

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. Electrical and Electronics Engineering

Regulations & Curriculum
(For the students admitted from 2013-14)



HAND BOOK

DEPARTMENT OF ELECTRICAL ENGINEERING

ANNAMALAI UNIVERSITY
FOUR YEAR B.E. DEGREE PROGRAM
REGULATIONS AND SYLLABUS

1. Conditions for Admission:

Candidates for admission to the first year of the four-year B.E. Degree programs shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as courses of study conducted by the Board of Secondary Education, Tamilnadu Government or an examination of any other authority accepted by the syndicate of this University as equivalent thereto.

They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the syndicate of the Annamalai University from time to time. Candidates who have passed the Higher Secondary Examination through vocational stream under ENGINEERING AND TECHNOLOGY and candidates who have passed the Diploma Course in Engineering of the State Board of Technical Education and Training, Tamilnadu, will also be eligible for admission to the first year of the four-year degree program in B.E. provided they satisfy other conditions.

2. Eligibility for the degree:

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of not less than four academic years and has passed the prescribed examinations in all the four academic years.

3. Branches of study in B.E.

- BRANCH I - Civil Engineering.
- BRANCH II - Civil and Structural Engineering
- BRANCH III - Mechanical Engineering
- BRANCH IV - Manufacturing Engineering
- BRANCH V - Electrical & Electronics Engineering
- BRANCH VI - Electronics & Instrumentation Engineering
- BRANCH VII - Computer Science and Engineering
- BRANCH VIII - Chemical Engineering
- BRANCH IX - Information Technology
- BRANCH X - Electronics & Communication Engineering

4. Courses of Study:

The courses of study are given separately. The syllabus for the courses is also given separately.

5. Scheme of Examinations:

The Scheme of Examinations is given in separately.

6. Choice Based Credit System:

Each course is normally assigned one credit per period of lecture/tutorial per week and one credit for two periods or part thereof for laboratory or practical or drawing per week.

Each semester curriculum shall normally have a blend of theory and practical courses. The total credits for the entire degree program will be 200. For the award of the degree, a student has to

1. Earn a minimum of 200 credits,
2. Serve in the NSS or NCC for at least one year, and
3. Enroll as a student member of a recognized professional society.

7. Duration of the Program:

A student is normally expected to complete the B.E. program in four years but in any case, not more than seven years from the time of admission.

8. Registration for Courses:

A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option.

Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day. Registration for the project work shall be done only for the final semester.

9. Assessment:

The break-up of assessment and examination marks for theory courses is as follows.

First assessment	: 10 marks
Second assessment (midsemester test)	: 10 marks
Third Assessment	: 05 marks
End Semester Examination	: 75 marks

The break-up of assessment and examination marks for Practical courses is as follows.

First assessment (test)	: 15 marks
Second assessment (test)	: 15 marks
Maintenance of record book	: 10 marks
End Semester Examination	: 60 marks

The project work will be assessed for 40 marks by a committee consisting of the guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may himself be a member or the Chairman. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

10. Student Counsellors:

To help the students in planning their course of study and for general advice on the academic program, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, given preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Head of the Department.

11. Class Committee:

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty.

From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator.

The composition of the class committee will during first and second semesters be as follows.

Course coordinators of all common courses.

Teachers of all other individual courses.

All Heads of the Departments, among whom one may be nominated as Chairman by the Dean.

The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Heads of Departments.

The composition of the class committees from third to eighth semester will be as follows.

Course coordinators of the common courses, if any, who shall be appointed by the Head of the Department from among the staff members teaching the common course.

A project coordinator (in the eighth semester committee only) who shall be appointed by the Head of the Department from among the project supervisors.

Teachers of other individual courses.

One professor or reader, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department. The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet four times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the first and third assessments and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The second assessment will be the mid-semester test. The third meeting will be held within a week after the second assessment is completed to review the performance and for follow-up action.

The fourth meeting will be held after all the assessments except the examinations are completed for all the courses, and at least one week before the commencement of the

examinations. During this meeting the assessment on a maximum of 40 marks will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

12. Withdrawal from a course:

A student can withdraw from a course at any time before a date fixed by the Head of the Department prior to the second assessment, with the approval of the Dean of the faculty on the recommendation of the Head of the Department.

13. Temporary break of study:

A student can take a one-time temporary break of study covering the current semester and/or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire program within the maximum period of seven years.

14. Movement to Higher Semesters:

The following minimum credits must be earned by the student to move to a higher semester.

To move to the fourth semester	: 25 credits
To move to the fifth semester	: 50 credits
To move to the sixth semester	: 75 credits
To move to the seventh semester	: 100 credits
To move to the eighth semester	: 125 credits

The result of the eight semesters will be withheld until the student passes all the previous semester examinations.

A student who has not fulfilled the NCC/NSS requirements will not be eligible to register for the fifth semester.

15. Substitute Assessments:

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment

must be completed before the date of the fourth meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

16. Attendance requirements:

To be eligible to appear for the examination in a particular semester, a student must put in a minimum of 80% of attendance in that semester. However, if the attendance is 75% or above but less than 80% in any semester, the authorities can permit the student to appear for the examination in that semester on payment of the prescribed condonation fee.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register for and repeat the semester.

17. Passing and declaration of examination results:

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average and cumulative grade point average, and prepare the grade cards.

90 to 100 marks	: Grade 'S'
80 to 89 marks	: Grade 'A'
70 to 79 marks	: Grade 'B'
60 to 69 marks	: Grade 'C'
55 to 59 marks	: Grade 'D'
50 to 54 marks	: Grade 'E'
Less than 50 marks	: Grade 'F'
Insufficient attendance	: Grade 'I'
Withdrawn from the course	: Grade 'W'

A student who obtains less than 24 marks out of 60 in the examination or is absent for the examination will be awarded grade 'F'.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who obtains letter grade F in a course has to reappear for the examination in that course.

A student who obtains letter grades I or W in a course must re-register for and repeat the course.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; F - 0

Courses with grades I and W are not considered for calculation of grade point average or cumulative grade point average. F grade will be considered for computing GPA and CGPA.

A student can apply for retotaling of one or more of his examination answers papers within a week from the date of issue of grade sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of examinations with the recommendation of the Head of the Department.

After results are declared, grade cards will be issued to the students. The grade card will contain the list of courses registered during the semester, the grades scored and the grade point average (GPA) for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

The results of the final semester will be withheld until the student obtains passing grade in all the courses of earlier semesters.

After successful completion of the program, the degree will be awarded with the following classification based on CGPA.

For First Class with Distinction the student must earn a minimum of 200 credits within four years from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above for all the courses from III Semester to VIII Semester.

For First Class the student must earn a minimum of 200 credits within five years from the time of admission and obtain a CGPA of 6.75 or above for all the courses from III Semester to VIII Semester.

For Second Class the student must earn a minimum of 200 credits within seven years from the time of admission.

18. Ranking of candidates:

The candidates who are eligible to get the B.E. degree in the First Class with Distinction will be ranked together on the basis of CGPA for all the courses of study from III to VIII Semester.

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the courses of study from III to VIII Semester.

The ranking will be done separately for each branch of study.

19. Electives:

Apart from the various elective courses offered in the curriculum of the branch of specialization, a student can choose a maximum of two electives from any specialization under the faculty during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

20. Transitory Regulations:

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent courses, as per the new syllabus, on the recommendations of the Head of the Department concerned.

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION

To develop the Department into a “Centre of Excellence” with a perspective to provide quality education and skill-based training with state-of-the-art technologies to the students, thereby enabling them to become achievers and contributors to the industry, society and nation together with a sense of commitment to the profession.

MISSION

- M1: To impart quality education in tune with emerging technological developments in the field of Electrical and Electronics Engineering.
- M2: To provide practical hands-on-training with a view to understand the theoretical concepts and latest technological developments.
- M3: To produce employable and self-employable graduates.
- M4: To nurture the personality traits among the students in different dimensions emphasizing the ethical values and to address the diversified societal needs of the Nation
- M5: To create futuristic ambience with the state-of-the-art facilities for pursuing research.

PROGRAMME EDUCATIONAL OBJECTIVES

- PEO1: Envisage a solid foundation in Basic Sciences, Electrical and Electronics Engineering for a successful career and Life-long Learning in the fields of having Societal Implications.
- PEO2: Design and implement effective solutions for complex Electrical and Electronics Engineering problems using modern tools and techniques.
- PEO3: Establish Professionalism, Good Communication skills and ethical attitude in multi disciplinary team work.
- PEO4: Apply creative thinking and critical reasoning skills in collaborative research.
- PEO5: Contribute to the economic growth of the country by creating job opportunities through entrepreneurship.

PROGRAM OUTCOMES (POs)

After the successful completion of B.E (Electrical and Electronics Engineering Engineering) Program the students will be able to:

PO 1: Engineering Knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem Analysis:

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct Investigations of Complex Problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern Tool Usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The Engineer and Society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and Sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and Team Work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project Management and Finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-Long Learning:

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the time of graduation, the students will be able to:

- PSO 1:** Identify, formulate and investigate various problems of electrical and electronic circuits, power electronics and power systems by applying the fundamental knowledge of mathematics, science and engineering.
- PSO 2:** Design, develop and implement multidisciplinary projects in the field of electrical power and energy using state-of-the-art technologies and modern software tools.
- PSO 3:** Develop effective communication skills and leadership qualities with professional and ethical responsibilities to meet the global technological challenges of the society and electrical industry.

Mapping PO with PEO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PEO1	3											3	3		
PEO2	3	2	3		3	1	1						2		3
PEO3						3		3	2	3	1			3	3
PEO4	2	2		2		3					3		1	3	
PEO5	1		2			2	2	2			3	1			2

SEMESTER VII

Code	Name of the Course	Periods/week	Credits
EEEC701	Protection, Switchgear and Utilisation	4L+1T	4
EEEC702	Power System Analysis	4L+1T	4
EEEC703	Communication Engineering	4L +1T	3
EEEE704	Elective I	4L	3
EEEE705	Elective II	4L	3
EEEE706	Elective III	4L	4
EEEP707	Embedded Systems Lab	6P	3
EEEP708	Electrical Estimation Lab	3P	2
EEEP709	CADD Lab	3P	2
Total periods: 42		24L+3T+12P	28
<p># L:- Lecture T:- Tutorial P:- Practical PR:- Project</p> <p># Marks for each theory course:100(25 for continuous assessment, 75 for examination)</p> <p># Marks for each Practical course:100(40 for continuous assessment, 60 for examination)</p> <p># Duration of examination: 3 hours for each course</p>			

SEMESTER VIII

Code	Name of the Course	Periods/week	Credits
EEEC801	Ethics in Engineering	4L	4
EEEC802	Computer Aided Power system Analysis	4L+1T	4
EEEC803	Quantitative Management Techniques	4L +1T	3
EEEC804	Power Plant Engineering	2L	3
EEEE805	Elective IV	4L	3
EEEE806	Elective V	4L	4
EEEP807	Advanced Processor based System Design and Computation Lab	6P	3
EEEV808	Project Work and Viva-Voce	6PR+2S	4
Total periods: 38		22L+2T+6P+6PR+2S	28
<p># L:- Lecture T:- Tutorial P:- Practical PR:- Project S:-Seminar</p> <p># Marks for each theory course:100(25 for continuous assessment, 75 for examination)</p> <p># Marks for each Practical course:100(40 for continuous assessment, 60 for examination)</p> <p># Duration of examination: 3 hours for each course EEEEC801 to EEEEP807</p> <p># Examination for course EEEEV808:in the form of viva voce and/or demonstration</p>			

THIRD SEMESTER**EEEC 301 ENGINEERING MATHEMATICS – III****AIM:**

The course aim to develop the skills of the students in the area of boundary value problems and transform techniques. this will be necessary for their effective studies in a large number of engineering courses like heat conduction, communication systems, electro-optics and electromagnetic theory. the course will also serve as a prerequisite for post graduate and specialized studies and research.

