of losses in DC shunt motor.

13. Separation of losses of single phase transformer.

References:

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

Online Learning Resources/Virtual Labs:

- http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
- http://vlabs.iitb.ac.in/vlabs/dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech I Sem (E.E.E)

L T P C

0 0 3 1.5

DIGITAL LOGIC DESIGN LAB (20A30405)

Course Objectives:

- To understand various pin configurations of the Digital ICs used in the laboratory
- To conduct the experiments and verify the truth tables of various logic circuits.
- To analyze the logic circuits
- To design sequential and combinational logic circuits and verify their properties.
- To design of any sequential/combinational circuit using Hardware Description Language.

Course Outcomes (CO):

CO1: Understand the pin configuration of various digital ICs used in the lab
CO2: Conduct the experiment and verify the properties of various logic circuits.
CO3: Analyze the sequential and combinational circuits.
CO4: Design of any sequential/combinational circuit using Hardware/ HDL.

List of Experiments:

1. Verification of truth tables of the following Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
4. 4-variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output
8. Design a four bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

Add on Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

References:

M. Morris Mano, “Digital Design”, 3rd Edition, PHI

Course Code	**Python Programming**		**L**	**T**	**P**	**C**
20A30205			**1**	**0**	**2**	**2**
Pre-requisite		**Semester**	**III**			

Course Objectives:

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

Course Outcomes (CO):

After completion of the course students should be able to

- Understand the python programming basic concepts like: structure, data types, files, strings etc.
- Apply the above basic concepts to create user defined functions or make use of the built in functions to solve various problems
- Design various computational algorithms to solve algebraic, arithmetic and scientific problems.
- Evaluation of real time issues with the help of special functions, tuples and fruitful functions etc.

List of Experiments:

The student is expected to do the following exercises through Python Programming.

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator
2. Write a function that draws a grid like the following:

```
+ - - - - + - - - - +
|         |         |
|         |         |
|         |         |
|         |         |
+ - - - - + - - - - +
|         |         |
|         |         |
|         |         |
|         |         |
+ - - - - + - - - - +
```

3. Write a function that draws a Pyramid with # symbols

```
         #
       # # #
     # # # # #
   # # # # # # #
         .
```

Up to 15 hashes at the bottom

4. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least 'ten' letters of the alphabet.
5. Write program which performs the following operations on lists. Don't use built-in functions
   a) Updating elements of a list
   b) Concatenation of list's
   c) Check for member in the list
   d) Insert into the list
   e) Sum the elements of the list
   f) Push and pop element of list
   g) Sorting of list
   h) Finding biggest and smallest elements in the list
   i) Finding common elements in the list
6. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.
7. The time module provides a function, also named time that returns the current Greenwich

Mean Time in "the epoch", which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
>>>time. time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.

8. Given n+r+1 <= 2^r .n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above.
9. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.
10. Write a program which counts number of vowels, consonants and special characters for a given text of characters.
11. Given a word which is a string of characters. Given an integer say 'n'. Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.
12. Write a program that takes a string and prints the letters in decreasing order of frequency.
13. Solving linear differential equations and optimization problems using Python programming.
14. Matrix operations.
15. Basic image processing.

References:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016
3. Dainel Y. Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 1st Edition, 2018
4. "Python programming and numerical methods: A guide for engineers and scientists" by Qingkai Kong, Timmy Siauw and Alexandre M.Bayen, Elsevier Inc, 2020.
5. "Python Programming" by Reema Thareja, Oxford University Press, 2017

Online Learning Resources/Virtual Labs:

. https://nptel.ac.in/courses/106/106/106106182/

2. https://nptel.ac.in/courses/106/106/106106212/

UNIVERSAL HUMAN VALUES

(Mandatory Course -III/IV SEMESTER)

(w.e.f Academic Year 2020-21)

(Common to EEE, ECE & CSE)

Subject Code	Title of the Subject	L	T	P	C
20A19101	**Universal Human Values**	3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	Exposure to the value of life, society and harmony
2	Leading towards holistic perspective based on self-exploration about themselves (human being), family, and society andnature/existence.
3	Bringing transition from the present state to Universal Human Order
4	Instill commitment and courage toact.
5	Know about appropriate technologies and management patterns

SYLLABUS

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 among Human Beings & Self Harmony!

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

1. HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
2. The Story of Stuff(Book).
3. Economy of Permanence - J C Kumarappa 8.
   Bharat Mein Angreji Raj - PanditSunderlal 9.
   Rediscovering India - byDharampal
4. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
5. India Wins Freedom - Maulana Abdul Kalam Azad 12.
   Vivekananda - Romain Rolland(English)

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define terms like Natural Acceptance, Happiness and Prosperity
CO2	**Understand awareness of oneself, and one's surroundings (family, society nature)**
CO3	**Apply what they have learnt to their own self in different day-to-daysettings 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)::ANANTAPURAMU
DEPARTMENT OF MATHEMATICS

Course Code	Numerical Methods &Probability theory- (EEE & MECH) B.Tech II Year II Sem (R20)		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 value**		9 Hrs			

	problems to Ordinary differential equations	

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:

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:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. nptel.ac.in/courses/117101056/17
3. http://nptel.ac.in/courses/111105090

II. B.Tech II Sem

Course Code	ANALOG ELECTRONICS		L	T	P	C
20A40409			3	0	0	3
Pre-requisite	Electronic Devices & Circuits	Semester	IV			

Course Objectives:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

Course Outcomes (CO):

CO1: List various types of feedback amplifiers, oscillators and large signal amplifiers
CO2: Explain the operation of various electronic circuits and linear ICs
CO3: Apply various types of electronic circuits to solve engineering problems
CO4: Analyze various electronic circuits and regulated power supplies for proper understanding
CO5: Justify choice of transistor configuration in a cascade amplifier
CO6: Design electronic circuits for a given specification

UNIT - I

Multistage Amplifiers

Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

UNIT - II

Feedback Amplifiers and Oscillators

Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage–shunt.

Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

UNIT - III

Large Signal Amplifiers

Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

UNIT - IV

Operational Amplifier

Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations.

The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.

UNIT - V

Applications of OP-AMPs and Special ICs

Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier.

Converters: Current to voltage and voltage to current converters.

Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, **Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Square wave generator.

Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

Textbooks:

1. Millman, Halkias and Jit , “Electronic Devices and Circuits” , 4th Edition , McGraw Hill Education (India) Private Ltd.,2015.
2. Ramakanth A. Gayakwad, “Op-Amps& LinearICs”,4thEdition, Pearson, 2017.

Reference Books:

1. Millman and Taub, Pulse, Digital and Switching Waveforms, 3rdEdition, TataMcGraw-Hill Education, 2011.
2. J. Milliman, C.C. Halkias and Chetan Parikh, “Integrated Electronics”, 2ndEdition, McGraw Hill, 2010.
3. David A. Bell, “ Electronic Devices and Circuits”, 5thedition,OxfordPress,2008.
4. D. Roy Choudhury, “LinearIntegratedCircuits”,2ndEdition, New Age International (p)Ltd,2003
5. Salivahanan and N. Suresh Kumar, “ Electronic Devices and Circuits”,4thEdition,McGrawHill Education (India) Private Ltd.,2017.

II. B.Tech II Sem

Course Code	**POWER ELECTRONICS**		**L**	**T**	**P**	**C**
20A40201			**3**	**0**	**0**	**3**
Pre-requisite	**Electrical circuits and semiconductor devices**	**Semester**	**IV**			

Course Objectives:

The student will be able to:

- Understand the differences between signal level and power level devices.
- Analyze the construction, operation, characteristics and usage of various converters.
- Analyze the voltage and current waveforms at various elements in the designed converter in different conduction modes of operation
- Apply concepts of converters to solve numerical problems

Course Outcomes (CO):

At the end of this course students will be able to:

- Understand and remember the construction, operation, characteristics and usage of basic Power Semiconductor Devices.
- Analyze the operation of various converters when different types of loads are connected.
- Analyze the voltage and current waveforms at various elements in the designed converter in different conduction modes of operation.
- Apply voltage and current equations derived to solve numerical problems.

UNIT - I	**Power Switching Devices**	9 Hrs

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Galium Nitride and Silicon Carbide Devices.

Unit Outcomes:

At the end of the unit, students will be able to

• Understand the basic power semiconductor devices their construction, principle of working and their characteristics.

• Understand in detail about SCR i.e., its characteristics, series and parallel connection of SCR's, specification, its ratings and various commutation methods.

• Apply the above concepts to solve numerical problems.

UNIT - II	**Rectifiers**	10 Hrs

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.

Unit Outcomes:

At the end of the unit, students will be able to

• Understand the concepts of phase control technique, midpoint and bridge connections of half and full controlled converters with various loads for both 1Ø and 3Ø phase converters, effect of source inductance and dual converters.

• Analyze and evaluate voltages and currents, active and reactive power inputs to converter with and without freewheeling diode for 1Ø and 3Ø converters.

• Apply the above concepts to solve numerical problems.

UNIT - III	**DC-DC CONVERTERS**	9 Hrs

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Unit Outcomes:

At the end of the unit, students will be able to

• Understand the concepts of various control strategies, types of choppers and analyze their principle operation, waveforms of voltages and currents at different loads.

• Apply the above concepts to solve numerical problems.

UNIT - IV	**INVERTERS**	10 Hrs

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

Unit Outcomes:

At the end of the unit, students will be able to

• Understand the construction, working of single phase and three phase voltage inverters with their waveforms in various operating modes when different loads.

• Understand the concept of harmonic components and the different modulating techniques.

• Apply the above concepts to solve numerical problems.

UNIT - V	**AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:**	10 Hrs

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems.

Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Unit Outcomes:

At the end of the unit, students will be able to

• Understand the concept of AC voltage controllers and analyse its output waveforms • Understand the concept of Cyclo Converters and its applications
Textbooks:
M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", 2nd edition, Prentice Hall of India, 1998 2. P.S.Bimbhra,"Power Electronics", 4th Edition, Khanna Publishers, 2010. 3. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.
Reference Books:
Ned Mohan, "Power Electronics", Wiley, 2011. 2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics" 2nd Edition, Kluwer Academic Publishers, 2004. 3. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, 1996. 4. V.R.Murthy, "Power Electronics", 1st Edition, Oxford University Press, 2005. 5. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Education, 1987. 5. "Power Electronic Control of Alternating Current Motors" by J.M.D.Murphy
Online Learning Resources:
• **https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom** • **https://onlinecourses.nptel.ac.in/noc21_ee01/preview**

II. B.Tech II Sem

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">AC MACHINES</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A40202</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electrical circuits, Magnetic circuits, DC machines and transformers</td><td>Semester</td><td colspan="4">IV</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">The students will be able to:
• Understand the principle, construction and operation of AC machines and Special Machines.
• Analyze the concept of circle diagram, starting methods and speed control of inductor motor
• Analyse the concept of parallel operation, power circles and starting methods of synchronous machines.</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">At the end of this course, students will be able to:
• Understand and remember principle, construction, operation and winding concepts of AC machines, synchronous condenser and special machines.
• Analyze the concept of circle diagram, starting methods and speed control of inductor motor, parallel operation, power circles and starting methods of synchronous machines
• Obtain and draw the equivalent circuit, phasor diagrams, various voltage regulation methods and V and inverted V curves of synchronous machine.
• Apply the concepts to evaluate the performance characteristics of AC machines.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">Induction Machines - I</td><td colspan="4">9Hrs</td></tr>
<tr><td colspan="7">Poly phase Induction Motors - Construction Details of Cage and Wound Rotor Machines-Production of a Rotating Magnetic Field - Principle of Operation - Rotor EMF and Rotor</td></tr>
</table>

Frequency - Rotor Reactance, Rotor Current and Power factor at Standstill and During Operation. Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and their inter relation-Torque Equation-Deduction From Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristics. **Learning Outcomes:** By the end of the unit, student will be able to: • Understand the principle, construction and types of induction motors. • Analyze the change of parameters with respect to slip, various types of powers, torque equations and their characteristics. • Apply the above concepts to solve numerical problems.		
UNIT - II	**Induction Machines - II**	10 Hrs
Equivalent Circuit - Phasor Diagram - Crawling and Cogging –Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance - Generator Operation - Double Cage and Deep Bar Rotors - Starting Methods and Starting Current and Torque Calculations, Speed Control methods -Change of Frequency, Pole Changing and Methods of Consequent Poles, Cascade Connection, Injection of an EMF. **Learning Outcomes:** By the end of the unit, student will be able to: • Understand the concepts of crawling, cogging, generator operation and types of rotors and circle diagrams. • Analyze various starting methods and speed control of induction motors. • Apply the above concepts to solve numerical problems		
UNIT - III	**Synchronous Machines - I**	10 Hrs
Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings, Distributed and concentrated windings – Distribution, Pitch and Winding factors – E.M.F Equation - Harmonics in generated e.m.f. – suppression of harmonics – armature reaction – leakage reactance – synchronous reactance and		

impedance – Experimental determination - phasor diagram – load characteristics.

Predetermination of Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods –two reaction analysis – experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the types of windings, different winding factors, principle, construction, operation and armature reaction of synchronous generator.
- Analyze various regulation methods of synchronous machine.
- Apply the above concepts to solve numerical problems.

UNIT - IV	**Synchronous Machines - II**	10 Hrs

Synchronization of alternators with infinite bus bar – Synchronizing power, synchronizing torque –parallel operation and load sharing - Effect of change of excitation and mechanical power input - Analysis of short circuit current wave form – Determination of sub-transient, transient and steady state reactances.

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the concept of parallel operation of synchronous machines, principle and operation of synchronous motor.
- Analyze various staring methods, phasor diagram, power factor correction, excitation and power circles
- Apply the above concepts to solve numerical problems.

UNIT - V	**Special Machines**	9 Hrs

Single Phase Motors: Single phase induction motor – Constructional features - Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.

Special Motors: Construction, working principle and performance of- Stepper Motors, Reluctance motors, A.C. Series motors, Universal motors, BLDC motor.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the principle and construction of special machines.
- Analyze the operation of special machines.

Textbooks:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.

2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

Course Code	ELECTROMAGNETIC FIELD THEORY		L	T	P	C
20A40203			**3**	**0**	**0**	**3**
Pre-requisite	**Magnetic circuits**	**Semester**	**IV**			

Course Objectives:

- To understand the basic principles of electrostatics
- To understand and apply the basic principles of magneto statics for time invariant and time varying fields
- To apply the principles of dielectrics, conductors and magnetic potentials to numerical problems

Course Outcomes (CO):

After completion of the course, the student will be able to:

- Remember and understand the basics concepts and fundamental laws of electrostatics, magneto statics.
- Apply the concepts and laws in different charges in electrostatics, magneto statics and Time varying fields.
- Analyze the physical quantities of electromagnetic and time varying fields using the fundamental laws.
- Determine potential, charge, capacitance and inductance of electric field

UNIT - I	**ELECTROSTATICS**	9 Hrs

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field - Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law Application of Gauss Law-Maxwell's First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

Unit Outcomes:

• Able to determine electric field and potentials using Coulomb's law & Gauss law.

• Analyze potential differences for different configurations.

• Able to classify static electric magnetic fields in different engineering situations.

• Able to determine the Concepts of Electric dipole, Electrostatic Energy and Energy density

UNIT - II	**CONDUCTORS AND DIELECTRICS**	9 Hrs

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

Unit Outcomes:

• Analyze the Concepts of Conduction and Convection currents.

•Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.

• Able to Calculate Energy stored and energy density in a static electric fields.

UNIT - III	**MAGNETO STATICS**	11 Hrs

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

Unit Outcomes: • Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law. • Able to understand Maxwell's equations. • Determine MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops.		
UNIT - IV	**MAGNETIC POTENTIAL**	9 Hrs
Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems. **Unit Outcomes:** • Understand scalar magnetic potential and vector magnetic potential and its applications. • Able to calculate the magnetic forces and torque produced by currents in Magnetic Field. • Ability to calculate self and mutual Inductances. • Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic field.		
UNIT - V	**TIME VARYING FIELDS and WAVES**	10 Hrs
Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance. **Unit Outcomes:** • Acquires knowledge on time varying fields & Faraday's law for Electromagnetic induction		

• Analyze the Concepts Maxwell's Equations in Different Forms. • Understand the Concepts Calculation of Poynting vector & Theorem. • Analyze the Concepts of Wave Theory
Textbooks:
1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015 2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.
Reference Books:
1.J.D.Kraus, "Electromagnetics", 5th Edition, Mc Graw Hill Inc, 1999. 2. David K. Cheng, "Field & Electromagnetic Waves", 2nd Edition, 1989. 3. Joseph A. Edminister, "Electromagnetics", 2nd Edition, Schaum's Outline, Mc Graw Hill, 2017. 4. K.A. Gangadhar and P.M. Ramanathan, "Electomagnetic Field Theory", 8th Reprint, Khanna Publications, 2015.
Online Learning Resources:
• **https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom** • **https://onlinecourses.nptel.ac.in/noc21_ee83/preview**

II B.Tech II Sem (E.E.E) **L T P C**

0 0 3 1.5

ANALOG ELECTRONICS LAB (20A40410)

Course Objectives:

- To learn basic techniques for the design of analog circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

Course Outcomes (CO):

CO1: Analyze various amplifier circuits.
CO2: Design multistage amplifiers.
CO3: Design OPAMP based analog circuits.
CO4: Understand working of logic gates.
CO5: Design and implement Combinational and Sequential logic circuits.

List of Experiments:

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Band width from its frequent cure sponse curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without crossover distortion. Determine maximum output power and efficiency.
6. Design a class AB amplifier to remove the cross over distortion using MOSFETs.
7. Design inverting and non-inverting amplifiers for the given specifications using OP AMP and verify the same experimentally.
8. Design practical differentiator and integrator circuits using OP AMP for the given specifications and verify the same practically.
9. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
10. Design a square waveform generator using OP-AMP for the given specifications.
11. Design an astable multivibrator circuit for the given specifications using 555 timer. Observe ON & OFF states of transistor in an astable multi-vibrator. Plot output waveforms.
12. Design a Mono stable Multi-Vibrator circuit for the given specifications using 555 Timer. Plot output waveforms.
13. Verify one application of PLL (IC 565) by choosing appropriate circuit.
14. Conduct experiment to generate multiple functions using IC 566.

Course Code	POWER ELECTRONICS LAB		L	T	P	C
20A40204			0	0	3	1.5
Pre-requisite	Power Electronics	Semester	IV			

Course Objectives:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cycloconverters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

Course Outcomes (CO):

By the end of the course the student will be able to:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, Cycloconverters with different loads.
- Design various power electronic converters.

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. Study of Characteristics of SCR, MOSFET & IGBT

2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering

3. Single Phase AC Voltage Controller with R and RL Loads

4. Single Phase fully controlled bridge converter with R and RL loads

5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E) 6. DC Jones chopper with R and RL Loads 7. Single Phase Parallel inverter with R and RL loads 8. Single Phase Cycloconverter with R and RL loads 9. Single Phase Half controlled converter with R and RL load 10. Single Phase Fully controlled converter with R and RL load 10. Three Phase half controlled bridge converter with R,RL-load 11. Three Phase fully controlled bridge converter with R,RL-load 11. Single Phase series inverter with R and RL loads 12. Single Phase Bridge converter with R and RL loads 13. Single Phase dual converter with RL loads
References:
1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007. 2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications. 3. PSPICE A/D user's manual – Microsim, USA. 4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.
Online Learning Resources/Virtual Labs:
http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

II. B.Tech II Sem

Course Code	AC MACHINES LAB		L	T	P	C
20A40205			**0**	**0**	**3**	**1.5**
Pre-requisite	**AC MAchines**	**Semester**	**IV**			

Course Objectives:

- To perform load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- To Predetermine regulation of a three-phase alternator by synchronous impedance, m.m.f method and Zero Power Factor method.
- To determine Xd and Xq salient pole synchronous machine.
- To evaluate and analyze V and inverted V curves of 3 phase synchronous motor

Course Outcomes (CO):

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

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by various methods.
- Analyse Xd and Xq of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.