OBJECTIVE:

At the end of the course the students would.

- be capable of mathematically formulating certain practical problems in terms of partial differential equation. solve them and physically interpret the results.
- have gained a well founded knowledge of fourier series, their different possible forms and the frequently needed practical fourier analysis that an engineer may have to make from discrete data.
- have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the fourier series method of solution, solve them and interpret the results.
- have grasped to concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on fourier transform pair, their properties, the possible special cases with attention to their applications.
- have learnt the basics of z-transform in its applicability to discretely varying functions. gained the skill to formulate certain problems in terms of difference equations and solve them using the z-transform techniques bringing out the elegance of the procedure involved.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solution of standard types of first order partial differential equations –

Lagrange's linear equation – linear partial differential equations of second order with constant coefficients.

UNIT II FOURIER SERIES

Dirichlet's conditions – General Fourier Series – Odd and even functions – Half range sine series – Half range Cosine Series – Complex form of Fourier series – Parseval's identity.

UNIT III BOUNDARY VALUE PROBLEMS

Solutions of one Dimensional wave equation – one dimensional heat equation (Without derivation). Fourier series solutions in Cartesian Co-ordinates.

UNIT IV FOURIER TRANSFORM

Fourier integral theorem (Without proof)- Fourier transform pair- sine and cosine transforms- properties – transforms of simple functions – convolution theorem –Parseval's identity.

UNIT V Z-TRANSFORM AND DIFFERENCE EQUATIONS

Z- Transform – Elementary Properties- Inverse Z-Transform- Convolution theorem – solution of difference equations using Z-transform.

TEXT BOOKS

1. **Kandasamy. P.**, Thilagavathy. K., and Gunavathy,K., "Engineering Mathematics" Series.S.Chand & Co.Ltd. New Delhi. 2007
2. **Venkatraman, M.K.**, "Engineering Mathematics" series, the National Pub Co., Chennai, 2003.

REFERENCE BOOKS

1. **Veerarajan,T.**,"Engineering Mathematics" Series, Tata McGraw Hill Pub Co.,Ltd. New Delhi,2006.
2. **Singaravelu.A.**, "Engineering Mathematics " Series,Meenakshi Publication, Chennai, 2006.
3. **Wyle.C, Ray and Barrett Lows, C.**, "Advanced Engineering Mathematics", McGraw-Hill Inc., New York.

Course Outcomes

At the end of this course, students will able to

1. Acquire basic understanding of the most common partial differential equations.
2. Understand the concepts of Fourier series.
3. Solve boundary value problems.
4. Investigate signals problems using Fourier transform
5. Familiarize with Z-transform that play important roles in many discrete engineering problems.

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

EEEEC 302 ELECTRONICS -I**AIM**

To enable the students to gain a vast knowledge about the various electronic devices.

OBJECTIVES

To acquaint the students with construction ,theory and characteristics of the following electronic devices.

- i) P-N-junction diodes
- ii) Bipolar Junction transistor
- iii) Field effect transistor
- iv) LED,LCD and other photo electronic devices
- v) SCR, Diac & Triac

UNIT I PN JUNCTION DEVICES

Brief review of behaviour of PN junction - Current components in a PN junction diode - VI characteristics and its temperature dependence - Diode resistance - Transition and diffusion capacitance - Diode as a circuit element - Load line concept - Piece wise linear model of a diode - PN junction as a rectifier - Single phase half wave, full wave and bridge rectifier -Filters L,C and LC filters - Concept of critical inductance and bleeder resistance.

Principle of operation and characteristics of zener diode - Zener diode as a voltage regulating device.

Principle of operation and characteristics of varactor diode,Tunnel diode,SCR, Triac, Diac, UJT - Opto electronic devices - Photodiode - PIN photodiode - Photo voltaic effect - Photo conductive cell - LED - LCD - opto-isolators.

UNIT II BIPOLAR JUNCTION TRANSISTOR

Characteristics - Junction transistor - Current components - Transistor as an amplifier - Input /output characteristics of CB,CE,CC configurations - Cutoff, saturation, active regions - Common emitter current gain - Maximum voltage rating - Photo transistor . Transistor biasing and thermal stabilization - Operating point -

Bias stability - Stabilization factors - Different bias stabilization circuits - Bias compensation techniques -

Diode compensation - Thermistor and sensor compensation - Thermal runaway and operating point consideration - Thermal stability and use of heat sinks.

UNIT III BJT ANALYSIS

Transistor at low frequencies - Graphical analysis of CE configuration - Hybrid model and h parameters - Analysis of transistor amplifier using h parameters - Comparison of amplifier configuration - Cascading amplifier - Darlington pair - Bootstrap principle. Transistor at high frequencies - Hybrid π - CE model - CE short circuit current gain - Transistor as a switch.

UNIT IV MULTISTAGE AMPLIFIERS

Classification of amplifiers - Distortion - Frequency response and step response - Square wave testing - Bandwidth of cascaded stages - Low frequency response of a RC coupled amplifier and influence of bypass capacitor.

Transformer coupled amplifier - Analysis - Low frequency and step response.

Tuned amplifiers - Single tuned, double tuned and stagger tuned - Noise sources in an amplifier and noise figure.

UNIT V JUNCTION FIELD EFFECT TRANSISTOR

Operation - Static characteristics - JFET circuits - Graphical analysis - Biasing methods - JFET as an amplifier - Small signal equivalent circuit models - Common source amplifier - Source follower - JFET as a switch. Metal oxide semiconductor FET's - Operation and characteristics of depletion type and enhancement type. MOSFET - Biasing - Small signal equivalent circuit of an amplifier - MOSFET as a resistor - MOS amplifier with enhancement MOS load - MOS analog switches - Introduction to CMOS devices.

TEXT BOOK

1. **Jacob Millman and Halkias C.C.** "Electronic Devices and Circuits" Tata Mc Graw- Hill; 2004.

REFERENCE BOOKS

1. **Allen Mottershead** “Electronic Devices and Circuits” PHI; 1989.
2. **Jacob Millman and Halkias C.C.** “Integrated Electronics-Analog & Digital Circuits and Systems” Tata Mc Graw- Hill; 1992.
3. **Mathur S.P, Kulshreshtha D.C and Chanda P.R.** “Electronic Devices; Applications and Integrated Circuits (fifth edition)” Umesh Publications; 1988.
4. **Sharupick.L and Tugov.N** “Opto Electronics” MIR Publications Moscow; 1988.
5. **Jacob Millman and Arvin Grabel** “Microelectronics (Second edition)” Mc Graw-Hill; 2001.

Course Outcomes

At the end of this course, students will able to

- 1) Understand the concept of various electronic and switching devices by learning their characteristics.
- 2) Study the characteristics of transistor
- 3) Analyse the response of transistors at low and high frequencies
- 4) Obtain the responses of various types of amplifiers.
- 5) Familiarise with the concept of Junction Field effect transistors

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

EEEC 303 CIRCUIT THEORY- I**AIM**

To impart a sound knowledge to the students regarding the fundamentals of dc and ac circuits, methods of analysis, magnetism, resonance and transients.

OBJECTIVE

To make the students to understand the concept of circuit elements, lumped circuits, waveforms, circuit laws and network reduction. To analyze the magnetic circuits, series and parallel AC circuits, and to solve problems in time domain using laplace transform.

UNIT I INTRODUCTION

Types of sources; relation between voltage and current in network elements; concept of active, passive, linear, nonlinear, unilateral, bilateral, lumped, distributed elements; Kirchoff's laws and their application to node and mesh analysis of networks; Tellegen's theorem(statement only); concept of tree, branch, cotree, link, loop, and cutset. Problems involving d.c. circuits only.

UNIT II NETWORK REDUCTION TECHNIQUES

Series parallel circuits; star delta and reverse transformation; superposition, reciprocity, compensation, Thevenins, Nortons, Millmans and maximum power transfer theorems; principle of duality. Problems involving d.c. circuits only.

UNIT III AC CIRCUITS

Basic definitions; phasors and complex representation; solution of RLC networks; power and energy relations; application of Kirchoff's laws, Thevenins, Nortons, Maximum power transfer theorems to a.c. circuits ; series and parallel resonance; Q factor and bandwidth; locus diagrams.

UNIT IV MAGNETIC CIRCUITS

Ampere's law; magnetic circuit concept and laws; magnetisation curve of ferromagnetic materials; calculation of magnetic circuit quantities; series and parallel

circuits; circuits with short airgaps; fringing with long air gaps; energy of magnetic field; magnetic pull; hysteresis and eddy current losses with a.c. excitation; mutual inductance and coefficient of coupling.

UNIT V TIME DOMAIN ANALYSIS

Unit functions, step, impulse, ramp and parabolic; solution of network problems using Laplace transform; transient and steady state response of

RLC networks with different types of forcing functions. Complex frequency; poles and zeros of network functions (introductory concept only).

TEXT BOOK

1. **Soni, Gupta** “A Course in Electrical Circuit Analysis” Dhanpat Rai and Sons 2003.

REFERENCE BOOKS

1. **Umesh Sinha** “Circuit Theory”; Satya Prakasam : 1990.
2. **Edminster** “Electric Circuits”; Schaum's outline series : 1997.
3. **Sudhakar. A, Shyammohan. S.P** “Circuits and Networks-Analysis and Synthesis”; TMGH; 2006.
4. **Gupta. B R** “Theory and Problems of Electrical Networks” S.Chand & Company Ltd, New Delhi;1996.
6. **Paronjothi S.R.** “Electric Circuit Analysis” New Age Publishers 2003

Course Outcomes

At the end of this course, the students will be able to

- 1) Analyze the electrical circuits.
- 2) Apply different circuit theorems for solving complex circuits problems.
- 3) Understand the concept of AC circuits.
- 4) Acquire the basics of magnetic and coupled circuits .
- 5) Analyse the steady state and transient response of various networks.

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

EEEC 304 MECHANICAL TECHNOLOGY**AIM**

The students are enabled to gain an in-depth knowledge about the mechanical engineering related concepts and their application.

OBJECTIVES

To make the student understand the basic concepts and applications of the following.

- i) Thermo dynamics.
- ii) Properties of steam.
- iii) Internal combustion engines.
- iv) Heat transfer, refrigeration and air conditioning.
- v) Metrology and mechanical measurements.

UNIT I : THERMODYNAMICS

Basic concepts of thermodynamics - System properties, state and equilibrium - Process and cycle - Work - Heat and other forms of energy - Zeroth law and application - First law - Statements - Applications to closed and open systems - General energy equation and application - Second law - Statements - Reversibility, Carnot cycle and theorems - Clausius inequality - Concept of entropy - Availability and irreversibility.

UNIT II : PROPERTIES OF STEAM

Properties of steam - Use of steam tables - Mollier chart - Rankine cycle - Representation on P-V and T-S diagrams - Reheat cycles - calculation of efficiencies. Steam turbines - Impulse and reaction type - Governing of steam turbines - Types - Condensers.

UNIT III : INTERNAL COMBUSTION ENGINES

Internal combustion engine - Principle of operation - Two stroke and four stroke cycle engines - Petrol and diesel engines - Conventional and electronic fuel injection systems - Cooling and lubrication methods - Testing of IC engines - Simple

problems - Air standard cycles - Otto, Diesel and dual cycle - Efficiencies - Simple problems.