2. Load test on three phase slip ring Induction motor.

3. Speed control of three phase induction motor

4. Rotor resistance starter for slip ring induction motor

5. Load test on single phase induction motor.

6. Determination of Equivalent circuit of a single phase induction motor.

7. Predetermination of Regulation of a three phase alternator by synchronous impedance &m.m.f methods.

8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.

9. Determination of Xd and Xq of a salient pole synchronous machine by slip test.

10. V and inverted V curves of a 3-phase synchronous motor.

11. Speed control of wound rotor induction motor using rotor resistance control

References:

1. D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017.

2. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand & Bros.

Online Learning Resources/Virtual Labs:

- **http://vem-iitg.vlabs.ac.in/**
- http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
- http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

II. B.Tech II Sem

Course Code	CIRCUITS SIMULATION AND ANALYSIS USING PSPICE		L	T	P	C
20A40206			**1**	**0**	**2**	**2**
Pre-requisite	**Electrical Circuits, Power Electronics**	**Semester**	**IV**			

Course Objectives:

- To simulate of various circuits using PSPICE software.
- To analyze the operation of single-phase half & fully-controlled converters and inverters
- To apply and analyze single-phase AC Voltage controllers for different loading conditions.

Course Outcomes (CO):

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

- Understand and remember the basics of PSPICE software.
- Apply PSPICE on various power electronic circuits to analyze voltages, currents through the load and total harmonic distortion in the circuits.
- Analyze various AC and DC circuits using PSPICE to obtain voltages and currents at various nodes and branches.

List of Experiments:

I Simulation of Electrical Circuits

a) DC & AC Circuits
b) Mesh Analysis
c) Nodal Analysis
d) Transient Response

II Simulation of Power Electronic Circuits

a) Single-phase half wave, Semi and full converters with RLE loads.
b) Three-phase half wave, Semi and full converters with RLE loads.
c) Buck, Boost and Buck-Boost Converters
d) Single-phase AC voltage controller
e) Single and Three phase Quasi Square wave and PWM Inverters.

References:

Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.

2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid,

M/s PHI Publications.

3. PSPICE A/D user's manual – Microsim, USA.

4. PSPICE reference guide – Microsim, USA.

5. MATLAB and its Tool Books user's manual and – Mathworks, USA.

Online Learning Resources/Virtual Labs:

- **http://vlabs.iitb.ac.in/vlabs- ev/labs/mit_bootcamp/power_electronics/labs/index.php**

II. B.Tech II Sem

Course Code	Design Thinking for Innovation (Common to All Branches)		L	T	P	C
20A49102			**3**	**0**	**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, Relibility and plan for startup.		
Textbooks:		
1. Change by design, Tim Brown, Harper Bollins (2009) 2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.		
Reference Books: 1. Design Thinking in the Classroom by David Lee, Ulysses press 2. Design the Future, by Shrrutin N Shetty, Norton Press 3. Universal principles of design- William Lidwell, Kritinaholden, Jill Butter. 4. 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		

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">POWER SYSTEM ARCHITECTURE</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A50201</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">V</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives: To make the student learn about:</td></tr>
<tr><td colspan="7">• The Block Diagram and Operation of Conventional Power Generating Systems and their Components.
• The role of non-conventional Power Generating Systems and their operation and economic aspects.
• Calculation of different transmission line parameters and their use.
• Modeling of transmission line and evaluation of constants.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO1 Remember and understand the concepts of conventional and nonconventional power generating systems.
CO2 Apply the economic aspects to the power generating systems.
CO3 Analyse the transmission lines and obtain the transmission line parameters and constants.
CO4 Design and Develop the schemes to improve the generation and capability of transmission line to meet the day to day power requirements.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">POWER GENERATING SYSTEMS</td><td colspan="4">Lecture Hrs: 8</td></tr>
<tr><td colspan="7">Thermal Power: Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components
Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants- Radiation Hazards: Shielding and Safety Precautions- Types of Nuclear Reactors.
Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.
Wind Power Generation: Role and Potential of Wind Energy Options, Horizontal and Vertical Axis Wind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.</td></tr>
<tr><td>UNIT - II</td><td colspan="2">TRANSMISSION LINE PARAMETERS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.</td></tr>
</table>

UNIT - III	MODELING OF TRANSMISSION LINES	Lecture Hrs: 10
Classification of Transmission Lines - Short, Medium and Long lines and their models - Representations - Nominal-T, Nominal-π and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, Evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems – Surge Impedance and Surge Impedance Loading - Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients-Termination of lines with different types of conditions-wavelengths and Velocity of Propagation – Ferranti effect, Charging current, Need of Shunt Compensation.		
UNIT - IV	**INSULATORS, CORONA AND MECHANICAL DESIGN OF LINES AND CABLES**	Lecture Hrs: 10
Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of String Efficiency, Capacitance Grading and Static Shielding. Corona - Description of the phenomenon, Factors affecting Corona, Critical Voltages and Power Loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing Chart and Sag template and its Applications. Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation Resistance and Stress in Insulation, Numerical Problems.		
UNIT - V	**GENERAL ASPECTS OF DISTRIBUTION SYSTEMS**	Lecture Hrs: 10
Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over - Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.		
Textbooks:		
1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999. 2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.		
Reference Books:		
1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000. 2. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006. 3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003. 4. Principles of Power Systems by V.K. Mehta and Rohit Mehta, S.CHAND& COMPANY LTD., New Delhi 2004. 5. Wind Electrical Systems by S. N. Bhadra, D. Kastha& S. Banerjee – Oxford University Press, 2013.		
Online Learning Resources:		

1. https://onlinecourses.nptel.ac.in/noc22_ee17/preview

Course Code	CONTROL SYSTEMS		L	T	P	C
20A50202			3	0	0	3
Pre-requisite		Semester	V			

Course Objectives: To make the students learn about:

- Merits and demerits of open loop and closed loop systems; the effect of feedback.
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function.
- Transient and steady state response, time domain specifications and the concept of Root loci.
- Frequency domain specifications, Bode and Nyquist plots.
- State space modelling of Control system.

Course Outcomes (CO): After completing the course, the student should be able to:

CO1	Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics and state space analysis.
CO2	Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical model, Root locus, Bode, Nyquist and Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
CO3	Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
CO4	Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them for various engineering applications.

UNIT - I	***CONTROL SYSTEMS CONCEPTS***	Lecture Hrs: 12

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle and operation of DC and AC Servo motors, Transfer function of DC servo motor - AC servo motor and Synchros.

UNIT - II	**TIME RESPONSE ANALYSIS**	Lecture Hrs: 8

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

UNIT - III	***STABILITY ANALYSIS IN TIME DOMAIN***	Lecture Hrs: 10

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci- Design of Lag, Lead, Lag-Lead Compensators using Root Locus.

UNIT - IV	**STABILITY ANALYSIS INFREQUENCY DOMAIN**	Lecture Hrs: 12

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

UNIT - V	**STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**	Lecture Hrs: 8

Concepts of state, state variables, state model-state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability - Duality between controllability and observability.

Textbooks:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

Reference Books:

1. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee31/preview

Course Code	DIGITAL COMPUTER PLATFORMS		L	T	P	C
20A50203			3	0	0	3
Pre-requisite	Signals and Systems	Semester	V			

Course Objectives:

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

Course Outcomes (CO):

CO1 Understand the basic architecture & pin diagram of 8086 microprocessor, 8051 Microcontroller, DSP Processor and FPGA Processors

CO2 Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types

CO3 Design Real time applications by writing Assembly Language Programs for the Digital Signal Processors, Xilinx programming for Spartan FPGA boards and use Interrupts for real-time control applications

CO4 Analyse various real time systems by using various controllers

UNIT - I	**INTRODUCTION TO MICROPROCESSORS**	Lecture Hrs: 10

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors- Introduction to Multicore Processors- GPU.

UNIT - II	**ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE**	Lecture Hrs: 10

Macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

UNIT - III	**8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS**	Lecture Hrs: 10

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

UNIT - IV	**INTRODUCTION TO TMS320LF2407 DSP CONTROLLER**	Lecture Hrs: 10

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

UNIT - V	FIELD PROGRAMMABLE GATE ARRAYS (FPGA)	Lecture Hrs: 8
Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.		
Textbooks:		
1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085, Penram Intl. Publishing, 6th Edition, 2013 2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.		
Reference Books:		
1. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992 2. Microprocessor, Nilesh B Bahadure, PHI, 2010. 3. The 8051 Micro Controller Architecture, Programming and Applications by Kenneth J Ayala, Pearson International publishing (India). 4. Hamid A. Tolyat, DSP Based Electro Mechanical Motion Control, CRC press, 2004. 5. Application Notes from the webpage of Texas Instruments. 6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998 7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999 8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.		
Online Learning Resources:		
1. https://nptel.ac.in/courses/106108100 2. https://nptel.ac.in/courses/108105102 3. https://nptel.ac.in/courses/117108040		

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">PROGRAMMABLE LOGIC CONTROLLERS (PE-I)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A50204a</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Digital Circuits</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

Course Objectives: The student will be able to:

- Understand the basic functions and types of PLCs, Easy Veep software.
- Understand Classification of PLCs and applications.
- Design PLC Programming for various applications.
- Analyze PLC troubleshooting aspects.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1 Understand different types of PLCs, Its classification and the usage of EasyVeep software.
CO2 Analyze the hardware details of Allen Bradley PLC.
CO3 Design PLC Programming for various applications.
CO4 Apply PLC programming concepts in different fields of Science and Technology.