UNIT IV : HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING

Basic concepts of heat transfer - Basic laws of conduction, convection and radiation - One dimensional heat conduction through a plane wall and cylinder - Use of fins in heat transfer - Heat exchangers - Parallel counter and cross flow - Simple problems. Refrigeration - Units of refrigeration - Refrigerants and their properties - Types of refrigeration system - Air, vapour compression and vapour absorption systems - Air conditioning - Summer and winter air conditioning.

UNIT V : METROLOGY AND MECHANICAL MEASUREMENTS

Measurement and precision engineering : Linear and angular measurement - Measurement of flatness, stiffness and hardness. Comparators, side bands, slip gauges, angular gauges and auto collimeter. Measurement of pressure : McLeod vacuum gauge and electrical resistance pressure gauges - Dynamic characteristics of pressure measuring systems. Measurement of temperature : Bimetallic thermometers - Linear quartz thermometer and pyrometers. Measurement of strain : Electrical resistance strain gauge, constant current strain gauge and strain gauge bridge circuit.

TEXT BOOKS

1. **Nag P.K;** “Engineering Thermodynamics” Tata Mc Graw Hill Publishing Company Limited, New Delhi; 1991.
2. **Ballaney P.L** ”Thermal Engineering” Khanna Publishers, Delhi; 1991.

REFERENCE BOOKS

1. **Domkundwar.S, Dhanpat Rai and Sons** “A Course in Thermodynamics and Heat Engines” New Delhi; 1989.
2. **Mathur M.L. and Sharma R.P** “Internal Combustion Engines” Dhanpat Rai & Sons, New Delhi; 1992.
3. **Arora C.P** “Refrigeration and Airconditioning” Tata Mc Graw- Hill; 1993.

4. **Thomas G. Beckwith and Lewis Buck.N** “Mechanical Measurements” Narosa Publishing Company, New Delhi; 1992.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Recognize the forces and their related laws of mechanics in static and dynamic conditions.
2. Analyze the forces and their motions on particles, rigid bodies and structures.
3. Solve the moment of inertia of any section and masses for the structural members.
4. Study the dynamics of particles.
5. Appreciate the elements of rigid body dynamics.

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

EEEC 305 MATERIAL SCIENCE**AIM**

To acquaint the students with physics of materials used in their field of study.

OBJECTIVES

This course enables the students to gain a vast knowledge about various conducting, semi conducting, magnetic, dielectric and optical materials.

UNIT I: CONDUCTING MATERIALS

Classical free electron theory of metals-electrical conductivity of Al - drawbacks of classical theory - quantum free electron theory of metals and its importance - density of states - Fermi-Dirac statistics - calculation of Fermi energy and its importance - concept of hole-origin of band gap in solids (qualitative treatment only) - effective mass of electron-high resistivity alloys superconductors-properties and applications.

UNIT II: SEMICONDUCTING MATERIALS

Elemental and compound semiconductors and their properties-carrier concentration intrinsic semiconductors-carrier concentration in n-type and p-type semiconductors - variation of Fermi level and carrier concentration with temperature - Hall effect – applications.

UNIT III: MAGNETIC AND DIELECTRIC MATERIALS

Different types of magnetic materials and their properties-domain theory of ferromagnetism-Heisenberg criteria-Hysteresis Energy product of a magnetic material-merits and their applications- magnetic recording materials-metallic glasses - Active and passive dielectrics and their applications - Ferro electrics – Piezo electrics .

UNIT IV: OPTICAL MATERIALS

Optical properties of metals, insulators and semiconductors - phosphorescence and fluorescence - excitons, traps and colour centres and their importance-different

phosphors used in CRO screens-liquid crystal as display material-thermography and its applications-photoconductivity and photo conducting materials.

UNIT V: NEW ENGINEERING MATERIALS

Metallic glasses as transformer core materials - Nano phase materials-Shape memory alloys-Bio materials-Non linear materials – Second harmonic generation-Optical mixing – Optical phase conjugation – Solutions – IC packaging material.

TEXT BOOKS

1. **Arumugam M.**, "Materials Science", Anuradha Technical Book Publishers, 2005.
2. **Indulkar C.S. and Thiruvengadem. S.**, "Introduction to Electrical Engineering Materials", 5th Edition, S.chand &Co New Delhi, 2010.
3. **Raghavan.V.**, "Materials Science and Engineering", Prentice Hall of India, New Delhi, 2005.

REFERENCE BOOKS

1. **Dekker A.J.** "Electrical Engineering Materials" Prentice Hall of India, 2006.
2. **Rajput, R.K.** "Electrical Engineering Materials", Laxmi Publications New Delhi 1993.
3. **Simon S.M.**, "Physics of Semiconductor devices", 3rd Edition, Wiley Eastern, 2007.
4. **Van Vlack L.H.**, "Material Science for Engineers", Addison Wesley 2000.

Course Outcomes

At the end of this course, the students will be able to

- 1) Understand the concept of electric engineering materials.
- 2) Familiarize with the properties of conducting and semiconducting materials,
- 3) Select suitable magnetic and dielectric materials for required specification.
- 4) Acknowledge the importance of optical materials in electrical engineering field.
- 5) Acquaint with new engineering materials in electrical engineering.

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

EEEC 306 FLUID MECHANICS AND FLUID MACHINERY**AIM**

To impart the essential knowledge to the students in the area of fluid mechanics and Hydraulic machinery

OBJECTIVES

At the end of the course the students are expected to have a knowledge about the following

- i) Physical properties of fluids, pressure and its measurement and kinematics of flow
- ii) Dynamics of fluid, flow through pipes and nozzles
- iii) Flow in open channels
- iv) Turbines, Radial flow, reaction turbines and governing of turbines
- v) Centrifugal pumps and reciprocating pumps.

UNIT I PHYSICAL PROPERTIES OF FLUIDS

Mass density, specific weight, specific volume, specific gravity, viscosity - Newtons law of viscosity - compressibility - surface tension and capillarity.

Pressure and its measurement - absolute, gauge, atmospheric and vacuum pressures - simple manometers only.

Kinematics of flow - definitions of various types of fluid flow - continuity equation.

UNIT II DYNAMICS OF FLUID FLOW

Euler's equation of motion - Bernoulli's equation - practical applications - venturi meter, orifice meter and pitot tube. Simple treatment of orifices, mouthpieces, notches and weirs.

Flow through pipes - loss of energy due to friction - minor energy losses - hydraulic gradient and total energy line - flow through pipes in series - Flow through parallel pipes - power transmission through pipes - flow through nozzles.

UNIT III FLOW IN OPEN CHANNELS

Classification of flow in channels - Chezy's and Manning's formulae - most economical section of channels.

Nonuniform flow through open channels - specific energy and specific energy curve - critical depth - critical velocity - critical, supercritical and subcritical flows - alternate depths.

Impact of jets - force exerted by a fluid on stationary and moving flat plates held in various positions - force exerted on curved plates - concept of velocity triangles.

UNIT IV TURBINES

General layout of a hydroelectric power plant - definitions of heads and efficiencies of a turbine - classification of turbines - Pelton wheel - velocity triangles - work done - efficiency Radial flow reaction turbines - Francis turbine - velocity triangles - work done - efficiency - draft tube theory.

Governing of turbines : Specific speed and its significance - unit quantities - unit speed, unit discharge, unit power.

UNIT V PUMPS

Centrifugal pumps - main parts - work done - definitions of heads and efficiencies - minimum starting speed - multistage pumps - specific speed - priming - cavitation.

Reciprocating pumps - main parts - working principle - slip _ indicator diagrams - effects of acceleration and friction on indicator diagrams - maximum speed of a reciprocating pump - study of air vessels. Hydraulic press, hydraulic accumulator and hydraulic intensifier.

TEXT BOOKS

1. **Modi & Seth** “Fluid Mechanics, Hydraulics & Hydraulic Machines” Standard Publishing House, New Delhi 1993.
2. **Bansal R.K** “A Text Book of Fluid Mechanics & Hydraulic Machines” Lakshmi Publications, Madras; 1992.
3. **Jadish Lal** “Hydraulic Machines” Metropolitan Book Company, Delhi; 1993.

REFERENCE BOOKS

1. **Kumar K.L.** “Engineering Fluid Mechanics” Eurasia Publications; 1984.
2. **Vasandani V.P.** “Theory of Hydraulic Machines” Khanna Publishers, Delhi; 1991

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Apply the basic knowledge of fluid mechanics in finding fluid properties, performance parameters of hydraulic turbines and pumps.
2. Understand various dynamics of fluid flow.
3. Use fluid dynamics for the study of flow through pipes and flow in open channels.
4. Present hydraulic design for the construction of efficient hydraulic turbines and pumps.
5. Investigate the performance of different kinds of pumps.

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

LABORATORY COURSES

The syllabus in Electrical Engineering Laboratories will generally follow the theory courses concerned taking into account the needs of the course, the needs of the time, and the technological advances.

The list of experiments will be prepared by the Head of the Department of Electrical Engineering from time to time.

EEEP307 CIRCUITS AND DEVICES LABORATORY

AIM

To impart practical knowledge to the students about the electronic circuit elements and their characteristics.

OBJECTIVES

To enable the students to gain practical knowledge about the basic concept of circuit elements and performance characteristics of various devices like, diodes, transistors and other controlled devices.

Course Outcomes

At the end of this course, the students will be able to

- 1) Learn the applications and characteristics of basic electronic devices.
- 2) Analyze RL and RC circuits.
- 3) Acquire knowledge to troubleshoot various electronic circuits.
- 4) Apply circuit theorems to solve complex circuits.
- 5) Demonstrate the characteristics of transistors.

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

EEEP308 HYDRAULICS LABORATORY

AIM

To introduce to the students the features of utilities in power stations.

OBJECTIVE

A study of the characteristic features of pumps and turbines using experiments in envisaged. Methods for determination of co-efficients of discharged are to be explained and computed practically.

The lab will go a long way is enabling the student to understand the significance and role of such utilities in their further course of study.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Determine the properties of fluids, pressure and their measurements.
2. Measure the flow in pipes and determine frictional losses.
3. Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits.
4. Demonstrate characteristics of pumps and turbines.
5. Demonstrate the characteristics of turbines.

Mapping with Program Outcomes

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

EEEP 309 MECHANICAL LAB

AIM

To impart to the students to gain sound knowledge and practical skill in mechanical machines and equipments

OBJECTIVES

To enable the students to gain practical knowledge about the IC Engines,boilers,turbines, Refrigeration and air conditioning and air compressor

Course Outcomes

At the end of this course, the students will be able to

- 1) Acquire knowledge on IC engines
- 2) Know about the operation of boilers.
- 3) Familiarize with different types of turbines.
- 4) Demonstrate the operation of Refrigerators and air conditioners
- 5) Gain knowledge about air compressors

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

FOURTH SEMESTER**EEEC 401- ENGINEERING MATHEMATICS – IV****AIM**

The course aims at providing necessary basic concepts in probabilistic and random process. A knowledge of fundamentals and applications of phenomena will greatly help in the understanding of topics such as estimation and detection, pattern recognition, voice and image processing, networking and queuing.

OBJECTIVES

At the end of the course, the students would

- have a fundamental knowledge of the basic probability concepts
- have a well – founded knowledge of random process
- acquire skills in the study of tests of significance for large and small samples
- when huge amount of experimental data are involved the methods discussed on interpolation will be useful in constructing approximate polynomial to represent their data and to find the intermediate values.
- The numerical differentiation and integration find application when the function in the analytical form is too complicated or huge amount of data are given such as series of measurements, observations or some other empirical information.