UNIT - I	**BASIC CONCEPTS OF PLCs**	Lecture Hrs: 8

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards.

UNIT - II	**PLC COMPUTATIONAL TOOLS**	Lecture Hrs: 10

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500.

UNIT - III	**PLC DEVELOPMENT**	Lecture Hrs: 10

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.
Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

UNIT - IV	**PLC PROGRAMMING**	Lecture Hrs: 10

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring – Examples, Motor START and STOP Logic, Lube Oil Pump Ladder Logic, Star Delta Motor Starter using PLC Logic.

UNIT - V	**PLC APPLICATIONS**	Lecture Hrs: 10

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Textbooks:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

Reference Books:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Learning Resources:

1. https://nptel.ac.in/courses/108105088

Course Code	**LINEAR AND DIGITAL IC APPLICATIONS**	**L**	**T**	**P**	**C**
20A50204b		3	0	0	3
Pre-requisite	**Semester**				

- Electronic Devices & Circuits
- Digital Logic Design

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce some special function
- ICs.

Course Outcomes (CO): At the end of this course, the students will be able to

- List out the characteristics of Linear and Digital ICs.
- Discuss the various applications of linear & Digital ICs.
- Solve the application-based problems related to linear and digital ICs.
- Analyze various applications-based circuits of linear and digital ICs.
- Design the circuits using either linear ICs or Digital ICs from the given specifications.

UNIT - I

Integrated Circuits and Operational Amplifier: Introduction, Classification ofIC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and itsfeatures, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics –DCand AC.

UNIT - II

Linear Applications of OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor,Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

Non-Linear Applications of OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular andSquare waveform generators, Oscillators

UNIT - III

Active Filters: Introduction, Butterworth filters – 1st order, 2nd order low pass and high passfilters, band pass, band reject and all pass filters.

Timer And Phase Locked Loops: Introduction to IC 555 timer, description of functionaldiagram, monostable and Astable operations and applications, Schmitt trigger, PLL -introduction, basic principle, phase detector/comparator, voltage-controlled oscillator (IC 566),low pass filter, monolithic PLL and applications of PLL.

UNIT - IV

Voltage Regulator: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723general purpose regulators, Switching Regulator.

D to A and A to D Converters: Introduction, basic DAC techniques - weighted resistor

DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC,counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADCSpecifications.

UNIT - V

Digital ICs: CMOS Logic: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NORgates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any functionusing CMOS logic.

Combinational Circuits using TTL 74XX ICs: Study of logic gates using 74XX ICs,

Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer(IC74154).

Sequential Circuits using TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers,

Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

Textbooks:

1. D. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuit”, 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Ramakant A. Gayakwad, “OP-AMP and Linear Integrated Circuits”, 4th edition (2012),Prentice Hall / Pearson Education, New Delhi.
3. Floyd, Jain, “Digital Fundamentals”, 8th edition (2009), Pearson Education, New Delhi

Reference Books:

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits,Wiley International, NewDelhi.

Online Learning Resources:

1. https://nptel.ac.in/courses/108108111

2. https://nptel.ac.in/courses/108106069

Course Code	**EMBEDDED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
20A50204c		3	0	0	3
Pre-requisite	**Semester**				

- Digital Logic Design
- Microprocessors/ Microcontrollers and Interfacing

Course Objectives:

- To teach the basics of an embedded system and RTOS.
- To introduce the typical components of an embedded system & different communication interfaces.
- To provide knowledge on the design process of embedded system applications

Course Outcomes (CO): At the end of this course, the students will be able to

- Identify hardware and software components of an embedded system
- Learn the basics of OS and RTOS
- Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment
- Design simple embedded system-based applications

UNIT - I

Introduction To Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT - II

Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT - III

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM.

UNIT - IV

Embedded Firmware Design and Development:

Embedded firmware design approaches-super loop-based approach, operating system-based approach; embedded firmware development languages-assembly language-based development, high level language-based development.

UNIT - V

RTOS Based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Textbooks:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

Reference Books:

1. Embedded System Design -frank vahid, tony grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Online Learning Resources:

Open Elective Course -I

Course Code	ELECTRIC VEHICLE ENGINEERING (OE-I) Common to All Branches	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:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.
3. Tom Denton, “Electric and Hybrid Vehicles”, TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2nd Edition, 2020.
4. Mehrdad Ehsani, 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

Course Code	CONTROL SYSTEMS LAB		L	T	P	C
20A50206			**0**	**0**	**3**	**1.5**
		Semester	**V**			

Course Objectives: To make the students learn about:

- Determinations of transfer function of various systems and control of it by different methodologies.
- To provide knowledge in the design and analysis of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

Course Outcomes (CO): After completing the course, the student should be able to:

CO1: Understand the basic concept of feedback control and transfer function of DC servo motor and AC Servo motor, P, PD, PI, PID Controller and Compensators.
CO2: Analysis of control system stability using soft tools.
CO3: Apply programmable logic controllers to demonstrate industrial controls in the laboratory.
CO4: Demonstrate the time domain and frequency domain analysis for linear time invariant systems.

List of Experiments:

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC Machine.
6. Effect of P, PD, PI, PID Controller on a second order system.
7. Lag and lead compensation – Magnitude and phase plot.
8. Temperature controller using PID.
9. Characteristics of magnetic amplifiers.
10. Characteristics of AC servo motor.
11. Simulation of Op-Amp based Integrator and Differentiator circuits.
12. Linear system analysis (Time domain analysis, Error analysis) using Soft Tools.
13. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Soft Tools.
14. State space model for classical transfer function using Soft Tools – Verification.
15. P, PI and PID Controller design for Temperature Control using Soft Tools.

References:

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

Online Learning Resources/Virtual Labs:

1. http://iitb.vlab.co.in/?sub=8&brch=117

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">DIGITAL COMPUTING PLATFORMS LAB</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A50207</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td></td><td></td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

Course Objectives: To make the students learn about:

- Write Assembly language programming on 8086 Microprocessors
- To Interface various devices with 8086
- To develop MASAM Programming
- For Interfacing of 8051 Microcontroller with its peripheral devices.

Course Outcomes (CO): After completing the course, the student should be able to:

CO 1 Understand the basic concepts to write assembly language programming on 8086 Microprocessors.
CO 2 Analyze various device configurations and Interfacing of various devices with 8086.
CO 3 Apply the basic concepts to write programming on 8051 Microcontroller.
CO 4 Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices

List of Experiments:

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes).
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.
11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051.

References:

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

Online Learning Resources/Virtual Labs:

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Skill Oriented Course- III

Course Code	**Soft Skills**			**L**	**T**	**P**
20A55502	**Common to EEE, ECE, CSE**			**1**	**0**	**2**
Pre-requisite		**Semester v**				

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 leade 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 nor verbal clues and remedy the lapses on observation

<table>
<tr><td colspan="3"></td></tr>
<tr><td>UNIT – II</td><td>Critical Thinking</td><td>Lecture Hrs</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>UNIT – III</td><td>Problem Solving & Decision Making</td><td>Lecture Hrs</td></tr>
<tr><td colspan="3">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 initia debate on the appropriateness of the decision.
Case Study & Group Discussion</td></tr>
<tr><td>UNIT – IV</td><td>Emotional Intelligence & Stress Management</td><td>Lecture Hrs</td></tr>
<tr><td colspan="3">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, an 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</td></tr>
<tr><td>UNIT – V</td><td>Leadership Skills</td><td>Lecture Hrs</td></tr>
<tr><td colspan="3">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 – accommodatin 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 et

NOTE-:
1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdote 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.</td></tr>
</table>

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher : Oxford Universit 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: **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, Sangeeth 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 C 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**

Common to EEE, ECE, CSE

INTELLECTUAL PROPERTY RIGHTS & PATENTS

Course Code	**L**	**T**	**P**	**C**
20A69901	**2**	**0**	**0**	**0**

Course Objectives:·

1. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
2. To help them in knowing the significance of real life practice and procedure of Patents.
3. To make the students to understand the statutory provisions of different forms of IPRs in simple forms.
4. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks
5. To enable the students to keep their IP rights alive.

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

CO1:Identify different types of intellectual properties (IPS), the right of ownership, scope of protection
CO2: Understand and defining various types of intellectual properties and their roles in contributing to organizational competitiveness.
CO3: Apply statutory provisions to protect particular form of IPRs.
CO 4: Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.
CO:5 Evaluate different forms of IPR available at national & international level
CO:6 Develop skill of making search of various of forms of IPR by using modern tools and techniques.

SYLLABUS

UNIT – I:
Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II:
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III:
Patents: Introduction to Patents – Laws Relating to Patents in India – Patent Requirements,Patent Registration and Granting of Patent – Exclusive Rights – Limitations – Ownership and Transfer –

– Revocation of Patent. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – IV:

Trade Secrets: New developments in Patents – Software Protection and Computer related Innovations Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secrets litigation.Unfair competition: Misappropriation - Right of publicity, False advertising.

UNIT – V:

New development of intellectual property: New developments in trade mark law: copy right law, patent law, intellectual property audits.
International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Textbooks:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. P.Naryan, "Intellectual Property Law", 3rd Ed ,Eastern Law House, 2007.

Reference Books:

R.Myneni, Law of Intellectual Property", 9th Ed, Asia law House, 2019.
PrabuddhaGganguli, ,Intellectual Property Rights Tata Mcgraw Hill, 2001

Course Code	POWER SYSTEM ANALYSIS		L	T	P	C
20A60201			3	0	0	3
Pre-requisite	Power System Architecture	Semester	VI			

Course Objectives:

To make the students learn about:

- The Use of per unit Values and Graph Theory Concepts, Solving a Problem using Computer.
- Formation of Y_{bus}AndZ_{bus} of a Power System Network, Power Flow Studies by Various Methods.
- Different Types of Faults and Power System Analysis for Symmetrical and also Unsymmetrical Faults.
- Analysis of Power System for Steady State and Transient Stability and also Methods to Improve Stability

Course Outcomes (CO):

After completing the course, the student should be able to do the following:

CO 1 Remember and Understand the Concepts of per unit Values, Y_{Bus}And Z_{Bus} Formation, Load Flow Studies, Symmetrical and Unsymmetrical Fault Calculations.

CO 2 Apply the Concepts of Good Algorithm for the Given Power System Network and Obtain the Converged Load Flow Solution and Experiment Some of these Methods using Modern Tools and Examine the Results.

CO 3 Analyse the Symmetrical Faults and Unsymmetrical Faults and Done the Fault Calculations, Analyse the Stability of the System and Improve the Stability. Demonstrate the use of these Techniques through Good Communication Skills.

CO 4 Develop Accurate Algorithms for Different Networks and Determine Load Flow Studies and Zero, Positive and Negative Sequence Impedances to Find Fault Calculations.

UNIT - I	**PER UNIT SYSTEM AND FORMATION OF Y_{bus}**	Lecture Hrs: 8

Per-Unit Representation of Power System Elements - per-unit Equivalent Reactance Network of a Three Phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} Formation by Direct And Singular Transformation Methods, Numerical Problems.

UNIT - II	**FORMATION OF Z_{bus}**	Lecture Hrs: 10

Partial Network, Algorithm for the Modification of Z_{bus} Matrix for Addition Element for the Following Cases: Addition of Element from a New Bus to Reference, Addition of Element from a New Bus to an Old Bus, Addition of Element Between an Old Bus to Reference and Addition of Element Between Two Old Buses - Modification of Z_{bus} for the Changes in Network (Problems)		
UNIT - III	**POWER FLOW ANALYSIS**	Lecture Hrs: 10
Static Load Flow Equations – Load Flow Solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load Flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods.		
UNIT - IV	SHORT CIRCUIT ANALYSIS	Lecture Hrs: 10
Short Circuit Current and MVA Calculations, Selection of Ratings of Protective Equipments - Circuit Breaker, Fault Levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero Sequence Components, Positive, Negative and Zero Sequence Networks. Symmetrical Fault Analysis: LLLG Faults with and without Fault Impedance, Unsymmetrical Fault Analysis: LG, LL and LLG Faults with and without Fault Impedance, Numerical Problems.		
UNIT - V	STABILITY ANALYSIS	Lecture Hrs: 10
Elementary Concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical Methods for Solution of Swing Equation - Methods to Improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.		
Textbooks:		
1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006. 2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.		
Reference Books:		
1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994. 2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998. 3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee120/preview		

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">MEASUREMENTS & SENSORS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60202</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">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
The measurements of RLC parameters using bridge principles.
The principles of magnetic measurements
The principle of working of CRO and its applications</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO 1 Understand the working of various instruments and equipment used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors
CO 2 Analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements.
CO 3Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.
CO 4 Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">MEASURING INSTRUMENTS & DIGITAL METERS</td><td colspan="4">Lecture Hrs: 8</td></tr>
<tr><td colspan="7">Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples.
Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer.</td></tr>
<tr><td>UNIT - II</td><td colspan="2">MEASUREMENT OF POWER, POWER FACTOR AND ENERGY</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">INSTRUEMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS</td><td colspan="4">Lecture Hrs: 10</td></tr>
</table>

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications. Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples –Numerical Examples		
UNIT - IV	***D.C & A.C BRIDGES***	Lecture Hrs: 10
Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples		
UNIT - V	***CRO AND SENSORS***	Lecture Hrs: 10
Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajious Patterns. Capacitive and Inductive displacement sensors, Electromagnetism in sensing, Flow, Level sensors, Position and Motion sensors, Pressure sensors and Temperature sensors		
Textbooks:		
1. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpat Rai & Co. Publications, 2007. **2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.**		
Reference Books:		
1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011. 2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010. **3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.** **4. Sensor Technology: Hand Book by Jon S. Wilson, ELSEVIER publications, 2005**		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview		

Course Code	DIGITAL SIGNAL PROCESSING		L	T	P	C
20A60203			**3**	**0**	**0**	**3**
Pre-requisite	**Mathematics and Signals & Systems**	**Semester**	**VI**			

Course Objectives: To make the students learn about:

- Understanding the fundamental characteristics of signals and systems.
- Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling
- Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform
- Realization of FIR and IIR digital filters

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand different transformation techniques.

CO 2 Analyze the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice.

CO 3 Apply Fourier transform to analyse the operations on signals and acquire knowledge about Systems.

CO 4 Design FIR Digital Filters Using Window Techniques.

UNIT - I	INTRODUCTION TO DIGITAL SIGNAL PROCESSING	Lecture Hrs: 8

Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems.

UNIT - II	DISCRETE FOURIER SERIES AND FAST FOURIER TRANSFORMS	Lecture Hrs: 10

Properties of Discrete Fourier Series, DFS Representation of Periodic Sequences, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences Using DFT, Computation of DFT. Relation between Z-Transform and DFS, Fast Fourier Transforms (FFT)-Radix2 Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT and FFT for Composite N.

UNIT - III	REALIZATION OF DIGITAL FILTERS	Lecture Hrs: 10

Z-Transforms: Concept, Properties, Region of Convergence, and Applications; Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant Coefficient Difference Equations, Basic Structures of IIR Systems, Transposed Forms, Basic Structures of FIR Systems, System Function.

UNIT - IV	IIR AND FIR DIGITAL FILTERS	Lecture Hrs: 10

Analog Filter Approximations-Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations, Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR Filters, Illustrative Problems.

UNIT - V	MULTIRATE DIGITAL SIGNAL PROCESSING	Lecture Hrs: 10
Basic Sample Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Polyphase Decomposition, Nyquist Filters. Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Signal Compression, Transmultiplexers, Discrete Multitone Transmission of Digital Data.		
Textbooks:		
1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 2007. **2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd edition, 2009.**		
Reference Books:		
1. Signals - Discrete Time Signal Processing – Allan V Oppenheim and Systems, Pearson. **2. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.** **3. A Text book on Digital Signal processing – R S Kaler, M Kulkarni, Umesh Gupta, I K International Publishing House Pvt. Ltd., 2009.**		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee99/preview 2. https://nptel.ac.in/courses/108105055		

Course Code	SWITCHGEAR AND PROTECTION (PE-II)		L	T	P	C
20A60204a			3	0	0	3
Pre-requisite		Semester	VI			

Course Objectives: To make the students learn about:

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- The study of different Circuit Breakers and Relays
- The protection of Generators and Transformers
- The protection of various feeder bus bars from abnormal conditions and over voltages & importance on Neutral grounding for overall protection.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the operation of different circuit breakers.
CO 2 Analyze the concepts of different relays which are used in real time power system operation.
CO 3 Apply various protective schemes for Transformers, Rotating machines, Bus bars, Feeders.
CO 4 Develop the practical applications of power system operation and planning.

UNIT – I	CIRCUIT BREAKERS	Lecture Hrs: 8

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT – II	ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS	Lecture Hrs: 10

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT) and Distance Relays and their Flow Charts.

UNIT - III	PROTECTION OF GENERATORS AND TRANSFORMERS	Lecture Hrs: 10

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.

UNIT - IV	PROTECTION OF FEEDERS, TRANSMISSION LINES AND BUSBARS	Lecture Hrs: 10

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars -Differential protection.

UNIT - V	PROTECTION AGAINST OVER VOLTAGES	Lecture Hrs: 10

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

Textbooks:

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers.
2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.

Reference Books:

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.
5. Power System Protection- P. M. Anderson, Wiley Publishers.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee101/preview

Course Code	NONLINEAR SYSTEM ANALYSIS (PE-II)		L	T	P	C
20A60204b			3	0	0	3
Pre-requisite	Control Systems	Semester	VI			

Course Objectives: The student will be able to:

- Learn linear and nonlinear systems, overview of system analysis and Stability.
- Know Lyaponov stability functions to nonlinear systems.
- Understand the systems with Lyapunov stability theorems.
- Know about applications of nonlinear systems such as flight control, magnetic levitation and robotic manipulator.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1: Understand linear and nonlinear systems, describing function, overview of system analysis and Stability.

CO2: Apply Lyaponov functions to nonlinear systems.

CO3: Analyze the systems with Lyapunov stability theorem and Popov's stability criterion.

CO4: Design of nonlinear systems such as the ball and beam, flight control, magnetic levitation and robotic manipulator.

UNIT - I	SYSTEM NONLINEARITIES	Lecture Hrs: 10

Linear versus nonlinear systems - Describing function analysis: Fundamentals- common nonlinearities (saturation, dead – zone- on - off non – linearity- backlash- hysteresis) and their describing functions.

UNIT - II	DESCRIBING FUNCTION	Lecture Hrs: 10

Describing function analysis of nonlinear systems- - Phase plane analysis: Phase portraits-Singular points characterization- Analysis of non - linear systems using phase plane techniques-Existence of limit cycles.

UNIT - III	CONCEPT OF STABILITY AND THEOREMS	Lecture Hrs: 10

Concept of stability-Zero - input and BIBO stability- stability in the sense of Lyapunov and absolute stability- Lyapunov stability definitions-First method of Lyapunov- Second (or direct) method of Lyapunov stability theory for continuous and discrete time systems- Aids to generate Lyapunov function – Krasovskii's theorem.

UNIT - IV	*STABILITY ANALYSIS*	Lecture Hrs: 10

Aizerman's and Kalman's conjecture-Construction of Lyapunov function - Methods of Aizerman-Zubov- Variable gradient method- Lure problem. Popov's stability criterion- generalized circle criterion- Kalman - Yakubovich - Popov Lemma- Popov's hyper stability theorem.

UNIT - V	*APPLICATIONS OF NON-LINEAR CONTROLLER*	Lecture Hrs: 9

Concept of variable - structure controller and Basic feedback stabilization, Integrator Backstepping. Backstepping: More General Cases - reaching condition and reaching mode-Some design examples of nonlinear systems such as the ball and beam-flight control-magnetic levitation and robotic manipulator etc.