UNIT - I PROBABILITY THEORY

Definition – types of random variables – probability distribution function - Probability Density functions – Expectation and moments – moment generating functions – characteristic function – joint probability distribution – Joint cumulative distribution – Marginal probability distribution function – Joint probability density function – Marginal probability density function - conditional probability distribution function - conditional probability Density function – Transformation of random variables

UNIT – II RANDOM PROCESS

Classification of random process – Methods Of Description of a Random process – Special classes of Random Process – Average Values of Random Process – Stationarity – Analytical Representation of a Random Process – Auto Correlation Function and its properties - Properties of $R(t)$ – cross correlation function and its properties

UNIT - III TESTS OF SIGNIFICANCE

Hypothesis testing – Large sampling Tests – small sampling tests based on t, f and chi-square distributions – interval estimates of mean, standard deviation and proportion.

UNIT – IV INTERPOLATION AND CURVE FITTING

Gregory Newton forward and backward interpolation formula; Stirlings central difference formula; Lagrange's interpolation formula for unequal interval, inverse interpolation numerical differentiation; numerical integration; trapezoidal rule; Simpson's third and three – eighths rule.

Fitting a straight line, parabol, exponential ($y=ae^{bx}$) , power equation ($Y=ab^x$ and $y=ax^b$) by the method of least squares

UNIT -V SOLUTION OF ALGEBRAIC AND TRANSCENDENTIAL EQUATIONS

Regular- falsi method., Bolzano's bisection method; Newton – Raphson method; solution of simultaneous algebraic equation; Gauss elimination method; Gauss Jordan elimination method; Crouts method; Gauss-seidel iteration method; Solution of ordinary differential equation; Taylor series method; Euler's method; modified Euler's method (polygon method); Runge – Kutta fourth order method; Milne's – predictor corrector method.

TEXT BOOKS

1. **Kandasamy . P , Thilagavathi. K ; Gunawathy .K** “Probability Statistics and Queing Theory “ S.CHAND & Co. Ltd .
2. **Veerarajan .T** , “ Probability theory and Random Process” , Tata MC Graw – Hill , Second Edition , New – Delhi – 2003
3. **Venkatraman M.K;** “Numerical method in Science and Engineering” National publishing Co. Chennai 2003.

REFERENCES

1. **Lipschutz . S and Schitter . J** ; “ Schawam's outlines – Introduction to Probalility and Statics” , Mc Graw Hill , New Delhi , 1998.
2. **Kandasamy . P , Thilagavathi. K ; Gunawathy .K** “Numerical Methods” . S.CHAND & Co. Ltd ., 2004.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Solve the situations with problems involving random experiments.
2. Comprehend the concept of random processes.
3. Understand the basic concepts of theory of sampling to any collection of individuals of their attributes and can numerically specify them.
4. Solve the problems of algebraic transcendental equations and numerical integration.
5. Obtain numerical solutions for ordinary and partial differential equations.

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

EEEC 402 CIRCUIT THEORY II**AIM**

To enable the students to gain a vast knowledge about the network analysis and synthesis.

OBJECTIVES

- * To understand the concepts of phase sequence, vector diagrams, and three phase three wire and four wire circuits.
- * To analyse the relationship between various two port parameters, ladder and lattice networks.
- * To synthesis RL,RC & LC networks by Foster and Cauer form and design of filters.

UNIT I THREE PHASE CIRCUITS

Three phase sources - Analysis of three phase three wire and four wire circuits with balanced and unbalanced loads - Power relations.

UNIT II TWO PORT NETWORK

Network functions - Poles and zeros of network functions - Complex frequency - Two port parameters Z,Y,H and ABCD - Scaling network functions -T and = equivalent circuits - Bridged networks - Analysis of ladder and lattice networks - Coupled circuits as two port network - Tuned circuits.

UNIT III RELIABILITY AND IMMITTANCE FUNCTIONS

Causality, stability. Hurwitz polynomial - Positive real functions - Properties of LC,RC and RL driving point functions - Basic synthesis procedure of driving point functions - Synthesis of driving point LC,RC and RL functions - Foster and Cauer forms.

UNIT IV TRANSFER FUNCTION SYNTHESIS

Properties of transfer function - Zeros of transmission - Synthesis of transfer admittance, transfer impedance with a one ohm termination - Synthesis of constant-resistance network.

UNIT V FILTERS

Design of filters: Specifications of filter characteristics - frequency transformation techniques - design of constant K, M derived and composite filters. Introduction to Butterworth and Chebyshev filters.

TEXT BOOK

1. **Franklin F.Kuo** “Network Analysis and Synthesis (Second edition)” Wiley International; 1996.

REFERENCE BOOKS

1. **Soni, Gupta** “A Course in Electrical Circuit Analysis” Dhanpat Rai and Sons 2003.
2. **M.E.Van Valkenberg** “Introduction to Modern Network Synthesis” Wiley Eastern; 1986.
3. **Umesh Sinha** “Network Analysis and Synthesis” Satya Prakashan Publishers 1985.
4. **V.K Aatre** “Network Theory and Filter Design” Wiley Eastern; 1985.
5. **M.E.Van Valkenberg** “Network Analysis and Synthesis” John Wiley; 1976.

Course Outcomes

At the end of this course, the students will be able to

- 1) Understand and analyze different 3 phase configuration.
- 2) Develop network functions and capable to evaluate two port network parameters.
- 3) Analyse the stability of the network function.
- 4) Synthesis a network from network function.
- 5) Understand the concept and designing of filters.

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

EEEC 403 - ELECTRONICS - II**AIM**

This course enables to gain an in-depth knowledge about the power amplifiers, oscillators, integrated circuits and filters.

OBJECTIVES

At the end of the course students are expected to have knowledge on the concepts of feedback, oscillators and multivibrators. They also gain knowledge regarding the integrated Circuit fabrications, the concept of power amplifiers, operational amplifiers and Timer - 555 and their applications.

UNIT I FEEDBACK AMPLIFIERS

Positive and negative feedback - Effects of negative feedback - Loop gain - Types of negative feedback.

Oscillators - Requirements for oscillation - Hartley, Colpitts and crystal oscillator - phase shift oscillators - Wien bridge oscillator - Amplitude and frequency stability - Sawtooth oscillator(UJT) - Multivibrators - Design of astable, monostable and bistable multivibrators and Schmitt trigger.

UNIT II INTEGRATED CIRCUIT FABRICATION

Monolithic integrated circuit technology - Planar processes - Bipolar transistor fabrication - Fabrication of FETs - CMOS technology - Monolithic diodes - Metal to semiconductor contact - Integrated circuit resistors, capacitors - Packaging - Characteristics of integrated circuit components -Microelectronic circuit layout.

UNIT III DIFFERENTIAL AMPLIFIERS

Analysis of BJT and FET differential amplifiers - Differential voltage gain - CMRR.

Power amplifiers - Classification - Class A,B,C & AB -Single ended, push pull configurations - Power dissipation - Output power,efficiency, distortion -

Complementary symmetry. Power amplifier - Class C power amplifier - Thermal considerations - IC power amplifier - Introduction to VMOS.

UNIT IV OPERATIONAL AMPLIFIER

Characteristics of ideal op.amp - op.amp with negative feed back - Voltage series, voltage shunt feedback amplifier - Differential amplifier - Characteristics of practical op.amp. Frequency response of op.amp - Comparator - Zero crossing detector - Astable, monostable, triangular wave and sawtooth wave generators - Schmitt trigger - VCO - Timer 555 and applications - Oscillators - Phase shift, Wien bridge and quadrature type. Precision rectifier - IC voltage regulator - V/F and F/V converter.

UNIT V GENERAL APPLICATIONS OF OPERATIONAL AMPLIFIERS

DC and AC amplifier - Mathematical operations - Instrumentation amplifier - V/I and I/V converter - Log amplifier.

Introduction to active filters - First order, second order low pass and high pass filter - Band pass filter.

TEXT BOOK

1. **Jacob Millman and Arvin Grabel** "Microelectronics (Second edition)" Mc Graw- Hill; 2001.

REFERENCE BOOKS

1. **Allen Mottershead** "Electronic Devices and Circuits" PHI; 1994.
2. **Jacob Millman and Halkias. C.C** "Electronic Devices and Circuits" Mc Graw Hill; 1987.
3. **Rinehart and Wenston** "Microelectronic Circuits" A.S. Sedra and K.C.Smith 1987.
4. **Gayakwad A.** Op.amp and Linear Integrated Circuits(second edition); PHI; 2000.
5. **Roy Choudhury and Shail Jain** Linear Intergrated Circuits; Wiley Eastern; 1991.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the fabrication process of monolithic IC technology
2. Understand the basics of operational amplifiers
3. Analyze the different applications of operational amplifiers
4. Apply op-amps as multivibrators and oscillators
5. Apply op-amps as active filter.

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

EEEC 404 ELECTRICAL MACHINES-I**AIM**

The course enables the students to gain an in-depth knowledge about the DC machines, transformers and three phase induction motors.

OBJECTIVES

To Impart Wide Knowledge on Construction & Working principle of DC Machines, Power Transformers, three phase Induction motors and their related applications.

UNIT I : D.C. MACHINES

DC Generators - Principle of operation, components and their constructional features, EMF equation, commutation, lap and wave windings, armature reaction, performance characteristics of separately excited, shunt and cumulatively compounded generators.

DC Motors - Principle of operation, different types of d.c motors, torque equation, armature reaction, typical performance characteristics, Swinburne's test, Hopkinson's test, separation of losses, applications of different types of dc motors.

UNIT II CONTROL OF DC MOTORS

Speed control of d.c shunt motors by armature control and field control, Speed control of D.C series motor Electric braking.

Electric Traction : General aspects - systems and categories of traction for rail, road operations - speed time curves - Typical curves - Simplified curves - Trapezoidal curve - Quadrilateral curves - Factors affecting schedule speed - starting and speed control, of traction motors - rheostatic and regenerative braking of DC traction motors.

UNIT III TRANSFORMERS

Principle of operation, different types of transformers, general features of construction of single phase and three phase transformers - Bucholtz relay, conservator and breather - EMF equation - useful and leakage fluxes - leakage reactance, phasor diagram - paralleling and parallel operation of single-phase and three-phase transformers - harmonics in single phase and three phase transformers, inrush current and its prevention - No-load and on-load tap changing, auto transformer, comparison of auto transformer with two winding transformer,

UNIT IV TESTING OF TRANSFORMERS

O.C and S.C tests - voltage regulation and efficiency calculation on the basis of equivalent circuit - all day efficiency - Sumpner's test - pseudo load test on three phase transformer - separation of core losses - Scott connection - open delta connection, vector groups, regulating transformers and phase shifters, use of tertiary winding in three phase transformers.

UNIT V THREE PHASE INDUCTION MOTORS

Constructional features, cage and slip ring rotors, principle of operation, synchronous rotation of gap flux, phasor diagram, equivalent circuit, expression for torque, torque-slip characteristic, relation between slip and rotor copper loss, condition for maximum torque and for maximum power, load test, voltage ratio test, no-load and blocked-rotor tests, circle diagram, pre-determination of motor performance on the basis of circle diagram, starting of slip-ring and cage motors. Speed control of induction motors: Variation of supply voltage, rotor resistance control, cascading, pole changing.

TEXT BOOKS

1. **Say M.G. and Taylor E.O.** "Direct Current Machines" ELBS edition; 1985.
2. **M.G. Say** "Alternating Current Machines" ELBS edition; 1986.
3. **Nagrath I.J.& Kothari D.P.** "Electrical Machines" Tata McGraw Hill Publishing company Limited, New Delhi; II Edition; 1998.

REFERENCE BOOKS

1. **Clayton. A.E and Hancock** "Performance and Design of Direct Current Machines" Oxford and IBH publishing Co; 1988.
2. **Hughes. E** "Electrical Technology" ELBS & Longman edition; 1975.
3. **Theraja B.L. & Theraja A.K.** "A Text Book of Electrical Technology-Vol II" S.Chand & Company Ltd; 2000
4. **Bimbhra P.S.** "Electrical Machinery" Khanna Publishers; 1998.
5. **Murugesh Kumar K** "D.C.Machines & Transformers" Vikas Publishing House 1999
6. **Bhattacharya S.K.** "Electrical Machines" Tata McGraw Hill Publishing company Limited, New Delhi; 1998.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the construction, working principles & operations of all types of electrical machines.
2. Predict the performance of electrical machines from their equivalent circuit models.
3. Select suitable machine to meet specific application requirement.
4. Validate the theoretical concepts by conducting experiments in practical sessions.
5. Apprehend the different testing techniques available to assess the performance of machine.

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

EEEC 405 DIGITAL ELECTRONICS**AIM**

This course provides a vast knowledge about the fundamental concepts and design of digital electronic circuits.

OBJECTIVES

At the end of the course the students are expected to have knowledge on the following

- (i) Number systems, codes & Boolean algebra.
- (ii) Logic families (RTL,DTL,HTL,TTL,ECL,MOS & CMOS) & Logic packages (SSI,MSI,LSI,VLSI & VVLSI)
- (iii) Combinational logic circuits.
- (iv) Sequential logic circuits.
- (v) Digital IC's.

UNIT I : BOOLEAN ALGEBRA

Signed binary numbers - Binary arithmetic in computers - BCD arithmetic - Data representation - Fixed and floating point representation - Exponent representation of floating point binary numbers - Weighted and non weighted binary codes - Alphanumeric codes - Error detection and correction codes - Laws of boolean algebra - Boolean expressions and logic diagrams - Negative logic - Introduction to mixed logic.

UNIT II : LOGIC FAMILIES

Logic families - Specifications of a logic circuit - Operation and characteristics of RTL,DTL,HTL,TTL,ECL,MOS,CMOS and I²L families - Comparison of logic families - Open collector, totem pole, Schottky and tristate TTL gates - Wire-ANDing, strobed gate, expanders, and expandable gates - Logic packages SSI,MSI,LSI,VLSI and VVLSI

UNIT III : COMBINATIONAL LOGIC

Combinational logic - Introduction - Min Terms and Max Terms - Truth tables and maps - Solving digital problems using maps - Sum of products and product of

sums map reduction - Hybrid functions - Incompletely specified functions - Multiple output minimization - Tabular minimization - Implementation of boolean expressions using AND, OR, INVERT Logic gates & Universal gates.

Fault diagnosis in combinational circuits - Classical methods - Boolean difference method.

UNIT IV : SEQUENTIAL LOGIC

Sequential logic - Flip-flops - Counters - Types of counters - Ripple counter design - Type T, type D and type JK design - Design using state equations - Shift registers - Asynchronous sequential circuits - Fault diagnosis in sequential circuits (Qualitative treatment only)

UNIT V : DIGITAL INTEGRATED CIRCUITS

Multiplexer - Demultiplexer - Decoder - Code converter - Arithmetic functions - Memory circuit and systems ROM, PROM, EPROM, EEPROM, RAM, DRAM - D/A converters - A/D converters - memory subsystems - PLA,PAL, series PLD's - architecture programming technologies.

Introduction to system design using ASIC - Introduction to very high speed integrated circuits - hardware description language(VHDL)

TEXT BOOKS

1. **Samuel C.Lee** “Digital Circuits and Logic Design” PHI; 1984
2. **Gothman W.H** “Digital Electronics (second edition)” PHI; 2002.

REFERENCE BOOKS

1. **Jacob Millman and Arvin Grabel** “Micro Electronics” McGraw Hill 1987.
2. **Morris Mano** “Digital Logic and Computer Design” PHI; 1994.
3. **Kohavi** “Switching and Finite Automata Theory” Tata McGraw-Hill; 1978.
4. **William Fletcher** “An Engineering approach to Digital Design” PHI 1990.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Apply the laws of Boolean to reduce Boolean expressions
2. Understand the characteristics of the different logic families

3. Analyze the principles of combinational logic for reducing Boolean functions
4. Apply the theory of sequential logic to the operation of the digital circuits
5. Understand the functions of the different digital integrated circuits

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

EEEC 406 - ELECTRICAL MEASUREMENTS**AIM**

This course provides a vast knowledge about the fundamental concepts and design of electrical measurement and instruments.

OBJECTIVES

- The basic functional elements of instrumentation are to be introduced.
- The different methods of power and energy measurement are to be discussed.
- To explain various methods of measuring resistance and impedances
- To deliver information about various storage and display devices
- To discuss the fundamentals of various recorders, transducers and data acquisition systems

UNIT I UNITS AND STANDARDS

Dimensional analysis - D'Arsonval Galvanometer - Principle of operation and constructional details of moving coil, moving iron, dynamometer type, rectifier type, thermal type instruments - errors and compensations - extension of range using shunt, multiplier.

UNIT II MEASUREMENT OF POWER

Measurement of power in single phase and three phase circuits - Dynamometer type wattmeter - LPF wattmeter - Compensated wattmeter, Hall effect wattmeter, thermal type wattmeter - Errors and compensation. Measurement of energy in single phase and three phase circuits - Induction type energy meter - Errors and compensation - Calibration. Maximum demand meter, KVAR meter, Powerfactor meter, trivector meter, synchroscope.

UNIT III BRIDGES AND POTENTIOMETER

Measurement of low, medium and high resistances - Wheatstone bridge - Kelvin's double bridge - series and shunt type ohmmeter - Megger.

General principle of AC bridges - Bridge sensitivity and bridge balance - Screening and earthing devices Measurements of self and mutual inductance and capacitance - Maxwell, Hay's, Anderson, Wien and Schering bridges - Impedance bridge - Detectors and tuned detectors in bridge measurements.

DC potentiometer - student type - Leeds and Northrup potentiometer - Vernier potentiometer - AC potentiometer methods, Oscillographic method.

UNIT IV MAGNETIC MEASUREMENT

Introduction: Types of tests, Ballistic tests – Measurement of flux density, magnetising force(H), Magnetic potentiometer, Testing of Ring specimens, Determination of B-H curve, hysteresis loop, Testing of bar specimens.

Permeameter – Hopkinson permeameter(Bar and Yoke method). Ewing double bar permeameter, Fahy's simplex permeameter. Measurement of leakage factor with flux meter. Iron loss curves – Separation of iron losses, Methods of iron loss measurement, Methods of measurement of air gap flux - Testing of permanent magnets.

UNIT V HIGH VOLTAGE MEASUREMENT

Principle of high voltage measurement - Measurement of r.m.s voltages - ratio method - potential divider circuits - standard impedances - Measurement of Peak Voltage - ratio method - sphere gap - rectified capacitor current charging method.

Current and potential transformers - construction, and characteristics, errors, testing.

TEXT BOOK

1. **Sawhney A.K** “A Course in Electrical and Electronic Measurements and Instrumentation” Dhanpat Rai and Sons.2007.

REFERENCE BOOK

1. **Harris F.K.** “Electrical Measurements “Wiley Eastern 1994.
2. **Golding E.W and Willis F.E.** “Measurements and Measuring Instruments“ Sir Isaac Pictman and Sons(P) Ltd.1997.
3. **Rajendra Prasad** “Electrical Measurements and Measuring Instruments” - Khanna Publishers - 2007.
4. **Stout M.B** Basic Electrical Measurements - PHI,1981.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the basic principle of measuring instruments.
2. Understand the concepts of measurement of power and energy in single and three phase circuits.
3. Acknowledge the measurement of resistance and impedance.
4. Apprehend and use display instruments, amplifier measurements and CRO
5. Distinguish between recorders, transducers, data acquisition systems and also recognize the applications of display devices, frequency and period measurements.

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

EEEP 407 ELECTRICAL MACHINES LABORATORY- I

AIM

To enable the students to gain a sound knowledge and practical skill in electrical machines.

OBJECTIVES

It serves to acquire practical knowledge about the construction and working of transformers, DC machines and starters.

Course Outcomes

At the end of this course, the students will be able to

- 1) Understand the construction, working principles & operations of DC machines, transformers, Induction motors and Synchronous machines.
- 2) Distinguish the various categories of electrical machines
- 3) Predict the performance of electrical machines from their equivalent circuit models.
- 4) Validate the theoretical concepts by conducting experiments in practical sessions.
- 5) Accomplish the different testing techniques available to assess the actual performance of machines.

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

EEEP 408 ELECTRONICS LABORATORY

AIM

To impart sound knowledge and practical skill in electronics.

OBJECTIVES

It helps to gain practical knowledge about the design, construction and working of various electronic circuits like amplifiers, Oscillators etc.

Course Outcomes

At the end of this course, the students will be able to

- 1) Understand the concept of various electronic and switching devices by learning their characteristics.
- 2) Design amplifier circuits.
- 3) Troubleshoot various electronic circuits.
- 4) Analyze the characteristics of transistors.
- 5) Understand the concept of oscillator circuits.

Mapping with Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3												2		
C02	3	2												2	
C03			2											2	
C04		2											2		
C05	2												2		

FIFTH SEMESTER**EEEC 501 DATA STRUCTURES AND C++ PROGRAMMING****AIM**

To impart the concepts of data structure and C++ programming.

OBJECTIVES

At the end of the course students are expected to have knowledge in Data Structure and C++ programming.

UNIT I DATA STRUCTURES

Introduction to data structures - information & meaning - arrays - in C - Structures in C - Stack; Definition & examples - operations, representation, Queues & lists - representation and operations - linked list - creation.

UNIT II TECHNIQUES

Tree: Definition - types - binary tree - Representation - tree traversal techniques - applications. Sorting and Searching techniques - Selection Sorting . Insertion sorting - Merge sorting , radix, binary sorting - Tree searching - Hashing.

UNIT III OBJECT ORIENTED PROGRAMMING

Objects and classes - methods, messages, encapsulation, abstraction, inheritance, polymorphism dynamic building, Traditional approach versus object orientation: benefits of object orientation - flexibility in software development - reusability - extensibility - maintainability.

UNIT IV OBJECTS AND CLASSES

Specifying classes - using class - C++ objects and data types - constructors and destructors - object as function arguments - structures and classes . Array fundamentals - array as class member data - array of objects. Structures - simple structure - accessing structure member - structure within structure - structure and classes - Function overloading - Inline function - Virtual function and polymorphism.

UNIT V OPERATIONS

Operator overloading - overloading - unary operator - overloading binary operator
- data conversion. inheritance - derived class and base class - derived class constructors
- public and private inheritance - level of inheritance. C++ graphics - text-mode
graphics functions- graphics-mode graphics functions - colors - rectangles and lines -
polygons and inheritance - text in graphics mode - Address and pointers , Simple
file operations: streams - string I/O - character I/O.

TEXT BOOKS

1. **John R.Hubbard**, "Programming with C++", Tata McGraw Hill, New Delhi, 1988.
2. **Jean - Paul Tremblay and Paul G.Sorenson**, "An Introduction to Data Structures with Applications", Tata McGraw Hill, 1988.

REFERENCE BOOKS

1. **Bjarne Stroustrup**, "The C++ Programming Language", Addison - Wesley Publication , New York, 2006.
2. **Cay Horstmann**, "Computing Concepts with C++ Essentials" ,John Wiley, 2006.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the linear data structures such as arrays, linked lists, stacks and queues.
2. Understand the non linear data structures like sorting, searching, insertion and deletion of data.
3. Understand the basic concepts of object oriented programming language.
4. Obtain knowledge about objects and classes.
5. Acquire knowledge about various types of inheritance and operator overloading.

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

EEEEC 502 POWER ELECTRONICS**AIM**

To impart sound knowledge about the power control device and their applications in electrical engineering.

OBJECTIVES

This Course introduces various new generation power control devices and also impart knowledge in the area of application of control devices in the field of electrical Engineering and power system.