Textbooks:

1. J. E. Slotine and Weiping LI, Applied Nonlinear Control, Prentice Hall.
2. Hassan K. Khalil, Nonlinear Systems, Pearson India, Third Edition, 2014.

Reference Books:
1. Haracio J Marquez, Nonlinear Control Systems: Analysis and Design, John Wiley 1st Edition, 2002 2. Sankar Sastry, Nonlinear Systems Analysis, Stability and Control. 3. M. Vidyasagar, Nonlinear Systems Analysis, Prentice - Hall International editions,1993. 4. A. Isidori, Non linear Control Systems, Third Edition, Springer, 1999. 5. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International (P) Limited Publishers, 5th edition, 2007. 6. B.N. sarkar, Advanced Control Systems, PHI Learning Pvt. Ltd., 2013.
Online Learning Resources:
https://nptel.ac.in/courses/108/102/108102113/

Course Code	DESIGN OF PHOTOVOLTAIC SYSTEMS (PE-II)		L	T	P	C
20A60204c			**3**	**0**	**0**	**3**
Pre-requisite	**Electrical Circuits**	**Semester**	**VI**			

Course Objectives: To get the student learn about:

- Basics of PV Cell and its Equivalent Circuit, Fill Factor and PV Cell Simulation.
- Energy Estimation and costing, Other Energy Storage Methods and PV System Design.
- Maximum Power Point Tracking, PV and DC-DC Interface and MPPT for Non-Resistive Loads.
- PV Interfacing and PV Models and Annual Payment and Present Worth Factor.

Course Outcomes (CO): The student will be able to:

CO 1 Understand the basic concepts of PV Cells
CO 2 Analyze the principles of Energy estimation and Sizing
CO 3 Apply the techniques of MPPT to obtain maximum power tracking
CO 4 Design of PV system and its interfacing with grid.

UNIT - I	PV CELL	Lecture Hrs: 10

A Historical Perspective, PV Cell Characteristics and Equivalent Circuit, Model of PV Cell, Short Circuit, Open Circuit and Peak Power Parameters, Datasheet Study, Cell Efficiency, Effect of Temperature, Temperature Effect Calculation Example, Fill Factor, PV Cell Simulation, Series and Parallel Interconnection

UNIT – II	ENERGY ESTIMATION AND SIZING PV	Lecture Hrs: 10

Energy from Sun, Insolation and Irradiance, Insolation Variation with Time Delay, Solar Geometry, Insolation On a Horizontal Flat Plate, Sunrise and Sunset Hour Angles, Energy Plots in Octave, Atmospheric Effects, Air Mass, Clearness Index, Sizing PV for Applications without Batteries, Examples, Batteries: Introduction, Capacity, C-Rate, Efficiency, Energy and Power Densities, Battery Selection, Other Energy Storage Methods, PV System Design.

UNIT – III	MAXIMUM POWER POINT TRACKING	Lecture Hrs: 10

MPPT Concept, Input Impedance of DC-DC Converters – Boost Converter, Buck Converter, Buck-Boost Converter, PV Module in SPICE, Simulation – PV and DC-DC Interface, Impedance Control Methods-Voltage Scaling, Current Scaling, Sampling Method, Power Slope Method 1, Power Slope Method 2, Hill Climbing Method, Practical Points – Housekeeping Power Supply, Gate Driver, MPPT for Non-Resistive Loads, Simulation.

UNIT – IV	***PV-BATTERY INTERFACE***	Lecture Hrs: 10

Direct PV-Battery Connection, Charge Controller, Battery Charger – Understanding Current Control, Slope Compensation, Simulation of Current Control, Batteries in Series – Charge Equalization, Batteries in Parallel Peltier Device – Principle, Peltier Element – Datasheet, Peltier Cooling, Thermal Aspects- Conduction, Convection, A Peltier Refrigeration Example, Radiation and Mass Transport, Demo of Peltier Cooling, PV and Water Pumping

UNIT – V	*PV AND GRID INTERFACE*	Lecture Hrs: 8
Grid Connection Principle, PV to Grid Topologies, 3ph D-Q Controlled Grid Connection-Introduction, dq-Axis Theory, AC to DC Transformation, DC to AC Transformation, Complete 3ph Grid Connection, 1ph D-Q Controlled Grid Connection, 3ph PV-Grid Interface Example, SVPWM – Discrete Implementation, Analog Implementation, Application of Integrated Magnetics, Life Cycle Costing Growth Models, Examples, Annual Payment and Present Worth Factor, Examples		
Textbooks:		
1. Design of Photovoltaic Systems by L. Umanand 2. Chenming, H. and White, R.M., "Solar Cells from B to Advanced Systems", McGraw Hill Book Co, 1983		
Reference Books:		
1. Ruschenbach, HS, Reinhold, "Solar Cell Array Design Hand Varmostrand", NY, 1980 2. Dr. Sundaravadivelu S, Mr. Suresh R. Norman, Dr. Johnsi Stella I, Dr. Suresh Kumar A, ' Solar photo voltaic Power Systems", Notion press. 3. Suneel Deambi, Photovoltaic System Design, CRC Press 2020.		
Online Learning Resources:		
https://nptel.ac.in/courses/117108141 https://swayam.gov.in/nd1_noc20_ee57/preview		

Open Elective Course -II

Course Code	**RENEWABLE ENERGY SYSTEMS (OE-II) Common to All Branches**		**L**	**T**	**P**	**C**
20A60205			**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**VI**			

Course Objectives: To make the students learn about:

- 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.

Course Outcomes (CO): At the end of the course the student will be able to:

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", 4^{th} Edition, Khanna Publishers, 2000.

Reference Books:

1. S. P. Sukhatme, "Solar Energy",3^{rd} 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",3^{rd} 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

Course Code	POWER SYSTEMS LAB		L	T	P	C
20A60206			0	0	3	1.5
		Semester	VI			

Course Objectives: To make the students learn about:

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransientreactances.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's.
CO 2 Analyze how to draw the equivalent circuit of three winding transformer.
CO 3 Develop a MATLAB program for formation of Y and Z buses, Gauss-Seidel and Fast Decouple Load Flow studies.
CO 4 Design of Simulink models for load frequency control problems.

List of Experiments:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis
6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9. Y_{Bus} formation using Soft Tools
10. Z_{Bus} formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and

simulate the same using Soft Tools.

18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.

References:

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.

2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.

Online Learning Resources/Virtual Labs:

https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#

Course Code	MEASUREMENTS AND SENSORS LAB		L	T	P	C
20A60207			0	0	3	1.5
		Semester	VI			

Course Objectives: To make the students learn about:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

Course Outcomes (CO): At the end of the course, the student will be able to:

CO 1 Understand various electrical measuring instruments.
CO 2 Analyze and determine the values of inductance and capacitance using AC bridges
CO 3 Compute the coefficient of coupling between two coupled coils.
CO 4 Determine the values of very low resistances using various bridges.

List of Experiments:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Determination of Capacitance using Schering Bridge
7. Determination of Inductance using Anderson bridge
8. Measurement of 3-phase reactive power with single-phase wattmeter
9. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
10. Determination of Inductance using Maxwell's bridge
11. Determination of Capacitance using DeSauty bridge
12. Calibration of LPF wattmeter – by Phantom loading
13. Wheatstone bridge – measurement of medium resistances
14. LVDT and capacitance pickup – characteristics and Calibration
15. Resistance strain gauge – strain measurement and Calibration
16. Transformer turns ratio measurement using AC Bridge
17. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

References:

1. **Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.**
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. **Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.**
4. **Sensor Technology: Hand Book by Jon S. Wilson, ELSEVIER publications, 2005**

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ernet.in/asnm/#

Course Code	DIGITAL SIGNAL PROCESSING LAB		L	T	P	C
20A60208			**0**	**0**	**3**	**1.5**
		Semester	**VI**			

Course Objectives: To make the students learn about:

- Implement the processing techniques using the instructions of DSP Processor.
- Implement various filters using MATLAB Programming.
- Learn about discrete time systems and filters.
- Know about designing and implementation of various filters.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand Programming concepts to implement various digital filters.
CO 2 Analyze Generation of signals and their processing.
CO 3 Apply digital signal processing techniques to design discrete time systems and digital filters.
CO 4 Develop algorithms for designing and implementation of FIR and IIR filters.

List of Experiments:

1. Linear and circular convolution of two sequences using DSP Processor
2. Sampling and effect of aliasing using DSP Processor
3. Design of FIR filters using DSP Processor
4. Design of IIR filters using DSP Processor
5. Calculation of FFT of a signal using DSP Processor
6. Decimation by polyphase decomposition using DSP Processor
7. Implementation of Linear and Circular Convolution using soft tools.
8. Sampling of input signal and display using soft tools.
9. Waveform generation using soft tools.
10. Implementation of FIR filter using soft tools
11. Implementation of IIR filter using soft tools
12. FFT analysis using soft tools

References:

1. Digital Signal Processing: Alon V. Oppenhelm, PHI
2. Digital Signal processing(II-Edition): S.K. Mitra, TMH

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ac.in/dsp/#

Course Code	APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING		L	T	P	C
20A60209			**1**	**0**	**2**	**2**
		Semester	**VI**			

Course Objectives: To make the students learn about:

1. Basic concepts of Electrical Engineering and tools.
2. The concepts to design various models in MATLAB.
3. Various Electrical engineering applications through MATLAB.
4. Designing various models in MATLAB enviroment.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the basic concepts of Electrical Engineering.

CO 2 Apply the concepts to design MATLAB models.

CO 3 Analyse various Electrical engineering applications through MATLAB.

CO 4 Develop real time models using MATLAB.

List of Experiments:

Theory:
MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

List of Experiments:

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Z_{bus} matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

References:

1. **Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.**
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.
3. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009.