UNIT I POWER SEMICONDUCTOR DEVICES

Power diodes - Power Transistors - Power MOSFET`s - IGBT`s - Thyristor family SCR`s, Triacs - GTO`s and MCT`s - Static and dynamic characteristics - Protection circuits - Series and parallel connections.

UNIT II AC TO DC CONVERTERS

Single phase half wave and full wave controlled thyristor converters with R - RL and RLE load - Estimation of average load voltage and average load current - Estimation of input power factor for ripple free load current - Effect of free wheeling diode - Dual converters - Three phase half wave and full wave controlled thyristor bridge converters

UNIT III AC TO AC CONVERTERS

AC voltage controllers - Single phase full wave controller with R and RL load - Estimation of RMS load voltage - RMS load current and input power factor. Qualitative Treatment of Three phase AC voltage controller - Single phase AC chopper - Cycloconverter - Types - Tap charging of transformers - AC circuit breakers

UNIT IV DC TO DC CONVERTER

DC chopper using devices other than thyristors - Step up and step down operation - Time ratio control - single quadrant DC chopper with R - RL and RLE load - Estimation of average load voltage and load current - Two quadrant and four quadrant DC choppers – DC Circuit Breakers

UNIT V DC TO AC CONVERTERS

Inverters using devices other than thyristors - Types of inverters - Voltage source and current source inverters - Single phase bridge inverter - Three phase bridge inverter - Control of AC output voltage - PWM techniques for DC to AC converters – Thyristorised series and parallel inverters - HVDC systems - UPS.

TEXT BOOKS

1. **Rashid M.H.** “Power Electronics “ PHI New Delhi - 2004.
2. **Joseph Vithayathil** “Power Electronics “McGraw Hill New york - 1996.

REFERENCE BOOKS

1. **Sen.P.C**“Power Electronics”Tata McGraw-Hill Publishing Co. Ltd., New Delhi2005.
2. **Dubey .K.K Doralda S.R., Joshi A, Sinha. R.M.K.** “Thyristorised Power Controllers”Wiley Eastern Ltd, 2007.
3. **Bimbhra P.S.** “Power Electronics” Khanna Publishers;2007.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the characteristics and operation of AC-DC converters
2. Analyze the influence of AC-AC converters in the framework of obtaining a variable AC voltage
3. Understand the duty cycle control-based operation of DC-DC converters
4. Analyze the operation of DC-AC converters in the perspective of its suitability for practical applications
5. Apply the power converters in the operation of AC motors and special machine drives

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

EEEC 503 - ELECTRONIC INSTRUMENTS AND MEASUREMENTS**AIM**

This course provides a vast knowledge about the fundamental concepts and design of electrical measurement and instruments.

OBJECTIVES

- The basic functional elements of instrumentation are to be introduced.
- The different methods of power and energy measurement are to be discussed.
- To explain various methods of measuring resistance and impedances
- To deliver information about various storage and display devices
- To discuss the fundamentals of various recorders, transducers and data acquisition systems

UNIT I ELECTRONIC METERS AND SIGNAL SOURCES

Electronic Analog meters - DC and AC voltmeters - true rms voltmeters - differential voltmeters VTVM - TVM amplifier rectifier type voltmeter-Current measurements - Multimeters - Component measuring instruments Q meters - Vector impedance meter - power meter. Review of Signal Sources - Signal generator, Function generator, pulse generator, RF Signal generator - Distortion analyser - Spectrum analyzer - correlator.

UNIT II FREQUENCY AND PERIOD MEASUREMENTS

Standards of frequency - Frequency measurement by the absorption method - Comparison method - Heterodyne frequency meter - Capacitor charge discharge method - Pulse counting method - Comparison between analog and digital methods of measurement. Digital methods of measuring frequency, period, phase difference - pulse - width, time interval, AC and DC voltage and current - true rms voltage - DMM - DPM - Digital Q meter. - Introduction to intelligent measurement.

UNIT III DIGITAL TRANSDUCERS AND DISPLAY DEVICES

Digital displacement transducers - incremental and absolute - moire fringe transducer. Digital methods of measuring displacement - velocity - acceleration - temperature Display Devices - LED - LCD - annunciators, Numerics - Alphanumeric - Graphics.

UNIT IV DISPLAY INSTRUMENTS AND AMPLIFIER MEASUREMENTS: CRO

Sampling - CRO dual trace oscilloscope-Time base generator - Rate generator - Synchronisation - Sweep circuit Digital storage oscilloscope - XY Mode - Wave and distortion analyser for RF signals - Phase measurement using oscilloscope - Null balance method - Phase shift to pulse conversion method - Digital phase meter. Definition of amplification and gain - Voltage gain measurement - Insertion gain - Available power gain - Impedance measurements - Phase shift characteristics - Square wave testing of amplifiers - Measurements of nonlinear distortion - Measurements of noise figure of amplifiers.

UNIT V RECORDERS

Moving coil, potentiometer, event recorders - XY Recorders. Strip chart recorder - XY plotters - UV recorders - magnetic tape recording - FM digital recording - interference and screening - component impurities - electrostatic and electromagnetic interference - practical aspects of interference reduction. Introduction to automated measurement system IEEE 488 standard.

TEXT BOOKS

1. **Kalsi H.S.**; “Electronic Instrumentation” Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1998.
2. **Cooper W.D. and Helfrick A.D.**, “ Electronic Instrumentation and Measurement Techniques” Third Edition, PHI,1991.
3. **Bouwens A.J** “Digital Instrumentation”, Tata McGraw Hill Publishing Co. Ltd., New Delhi - 1997.
4. **Terman F.E.and.Petit J.M** "Electronic Measurement", McGraw Hill,1984.

REFERENCE BOOKS

1. **Sawhney. A.K** "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Sons 1995.
2. **Jones L.D and Foster Chin A.** "Electronic Instrumentation and Measurements", Prentice Hall , 1984.
3. **Donald P.Eckman** “Industrial Instrumentation”, Wiley Eastern Ltd, 1986..
4. **Oliver B.M and Cage J.M** “Electronic Measurements and

Instrumentation” McGraw Hill, 1977

5. **Barney G.C.** "Intelligent Instrumentation", Prentice Hall of India,1998.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand various types of electronic meters and signal sources
2. Analyze different frequency and period measurement methods
3. Gain knowledge of digital transducers and display devices
4. Impart the basic concepts of display instruments and amplifier measurements
5. Understand different recorders and associated concepts.

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

EEEC 504 FIELD THEORY**AIM**

The course enables the students to gain an in-depth knowledge about the electromagnetic.

OBJECTIVES

At the end of the course, the students will be familiar with

- i) Vector analysis of electromagnetic fields
- ii) Electro static principles
- iii) Various concepts of electro magnetic and magnetic circuits
- iv) Time varying magnetic fields
- v) Maxwell's equation and concepts of waves.

UNIT I : VECTOR ANALYSIS

Definition of scalar and vector, examples - Area expressed as a vector - Scalar product of vectors - Cross product of vectors - Time and space derivatives of scalar and vector functions - Definition of gradient of a scalar function, illustrative examples - Line integral, surface integral and volumetric integral, examples - Basic definitions of divergence and curl of vector functions - Illustrative examples - Stokes theorem and divergence theorem - Examples of application of these theorems.

UNIT II : ELECTROSTATICS

Definition of electric charge, electric field, electric flux line, properties of flux lines - Static field - Coulombs law of point charges - Electric field intensity - Permittivity - Electric flux density - Gauss's law - Electric potential and potential difference - Potential gradient - Relation between potential gradient and electric field intensity - Conservative property of electrical field - Poisson's equation and Laplace's equation - Electric dipole - Field intensity due to dipole - Polarization in a dielectric material - Field intensity and potential due to a group of point charges, spherical charge distribution, line charge distribution and cylindrical charge distribution - Method of electric images - Applications of method of images - Boundary conditions at conductor-dielectric interface, conductor-free space interface and dielectric-dielectric interface - Definition of capacitance - Loss angle of a capacitor - Capacitance of parallel plate system with single and multilayered dielectric,

capacitance of coaxial cable with single and multilayered dielectric - Spherical capacitor - Capacitance of isolated sphere - Capacitance of two conductor transmission line - Energy stored in electrostatic field - Force on a dielectric subjected to electrostatic field - Forces on charged parallel conductors. Dielectric strength - Relation between current density and electric field intensity - Conduction current, convection current and displacement current - Equation of continuity(qualitative treatment) - Electrostatic induction in telephone lines.

UNIT III : ELECTROMAGNETICS

Definition of magnetic field, magnetic flux lines - Properties of magnetic flux lines - Magnetic field intensity (H), permeability, magnetic flux density (B), scalar and vector potentials in a magnetic field - Solenoidal property of magnetic field - Biot-Savart's law - H due to straight current carrying conductor, H due to circular coil, H due to current carrying solenoid - Ampere's circuital law in a generalised form - Method of magnetic images - Force on a current carrying element inside a magnetic field - Lorentz force. Forces acting on parallel current carrying conductors, circular current carrying coils - Boundary conditions at magnetic interface - Energy stored in magnetic field - Lifting force of a magnet. Definition of self inductance (L), mutual inductance (M), examples - L of a solenoid, L of a toroidal system, M of coupled coils, energy in terms of L and M, torque in terms of L and M, L of two conductor transmission system - M between power line and telephone line. Magnetic dipole - The phenomena of magnetization of ferro magnetic materials - Magnetic circuits - Permanent magnets.

UNIT IV : TIME DEPENDENT ELECTROMAGNETIC FIELDS

Faraday's law of electromagnetic induction - Lenz's law - Flux cutting rule - Faraday's disc generator - Examples of electromagnetic induction - Hysteresis loss and eddy current loss - Electromagnetic induction in a telephone line due to power line - Electromagnetic shielding - Qualitative difference between field theory and circuit theory.

UNIT V : PLANE ELECTROMAGNETIC WAVES

Maxwell's equations in point and integral form - Maxwell's wave equation - Plane electromagnetic wave in free space - Sinusoidal electromagnetic wave -

Poynting vector and Poynting's theorem - Relation between electric field intensity and magnetic field intensity - Applications of the concept of Poynting vector - Examples of wave propagation - Surge impedance of a line in terms of energy balance.

TEXT BOOK

1. **William H.Hayt.Jr** “Engineering Electromagnetics” Tata McGraw - Hill Publishing Company Limited, New Delhi; 2007.

REFERENCE BOOKS

1. **Samuel Seely** “Introduction to Electromagnetic Fields” Mc Graw- Hill; 1958.
2. **Clayton R.Paul, Syed A.Nasar** “Introduction to Electromagnetic Fields” Mc Graw - Hill International Editions; 1987.
3. **Gangadhar K.A** “Field Theory” Khanna Publishers; Delhi : 2007.
4. **Sathaiah. D and Anitha .M** “ Electromagnetic Fields “ Scitech Publications (India) Private Ltd. Chennai. 2007.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

- 1) Understand the role of vector calculus in investigating the physics of electric and magnetic fields.
- 2) Explore the electrostatic applications and to solve problems related to different medium with different boundaries.
- 3) Acquaint the magnetostatics principles and their applications
- 4) Understand Faraday’s laws and Maxwell’s equations.
- 5) Comprehend the wave propagation, Poynting theorem and their applications

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

EEEC 505 CONTROL SYSTEMS**AIM**

To impart a sound knowledge to the students regarding the mathematical model and response analysis of control system.

OBJECTIVES

After completion of the course students able to get a knowledge in various aspects of

- i) Modeling of translational and rotational system, block diagram reduction techniques and signal flow graph for obtaining transfer function.
- ii) Transient analysis of various standard inputs for first order and second order system.
- iii) Frequency response analysis and frequency domain specification by bode plot and polar plot.
- iv) Stability analysis by Routh Hurwitz criterion and Nyquist stability criterion.
- v) Analysis of sampled data control system using Z transform.
- vi) State space analysis (writing state equation for physical, phase, canonical variables.)
- vii) Concept of controllability and observability.