Online Learning Resources/Virtual Labs:

1. **http://vem-iitg.vlabs.ac.in/**
2. **https://vp-dei.vlabs.ac.in/Dreamweaver/**

Subject Code	Title of the Subject	L	T	P	C
20A65901	**CONSTITUTION OF INDIA(Mandatory Non-Credit Course)**	2	0	0	0

Common to EEE, ECE,CSE

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-II Union 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 –Lok Sabha - Rajya Sabha - 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-III State 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 Panchayati Raj - Functions– PRI –Zilla Parishath - 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 of Zilla Parishath 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 viz SC/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. Subash Kashyap, 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 and Politics, 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 government ie., 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.

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">POWER SYSTEM OPERATION AND CONTROL (PE-III)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70201a</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">VII</td></tr>
</table>

Course Objectives: To make the students learn about:

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the concept of economic scheduling and automatic generation control.

CO 2 Analyze the coordination in hydro-thermal system and optimal power flow.

CO 3 Apply the compensation methods to control the reactive power and automatic generation control.

CO 4 Develop the techniques to find market power and transfer capabilities in power system deregulation.

UNIT - I	**ECONOMIC OPERATION OF POWER SYSTEMS**	Lecture Hrs: 10

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

UNIT - II	**HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW**	Lecture Hrs: 10

Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimisation,

Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems		
UNIT - III	**AUTOMATIC GENERATION CONTROL**	Lecture Hrs: 10
Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples		
UNIT - IV	**REAL & REACTIVE POWER CONTROL**	Lecture Hrs: 10
Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems		
UNIT - V	**POWER SYSTEMS DEREGULATION**	Lecture Hrs: 8
Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems		
Textbooks:		
1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996. 2. Power System Engineering, D P Kothari and I J Nagrath, McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019.		
Reference Books:		
1. G. Srinivasan & S. Sivanagaraju, Power System Operation and Control, Pearson Education India, First Edition, 2009. 2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983. 3. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982. 4. K. Nisha, Power System Operation and Control, S.K. Kataria& Sons, 2014. 5. Uma Rao, Power System Operation and Control, Willey Publishers, 2012.		
Online Learning Resources:		
1. https://nptel.ac.in/courses/108104052 2. https://nptel.ac.in/courses/108101004		

Course Code	**SWITCHED MODE POWER CONVERTERS (PE-III)**		**L**	**T**	**P**	**C**
20A70201b			**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**VII**			

Course Objectives:

- Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs
- Evaluate the performance of resonant converters
- Analyze the performance characteristics of 1-ϕ and 3-ϕ inverters with single/multi levels, power conditioners, UPS and filters
- Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

Course Outcomes (CO):

After completion of this course, student will be able to

CO1: Understand the basic concepts of DC-DC converters, DC-AC Converters, Resonant Converters and SMPCs.

CO2: Analyze the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.

CO3: Apply various modulation and harmonic elimination techniques over the converters.

CO4: Design inductor and transformer for various power electronic applications.

UNIT - I	**DC-DC CONVERTERS**	**Lecture Hrs: 8**

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

UNIT - II	**SWITCHING MODE POWER CONVERTERS**	**Lecture Hrs: 10**

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

UNIT - III	**RESONANT CONVERTERS**	**Lecture Hrs: 10**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

UNIT - IV	**DC-AC CONVERTERS**	**Lecture Hrs: 10**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.		
UNIT - V	**POWER CONDITIONERS, UPS & FILTERS**	**Lecture Hrs: 10**
Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.		
Textbooks:		
1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009 2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001. 3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.		
Reference Books:		
1. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2012 2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006 3. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007. 4. KengWu ,"Switched Mode Power Converters: Design and Analysis", Elseware academic press. 5. Dorin O. Neacsu, "Switching Power Converters Medium and High Power", CRC Press; 2nd edition, 2013.		
Online Learning Resources:		
1. https://nptel.ac.in/courses/108108036 2. https://nptel.ac.in/courses/108105180		

Course Code	ELECTRICAL & ELECTRONIC INSTRUMENTATION (PE-III)		L	T	P	C
20A70201c			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the students learn about:

- Measuring system, Common errors, and Objectives of Measuring systems.
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems.
- Measuring various meters and analysers.
- Basic transducers and their usage in various measurements.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques.
CO 2 Analyze various telemetry systems, basic operation of Data acquisition systems, measuring meters and signal analyzers.
CO 3 Apply Transducers and their measurement of electrical and non-electrical quantities in real time applications.
CO 4 Design various applications of the measuring instruments.

UNIT - I	INSTRUMENT ERRORS	Lecture Hrs: 10

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Spam & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

UNIT - II	DATA TRANSMISSION AND TELEMETRY	Lecture Hrs: 10

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram).

UNIT - III	SIGNAL ANALYZERS	Lecture Hrs: 10

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

UNIT - IV	TRANSDUCERS	Lecture Hrs: 10

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor**,** Inductor andCapacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.		
UNIT - V	**MEASUREMENT OF NON-ELECTRICAL QUANTITIES**	Lecture Hrs: 8
Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level		
Textbooks:		
1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India,2004. 2. A course in Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & Co.,2012.		
Reference Books:		
1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e.,2010. 2. Modern Electronic Instrumentation and Measurement techniques – by A.DHelfrick and W.D.Cooper, Pearson/Prentice Hall of India.,1990. 3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3rd re print, 2009.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview		

Course Code	ELECTRICAL DISTRIBUTION SYSTEM AUTOMATION (PE-IV)		L	T	P	C
20A70202a			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the students:

- To know about fundamental aspects of distribution system, principle of distribution substations
- To know about classification of various loads
- To understand difference between conventional load flow studies of power system and distribution system load flow
- To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand basics of distribution systems and substations, modelling of various loads
CO 2 Analyze of load flow solutions in distribution system
CO 3 Apply the concepts of SCADA, Automation distribution system and management in real time problems.
CO 4 Evaluation of power loss and feeder cost.

UNIT - I	DISTRIBUTION SYSTEM FUNDAMENTALS	Lecture Hrs: 10

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

UNIT - II	DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS	Lecture Hrs: 10

Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations.

Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

Loads: Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.

UNIT - III	DISTRIBUTION SYSTEM LOAD FLOW	Lecture Hrs: 10

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems		
UNIT - IV	**VOLTAGE DROP AND POWER LOSS CALCULATION**	Lecture Hrs: 10
Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems		
UNIT - V	**DISTRIBUTION AUTOMATION**	Lecture Hrs: 8
Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces. Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE		
Textbooks:		
1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002. 2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.		
Reference Books:		
1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007. 2. Biswarup Das, Power distribution Automation, IET publication, 2016. 3. Dr. M. K. Khedkar, Dr. G.M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee126/preview		

Course Code	RESTRUCTUREDPOWERSYSTEMS (PE-IV)		L	T	P	C
20A70202b			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the student learn

- Basic concepts of therestructuringofpower industryandmarketmodels.
- About thefundamentalconceptsofcongestionmanagement, Transfer Capability issues and ancillary service management.
- The transmission cost allocation methods to evaluate the cost.
- The operational planning activities in different competitive environment.

Course Outcomes (CO): Student will be able to

CO1: Understandthedifferences betweentheconventionalpower systemoperationandtherestructuredone and basics concepts of market power, electricity pricing and competitive environment.
CO2: AnalyzetheconceptsofIndependent System Operator (ISO) and OpenAccessSame-TimeInformationSystem (OASIS).
CO3: Apply the methods to find Available Transfer Capability (ATC) and to allocate the Transmission cost.
CO4: Develop power marketsandmarketarchitecturalaspects and short time Price forecasting.

UNIT – I	KEYISSUESINELECTRICUTILITIES	Lecture Hrs: 9

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange–Marketoperations–MarketPower–Standardcost–TransmissionPricing–Congestion Pricing –Management ofInter zonal/IntrazonalCongestion.

UNIT - II	OPENACCESSSAME-TIMEINFORMATIONSYSTEM(OASIS)&MARKETPOWER	Lecture Hrs: 8

Structure of OASIS – Posting of Information – Transfer capability on OASIS – Market Power:Introduction– Different typesof marketPower–MitigationofMarketPower– Examples.

UNIT - III	AVAILABLETRANSFERCAPABILITY(ATC) &ELECTRICITYPRICING	Lecture Hrs: 10

Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATCbased on power flow – Electricity Pricing: Introduction – Electricity Price Volatility ElectricityPrice Indexes – Challenges to Electricity Pricing –

Construction of Forward Price Curves –Short-time PriceForecasting.

UNIT - IV	POWERSYSTEMOPERATIONIN COMPETITIVEENVIRONMENT	Lecture Hrs: 9

Introduction – Operational Planning Activities of ISO – The ISO in Pool Markets – The ISO inBilateralMarkets– OperationalPlanningActivitiesofaGENCO.

UNIT - V	TRANSMISSION COST ALLOCATION METHODS &ANCILLARYSERVICESMANAGEMENT	Lecture Hrs: 10

Introduction –TransmissionCostAllocationMethods:PostageStampRateMethod – Contract PathMethod– MW-MileMethod– Unused TransmissionCapacity Method– MVA-Milemethod–Comparisonofcostallocationmethods – AncillaryServicesManagement:Introduction–Reactive Power as an Ancillary Service, a Review – Synchronous Generators as AncillaryService Providers.

Textbooks:

1. KankarBhattacharya, MathH.J.BollerandJaapE.Daalder, Operationof RestructuredPowerSystem,KulwerAcademicPublishers,1st Edition ,2001
2. MohammadShahidehpourandMuwaffaqAlomoush,RestructuredElectricalPowerSystems,MarcelDekker,Inc.,1st Edition ,2001.

Reference Books:

1. LoiLeiLai,PowerSystemRestructuring and Deregulation,John Wiley&SonsLtd.,England, 2001.
2. Pinni Srinivasa Varma, Sankar Velamuri, Power System Deregulation, Lambert Academic Publishing, First Edition, 2017.
3. P. Venkatesh, B. V. Manikandan, S.Charles Raja and A. Srinivasan, Electrical Power Systems Analysis Security and Deregulation, PHI Learning, 2012.
4. Dr. P. V. Rama Krishna, G. Srinivas and Dr. S.V. Padmavathi, Power System Deregulation, Namya press, 2014.