UNIT I SYSTEM MODELLING

Basic elements in control systems - Open loop & closed loop systems - Differential equation representation of physical systems - Transfer function - Modelling of translational & rotational systems- Block diagram reduction techniques - Signal flow graph.

UNIT II TIME DOMAIN ANALYSIS

Types of standard test inputs - Analysis of I order and II order systems - Time domain specifications - Steady state error - Generalized error coefficients - Stability analysis - Routh Hurwitz criterion - Root locus technique.

Compensators – Design of Lag, Lead and Lag Lead networks using root locus approach.

UNIT III FREQUENCY DOMAIN ANALYSIS

Frequency response -Definition - Frequency domain specifications - Bode plot- Polar plot - Nyquist stability criterion - Compensators – Design of Lag, Lead and Lag Lead networks using bode plot.

UNIT IV STATE SPACE ANALYSIS

Introduction - State space formulation-State model of continuous time systems - State diagram - State space representation using physical, phase and canonical variables – Solution of state equation for step input – Transfer function decomposition – Transfer matrix – Pole –Zero cancellation and system properties – Controllability, observability and detectability.

UNIT V OPTIMAL AND ADAPTIVE CONTROL

Introduction – Time optimal control of continuous time systems – Optimal control systems based on quadratic performance Indices, Direct Liapunov method for linear systems – Parameter optimization problems – Design with partial state feed back – Optimal linear regulator design – Introduction to Adaptive control Functions of adaptive controllers.

TEXT BOOK

1. **Nagrath. J and Gopal.M** ," Control System Engineering" New Age International(p)Ltd- NewDelhi- 2008.

REFERENCE BOOKS

1. **Ogata.K.**"Modern control engineering" Pearsan education- Asia 4th edition - 2002.
2. **Gopal.M,** "Digital control and state variable methods" TMH -2002.
3. **Kuo. B.C.,** "Automatic control systems" PHI 7'th edition - 1997.
4. **Goodwin G.C, Graebe S.F and Salgado M.E,** “Control system design”, Pearson Education – 2003.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Understand the modeling of linear-time-invariant systems using transfer function and feedback control systems.

2. Perform time response analysis and exhibit the use of root-loci to determine stability of systems.
3. Understand the concept of frequency response analysis
4. Design simple feedback controllers.
5. Acquire knowledge about state variable analysis.

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

EEEC 506 ELECTRICAL MACHINES II**AIM**

The course enables the students to gain the indepth knowledge about the various AC machines.

OBJECTIVES

At the end of the course, students would be exposed to essential principles which underlie the performance of all types of AC machines and they become familiar in solving problems connected with AC machines.

UNIT I : THREE PHASE INDUCTION MOTORS

Performance types, ratings and applications, gap flux harmonics, cogging, crawling, skewing of rotor bars, noise reduction, deep bar rotor and double cage rotor, torque-slip characteristic of double cage motor, operation on unbalanced supply, principle of induction generator, applications of induction generator.

UNIT II : SINGLE PHASE INDUCTION MOTORS

Double field revolving theory, cross field theory. Torque slip characteristic and its interpretation, split phase starting, resistance start, resistance start and run, capacitance start, capacitance start and run, typical performance characteristics, determination of constants of equivalent circuit, computation of performance from equivalent circuit.

UNIT III : SYNCHRONOUS GENERATORS

Constructional features of round rotor type and salient pole type machines, EMF equation, rotating magnetic field, armature reaction, armature reactance, leakage reactance, synchronous reactance, phasor diagram, performance characteristics, predetermination of voltage regulation by synchronous impedance, ampere turn and potier methods, synchronisation, synchronising torque, parallel operation, excitation systems, D.C. exciters, A.C. exciters, brushless excitation, automatic voltage regulator.

UNIT IV : SYNCHRONOUS MOTORS

Principle of operation, synchronous motor on infinite busbars, phasor diagram, V curves and inverted V curves, hunting and its suppression, natural frequency of oscillation, starting methods, synchronous induction motor and its applications - Synchronous phase modifier and its applications - Permanent magnet synchronous motors – Principle of operation and characteristics.

UNIT V : SPECIAL MACHINES : (QUALITATIVE TREATMENT ONLY)

Three phase commutator motors, general principles, effect of e.m.f injection into rotor circuit, stator fed three phase shunt commutator motor, schrage motor.

Construction, Principle of operation and characteristics of Single phase commutator motors, plain single phase series motor (universal motor), compensated series motor, repulsion motor, compensated repulsion motor.

Construction, Principle of operation and characteristics of Three phase reluctance motor, single phase reluctance motor, hysteresis motor, shaded pole motor, linear induction motor, stepper motors , switched reluctance motors.

TEXT BOOKS

1. **Say M.G** “Performance and Design of AC Machines” CBS Publishers. 1983
2. **Langsdorf A.S.** “Alternating Current Machines” Mc Graw- Hill; 1955.
3. **Openshaw Taylor .E** “Performance and Design of AC Commutator Motors”, Wheeler Publishing Company. New Delhi 1995

REFERENCE BOOKS

1. **Nagrath I.J. & Kothari D.P.** “Electrical Machines” Tata McGraw Hill Publishing company Limited, New Delhi; II Edition; 1998.
2. **Bimbhra P.S.** “Electrical Machinery” Khanna Publishers; 2007
3. **Theraja B.L. & Theraja A.K.** “A Text Book of Electrical Technology” VOL II; S.Chand & Company Ltd; 2000.

Course Outcomes

At the end of this course, the students will be able to

1. Gain knowledge of basic concepts, performance characteristics of 3 phase induction motors

2. Understand about single phase induction motor, its starting methods, characteristics
3. Study the basic concepts of synchronous generator and excitation systems
4. Impart knowledge of synchronous motor concepts
5. Acquire knowledge of different special machines.

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

EEEP 507 MEASUREMENTS AND INSTRUMENTS LAB

AIM

To impart to the students to gain sound knowledge and practical skill in measurements and instrumentation.

OBJECTIVES

To enable the students to gain some practical knowledge in various electrical measurements, like measurement of low/high resistance, capacitance and to have some knowledge in instruments like galvanometer, wattmeter, energymeter etc.

Course Outcomes

At the end of the course, the students will demonstrate the ability to

1. Understand the methods involved in magnetic measurements.
2. Measure various electrical parameters using bridges.
3. Investigate the impact of real and reactive powers for constant power factor loading.
4. Acquire knowledge in calibrating various Energy Meters for different load conditions.
5. Investigate the ABCD constants in transmission lines, detection of cable fault and RLC transients.

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

EEEP 508 ELECTRICAL MACHINES LAB II

AIM

To impart to the students to gain sound knowledge and practical skill in electrical machines.

OBJECTIVES

To enable the students to gain practical knowledge about the various machines, AC starters and other special machines.

COURSE OUTCOMES

At the end of the course, the students will demonstrate the ability to

- 1) Understand the construction, working principle & operation of Induction motors and Synchronous machines.
- 2) Distinguish between the various categories of electrical machines
- 3) Predict the performance of electrical machines from their equivalent circuit models.
- 4) Validate the theoretical concepts by conducting experiments in practical sessions.
- 5) Accomplish the different testing techniques available to assess the actual performance of machines.

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

SIXTH SEMESTER**EEEC 601 - EMBEDDED SYSTEMS****AIM**

The course enables the students to gain an in-depth knowledge about the embedded system.

OBJECTIVES

- To familiarize the fundamentals of embedded systems, design paradigms and architectures.
- To comprehend the basics of PIC Microcontroller PIC and their programming.
- To learn the different interfacing capabilities of PIC controllers and their Memory Organization.
- To study about the ARM Architecture and its programming.
- To understand the Real Time Operating Systems, and their Task Management.

UNIT I INTRODUCTION

Embedded system concept – Embedded hardware devices – overview of 8085 Microprocessor –Architecture – memory organization – flash memory peripheral interfacing with input / output devices – LED –LCD – Keyboard – ADC/DAC.

UNIT II 8051 ARCHITECTURE

Architecture (8051) – memory organization – addressing modes – instruction set – Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial Communication. Assembly language programming – Arithmetic Instructions – Logical Instructions –Single bit Instructions – Timer Counter Programming – Serial Communication Programming – Derivative Architecture 89C51.

UNIT III PIC MICROCONTROLLER

PIC 16C74A Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly – I/O port, Data Conversion, RAM & ROM Allocation, Timers – Interrupts, I/O Ports- I²C bus-A/D converter-UART–Flash and EEPROM memories.

UNIT IV ARM ARCHITECTURE AND PROGRAMMING

RISC Machine – Architectural Inheritance – Core & Architectures -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processor - Instruction set – Thumb instruction set – Instruction cycle timings – ARM Assembly Language.

UNIT V OPERATING SYSTEM OVERVIEW

Introduction to OS – Function of OS – Defining an RTOS – Differences in Embedded Operating Systems – Introduction to Kernel – Resources – Shared Resources- Task – Multitasking- Task Management Functions – Scheduling and Scheduling Algorithms – Implementation of scheduling and rescheduling.

TEXT BOOKS:

1. **Arnold, Berger.S** “Embedded System Design- An Introduction to Processes, Tools and Techniques CMP Books- 2002.
2. **Muhammad Ali Mazidi, Janice Gillispie Mazidi**, , “8051 Microcontroller and Embedded Systems”, PHI-2000.
3. **Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey** ‘PIC Microcontroller and Embedded Systems using Assembly Language’, Pearson Education - 2008.
4. **Steve Furber**, ‘ARM System on Chip Architecture’, 2nd Edition Addison Wesley – 2000.
5. **Raymond J.A.Bhur, Donald L.Bailey**, “An Introduction to Real Time Systems”, PHI- 1999.

REFERENCE BOOKS:

1. **Dijasio, Wilmsurst, Ibrahim, John Morton, Martin P Bates, Jack Smith, Smith D W**, “PIC Microcontrollers “, Newnes, Elsevier – 2008.
2. **Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield** ‘ARM System Developer’s Guide Designing and Optimizing System Software’, Elsevier 2007.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Understand the architecture and its programming aspects of embedded systems.
2. Distinguish between the general computing system and embedded system.
3. Design real time embedded systems using the concept of RTOS.
4. Acquire knowledge about architecture, registers, instruction set of arm processor.
5. Know about operating system function, resource and task management function.

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

EEEC 602 - INDUSTRIAL CONTROL AND AUTOMATION**AIM**

To impart to the students to gain sound knowledge in industrial control and automation.

OBJECTIVES

- To familiarize the students about the industrial control and automation.
- To provide elementary knowledge about PLC and its applications.
- To afford the significance of control concepts.

UNIT I PROCESS MODELLING

Mathematical modelling of a process - Process Identification - Open loop identification - First order and second order model - without and with pure delay - Closed loop identification method - Identification of unstable systems - Self regulation characteristics - Inverse response - Tuning theory - Antireset windup technique.

UNIT II CONTROLLERS

Transfer function of control equipments - ON OFF control - Time proportional control - Proportional plus integral control - Derivative control - PID controller - Electronic controller - Ratio control systems - Split range control - Cascade control - Selective control - Inverse derivative control - Feedback control - feed forward control - bumpless automatic control - Typical process - PID algorithms - design for load changes.

UNIT III DIGITAL CONTROL STRATEGIES

Introduction – Basics of a digital control system -Sampling - Sample and hold circuits - Discrete time signal - Linear discrete time systems - Pulse transfer functions - Analysis of digital control system using Z transform - Stability analysis - Jury's stability criterion.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS

Evolution of modern day PLC - relay based PLC - microprocessor based PLC - input and output modules - other functional elements - personal computer as PLC - Programming the PLC - ladder logic diagram - Boolean language - on line and off line programming aids - communication in PLC - typical applications of PLC - PID control capability in programmable controllers.