Online Learning Resources:

1. **https://nptel.ac.in/courses/108/101/108101005/**

Course Code	**INTELLIGENT CONTROL TECHNIQUES**	**L**	**T**	**P**	**C**
20A70202c	**(PE-IV)**	**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**VII**		

Course Objectives: To make the students learn about:

- To get exposed to a few Intelligent Control Techniques
- To learn about Artificial Neural Network based Estimators
- To learn about Fuzzy Logic Control System as one of the ICT
- To learn about a few evolutionary algorithms, implement the various ICTs for linear and non-linear systems as case studies

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand various Intelligent Control Techniques
CO 2 Design the controllers and estimators using ANN and Fuzzy Logic
CO 3 Apply Evolutionary algorithms suitable to optimize and design a given system specifications
CO 4 Develop various ICTs for system modeling, control schemes and to design estimators using MATLAB.

UNIT - I	**FUNDAMENTALS OF AI**	Lecture Hrs: 8

AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

UNIT - II	**ANN BASED CONTROLLERS AND ESTIMATORS**	Lecture Hrs: 12

Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; Learning and Training the neural network-Supervised and unsupervised learning concepts, simple Perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; BAM networks, Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.

UNIT - III	**FUZZY LOGIC CONTROL SYSTEM**	Lecture Hrs: 10

Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule

bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.		
UNIT - IV	**EVOLUTIONARY ALGORITHMS**	Lecture Hrs: 10
Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.		
UNIT - V	**CASE STUDIES**	Lecture Hrs: 8
Identification and control of linear and nonlinear dynamic systems using Neural Networks, Power System Load Flow using Back Propagation algorithm; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Single area Load Frequency Control using Fuzzy Logic; optimization for controller design in case of constrained and unconstrained optimization issues, Economic Load Dispatch using Genetic Algorithm/PSO.		
Textbooks:		
1. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", Jaico Publishing House, 1st Edition, 1994 2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, WILEY Publications, 2011 3. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008		
Reference Books:		
1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd. 2. LaurereFauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd. 3. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005		
Online Learning Resources:		
1. https://nptel.ac.in/courses/108104049 2. https://nptel.ac.in/courses/112103301		

Common to All Branches

Course Code	**MANAGEMENT SCIENCE**	**L**	**T**	**P**	**C**
	(HE-II) 20A75401a	**3**	**0**	**0**	**3**
Pre-requisite					

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 process and marketing management
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

Course Outcomes (CO): At the end of the course, students will be able to

1	Define the Management, and its Functions
2	Understand the concepts & principles of management and designs of organization in a practical world
3	Apply the knowledge of Work-study principles & Quality Control techniques in industry
4	Analyse the concepts of HRM in Recruitment, Selection and Training & Development.
5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyse the business through SWOT.
6	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:

1. A.R Aryasri, Management Science, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

1. Koontz &Weihrich, Essentials of Management, 6/e, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, Management Principles and Guidelines, Biztantra.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. 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

Course Code	BUSINESS ENVIRONMENT (HE-II)	L	T	P	C
20A75401b		3	0	0	3
Pre-requisite	Sem-VII				
	Common to All Branches				

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

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
6	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

UNIT - IV **World Trade Organization**

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.

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 - 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
2. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
3. 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.

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

Course Code	ORGANIZATIONAL BEHAVIOUR (HE-II)		L	T	P	C
20A75401c			**3**	**0**	**0**	**3**
Pre-requisite	**Common to All Branches**	**Sem-VII**				

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
6	Develop as powerful leader

UNIT - I **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:
1. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition 2011
2. P Subba Rao, OrganisationalBehaviour, Himalya Publishing House 2017

Reference Books:
- McShane, Organizational Behaviour, TMH 2009
- Nelson, OrganisationalBehaviour, Thomson, 2009.
- Robbins, P.Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson 2009.
- Aswathappa, OrganisationalBehaviour, 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

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">BATTERY MANAGEMENT SYSTEMS
(OE-III) Common to All Branches</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70204</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td>Basic Electrical Engineering</td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• 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</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completion of this course, student will be able to</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">INTRODUCTION</td><td colspan="4">Lecture Hrs: 14</td></tr>
<tr><td colspan="7">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</td></tr>
<tr><td>UNIT - II</td><td colspan="2">BATTERY MANAGEMENT SYSTEM</td><td colspan="4">Lecture Hrs: 14</td></tr>
<tr><td colspan="7">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</td></tr>
<tr><td>UNIT - III</td><td colspan="2">BATTERY STATE OF CHARGE AND STATE</td><td colspan="4">Lecture Hrs: 12</td></tr>
</table>

	OF HEALTH ESTIMATION	
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. Rui Xiong, "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		

Course Code	IoT APPLICATIONS IN ELECTRICAL ENGINEERING (OE-IV)Common to All Branches		L	T	P	C
20A70205			3	0	0	3
Pre-requisite		Semester	VII			

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. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, 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 Sundaram Shriram, 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

Course Code	ENERGY CONSERVATION AND AUDITING		L	T	P	C
20A70206	**(Skill oriented course – V)**		**1**	**0**	**2**	**2**
		Semester	**VII**			

Course Objectives: To make the students learn about:

The following industry relevant skills of the competency 'Undertake energy conservation and energy audit' are expected to be developed in the students by undertaking

- Identification of energy losses and opportunities of energy conservation.
- Implementation of energy conservation technique.
- Apply energy conservation techniques in electrical installations.
- Use Co-generation and relevant tariff for reducing losses in facilities.
- Carryout energy audit for electrical system.

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1 Understand energy conservation policies in India.

CO 2 Analyze energy conservation techniques in electrical machines.

CO 3 Apply energy conservation techniques in electrical installations, Co-generation and relevant tariff for reducing losses in facilities.

CO 4 Design and analyse energy audit for electrical system.

List of Experiments:

Theory:
Different types of Electrical apparatus, ratings, units, Loads, efficiency calculations, power consumption calculations, improvement of p.f., lightening, fans, electricity tariff, need for energy saving, energy audit questionnaire

List of Experiments:

1. Analyze star labeled electrical apparatus and compare the data sheet (Pamphlet) of various star ratings.

2. Determine the '% loading' and the related efficiency of given Induction motor at different

loading

3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode at no load/ light loads.

4. Use APFC / PFC unit for improvement of p. f. of electrical load.

5. Compare power consumption of (Fluorescent and LED) lighting

6. Determine Net Energy Saving by Lamp replacements.

7. Determine Energy conservation in Fan by using Electronic Regulator

8. Analysis of electric bill based on tariff of Industrial consumer to reduce energy usage and electric bill

9. To analyze the energy bill of a commercial consumer and to suggest (if needed) suitable tariff to achieve energy conservation and reduction in energy bill

10. To interpret the energy bill of a residential consumer, suggest suitable tariff to achieve energy conservation and reduction in energy bill.

11. Estimate energy saving by improving power factor and load factor for given cases.

12. Prepare a sample energy audit questionnaire for the given industrial facility.

13. Prepare an energy audit report

14. Determination of rating of Inverter capacity for household applications

References:

1. Guide Books no. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors

2. Energy Management and Conservation By Sharma, K. V., Venkataseshaiah P.

Online Learning Resources/Virtual Labs:

1. https://nptel.ac.in/courses/108106022

JNTUA College of Engineering (Autonomous), Ananthapuramu

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.

3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

6. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
7. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.
8. Tom Denton, "Electric and Hybrid Vehicles", TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2nd Edition, 2020.
9. MehrdadEhsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
10. 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

		L	T	P	C
Course Code	**BASICS OF ELECTRONICS AND COMMUNICATION ENGINEERING**	**L**	**T**	**P**	**C**
20A50405		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.
identify strategies in a game for optimal profit.
implement project planning.</td></tr>
<tr><td>UNIT - I</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.</td></tr>
<tr><td>UNIT - II</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
</table>

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- <u>Yang</u>

<u>Leng</u>- 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 7th Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff

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

Course Code	**RENEWABLE ENERGY SYSTEMS (OE-II)**		**L**	**T**	**P**	**C**
20A60205			**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**VI**			
Course Objectives: To make the students learn about:						

- 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.

Course Outcomes (CO): At the end of the course the student will be able to:

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:

3. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
4. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

Reference Books:

5. S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
6. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
7. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.
8. 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**		**L**	**T**	**P**	**C**
20A65101	**(Common for CIVIL,MECH&CHEM)**		**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

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Wavelet transforms and its Applications

(Common for EEE&ECE)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A65102</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Fourier Series</td><td>Semester</td><td colspan="4">II</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course provides the students to understand Wavelet transforms and its applications.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

• 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	L	T	P	C

20A65103	CSE (Data Science)			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 OFELECTRONICMATERIALS ANDDEVICES

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

SYLLABUSCredit: 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.

Learning Resources:

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., McGrawHiII 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		L	T	P	C
20A70204	**(OE-III)**		**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 ENGINEERING	L	T	P	C
20A70804		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:

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		L	T	P	C
20A75101	**(Common for all Branches)**		**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:		
4. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 5. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 6. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India		
Reference Books:		
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 4. 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**

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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.**

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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

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 Electrical & Electronic & Engineering

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">IoT APPLICATIONS IN ELECTRICAL ENGINEERING
(OE-IV)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70205</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td></td><td colspan="4"></td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

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:		
4. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004 5. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017 6. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019		

Reference Books:
4. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016 5. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019 6. 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

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 Electronics & Communication Engineering

Course Code **PRINCIPLES OF DIGITAL SIGNAL** **L T P C**

20A70405 PROCESSING 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

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 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

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 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*

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 Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75302	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**	2	1	-	3

COURSE OBJECTIVES	
1	To understand synthetic principles of Nanomaterials by various methods
2	And also characterisae the synthetic nanomaterials by various instrumental methods
3	To 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.