UNIT V DISTRIBUTED CONTROL SYSTEMS

Evolution of DCS - Factors to be considered in selecting a DCS – Typical architecture - local control unit (LCU) and architecture - LCU languages - LCU - process interfacing issues - communication system requirements - architectural issues - protocol issues - communication media - message security - communication system standards - field bus, HART. Operation interface - requirements - display -alarms and alarm management - engineering interface – requirements - Comparison of DCS with direct digital control and supervisory control

TEXT BOOKS

1. **George Stephanopoulos**, “Chemical Process Control, An introduction to the theory and Practice”, Prentice Hall International Inc.,2001
2. **Gopal.M**, "Digital control and state variable methods" TMH -2002
3. **Michal P Lucas.**, "Distributed Control Systems" Van Noster and Reinhold Co.,.1986

REFERENCE BOOKS

1. **Donald R Coughanowr**, ” **Process System and Control, Second Edition**” , McGraw Hill 2006.
2. **F.D Petruzella.**, "Programmable Logic Controllers" McGraw Hill 2006.
3. **Thomas Hughes**, "Programmable Controller" Instrument Society of America, 1992.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the basics of process modeling.
2. Acquire knowledge about various controller configurations.
3. Gain knowledge in the field of digital control system.
4. Familiarize PLC and its programming.
5. Understand the fundamentals of distributed control system.

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

EEEC 603 SIGNALS AND SYSTEMS**AIM**

To impart to the students to gain sound knowledge in signals and systems.

OBJECTIVES

- Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that is necessary for the analysis of continuous and discrete-time signals and systems.
- Impart Knowledge about time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc.
- Impart Knowledge on frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform.
- Elucidate the Concepts of the sampling process.

UNIT I: CONTINUOUS TIME (CT) AND DISCRETE TIME (DT) SIGNALS

Classification of signals – Signal Energy and Power – Properties - Periodic signals – Even and Odd signals – CT complex exponential and sinusoidal signals – DT complex exponential and sinusoidal signals – CT unit impulse and unit step function – DT unit impulse and unit step sequence – Random signals – Random processes .

UNIT II: CONTINUOUS TIME SYSTEMS

Properties of continuous time systems – Representation of continuous time Linear time invariant (LTI) systems using differential equations – Block diagram representation – Analysis of continuous time LTI systems – Transfer function model – Block diagram reduction – Continuous time unit impulse response – Convolution integral – unit step response of LTI system – Frequency response – Singularity function – Analysis of LTI systems using Laplace transform.

UNIT III: FOURIER ANALYSIS

Fourier series representation of continuous time periodic signals – Properties of continuous time Fourier series – Convergence of Fourier series – Representation of Aperiodic signals – Continuous time Fourier transform – Properties of continuous time Fourier transform – Analysis of continuous time LTI systems using Fourier transform.

UNIT IV: DTFT AND DFT

Discrete time Fourier transform (DTFT) – Properties of DTFT – Time and frequency shifting – Conjugation – Parseval’s relation - Discrete Fourier transform (DFT) – Properties of DFT – DFT Frequency response characteristics – Weighting function- Circular Convolution – Correlation – Auto Correlation.

UNIT V: DISCRETE TIME SYSTEMS

Properties of Discrete time systems – Representation of discrete time systems using difference equation – Block diagram representation - Z Transform and its properties - Pole-Zero representation – BIBO stability – Solution using Z transform – State variable equation – State space model.

TEXT BOOKS

1. **Alan V Oppenheim, Alan Wilskey. S and Hamid Nawab. S:** "Signals and systems" Second edition prentice Hall India, 2006.
2. **Simon Haykin, Barry Van Veen.,** “Signals & Systems”. John Wiley & Sons (ASIA) Private limited, 2001.
3. **Rodger Ziemer. E., William Tranter. H and Ronald Fannin. D,** Signals and Systems, Maxwell Macmillman, Canada, 1993.
4. **Ramesh Babu . P and Ananda Natarajan. R.,** “Signals and Systems”, 4th Edition, Sci-Tech Publications, Chennai, 2011.

REFERENCE BOOKS

1. **Gabel. R.A. and Richard. R.A.,** "Signals and linear systems", John Wiley and sons, 1987.
2. **Gordan E Carlson:** "Signals and linear systems analysis" Allied Publishers, New Delhi, 1993.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

- 1) Characterize and analyze the properties of CT and DT signals and systems.
- 2) Analyze CT and DT systems in Time domain using convolution.

- 3) Represent CT and DT systems in the Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT.
- 4) Conceptualize the effects of sampling a CT signal.
- 5) Analyze CT and DT systems using Z Transformation.

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

EEEC 604 SOLID STATE DRIVES**AIM**

To enable the students to acquire a thorough knowledge about the electrical drives, techniques for controlling the drives and their applications in industries.

OBJECTIVES

To impart a wide knowledge about the modern electric drives and its latest developments and its industrial applications.

UNIT I: INTRODUCTION

Electric Drives – Types of electric drives - Characteristics of Electric Drives - Advantages of electric drives - speed torque characteristics of various types of loads and drive motors - Joint speed torque characteristics - Selection of power rating for drive motors based on thermal limits, overload capacity and load variation factors.

UNIT II PHASE CONTROLLED DC DRIVES

Solid state Drives : Introduction - comparison between solid state and conventional drives - open loop and closed loop speed control - DC motor transfer function - speed and current control loops - converter fed DC drives (using thyristors) - single, two and four quadrant operations - Reversible drives - Armature and field current reversal - Dynamic and regenerative braking.

UNIT III CHOPPER CONTROLLED DC DRIVES (USING DEVICES OTHER THAN THYRISTORS)

Principles of chopper operation - chopper configuration - chopper fed D.C. motors, analysis and performance characteristics - Dynamic and regenerative braking of chopper controlled drives - regenerative reversals.

UNIT IV : INDUCTION MOTOR DRIVES (USING DEVICES OTHER THAN THYRISTORS)

Speed control of three phase induction motor - stator voltage and frequency control – V/F control - Rotor control - static control of rotor resistance using DC chopper - slip power recovery scheme – Static Kramer and Scherbius drives.

UNIT V: SYNCHRONOUS MOTOR AND SPECIAL MACHINE DRIVES

Speed control of synchronous motors - modes of operation - Adjustable frequency operation - controlled current operation – voltage source inverter and current source inverter fed synchronous motor drive - PWM inverter fed synchronous motor drives – cyclo converter fed synchronous motor drives

Special Machines Drives (qualitative treatment) – Principle of operation, Torque speed characteristics of Switched reluctance, Brush less DC and Permanent Magnet Synchronous Motor drives.

TEXT BOOKS

1. **Dubey G.K** “Fundamentals of Electrical Drives”, Narosa publishing House , New Delhi ,2004.
2. **Gopal k Dubey** “Power Semi Conductor Controlled Drives” Prentice Hall New Jersey ,1989.

REFERENCE BOOKS

1. **Pillai S.K.** “A First course on Electric Drives” Wilery Eastern Ltd, Bombay 1988.
2. **Sen P.C.** “Thyristorised D.C. Drives” Johnwiley and sons, Newyork,1981.
3. **Vedam Subramanian** “Electric Drives – Concepts and Applications” Tata McGraw Hill Publishing company Limited,New Delhi;2007.
4. **Murphy J.M.D. and Turnbull F.G.** “Power Electronic Control of A.C. Motors” Pergamon Press.
5. **Miller,T.J.E,** “Brushless I magnet and reluctance motor drives” Clarendon Press, Oxford, 1989.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the basics of electric drives
2. Analyze the operation of phase-controlledDC drives
3. Apply the theory of self-commutated switches to the operation of chopper fed drives
4. Analyze the speed control mechanisms for induction motor drives
5. Understand the operation of synchronous motor and special machine drives

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

EEEC 605 TRANSMISSION AND DISTRIBUTION**AIM**

The course enables to gain indepth knowledge about the electrical transmission and distribution systems.

OBJECTIVES

At the end of the course the students are exposed to have indepth knowledge of different types of distributors, voltage controllers, insulators, UG cables and power loss Calculations.

UNIT I INTRODUCTION

Fundamentals of power systems : Single phase transmission – Three phase transmission – complex power - Load characteristics. Inductance of a single phase two wire line – Inductance of composite conductor lines - Inductance of three phase lines – Inductance of double circuit three phase lines – Bundled conductors - Skin effect and proximity effect.

Capacitance of a two-wire line – Capacitance of a three phase line with equilateral spacing - Capacitance of a three phase line with unsymmetrical spacing - Capacitance of a double circuit line – Effect of earth on transmission line capacitance.

UNIT II DISTRIBUTION SYSTEMS

Feeders, distributors and service mains : D.C. distributors - Singly fed and doubly fed two wire and three wire systems, with concentrated and uniformly distributed loads. A.C. distributor – Single phase and three phase - Division of load between lines in parallel.

Effect of Working voltage on the size of feeders and distributors – Effect of system voltage on economy - Voltage drop and efficiency of transmission. Distribution systems : Types of distribution systems - Section and size of feeders - Primary and secondary distribution - Distribution substations - Qualitative Treatment of Rural distribution and Industrial distribution

UNIT III PERFORMANCE OF TRANSMISSION LINES

Characteristics and performance of transmission lines : Representation of lines – Short lines - Medium length lines - Solution by nominal T and π methods - Calculation of sending and receiving end voltages and current - Regulation and efficiency of a transmission line - Long transmission line - Hyperbolic form of equations for long lines – ABCD constants - Ferranti effect - Tuned power lines – Equivalent circuit of a long line.

Voltage control: Methods of voltage control shunt capacitors, series capacitors, tap changing transformers and booster transformers - Determination of phase modifier capacity – Sending end and receiving end power circle diagrams.

UNIT IV MECHANICAL CHARACTERISTICS

Mechanical characteristics of transmission lines: Sag in overhead lines – the catenary curve – calculation of sag with supports at different levels - Effects of wind and ice loading – Stringing chart – Sag template - Equivalent span – Stringing of conductors - vibration and vibration dampers.

Corona : Theory of formation – Factors affecting corona - Critical disruptive voltage – Visual critical voltage – Corona loss – Advantages and disadvantages of corona - Methods of reducing corona effect - Radio interference – Inductive interference between power and communication lines.

UNIT V INSULATORS

Overhead line insulators – Types of insulators - Potential distribution over a string of suspension insulators – Methods of equalizing potential - Causes of failure of insulators.

Underground cables - Types of cables - capacitance of single core cable - Grading of cables - Power factor and heating in cables - Capacitance of three core cable.

TEXT BOOK

1. **Nagrath I.J. and Kothari D.P.** “Power System Engineering” Tata McGraw Hill Publishing company Limited, New Delhi; 2007.

REFERENCE BOOKS

1. **Soni,Gupta, Bhatnagar and Chakrabarthy** “A Text Book on Power system Engineering” Dhanpat Rai and Co; 1998.
2. **Stevenson W.D.** “Elements of Power System Analysis” Mc Graw-Hill;1985.
3. **Wadhwa C.L.** “Electrical of Power Systems” Wiley Eastern; 2007.
4. **Ashfaq Husain**“Electrical Power Systems” CBS Publications & Distributors; 2006.

COURSE OUTCOMES

At the end of this course, the students will be able to,

1. Understand the fundamental concepts of power systems
2. Determine the line parameters and analyze the performance of transmission lines
3. Acquire knowledge of mechanical characteristics of transmission lines
4. Analyze the concepts of distribution systems
5. Familiarize with the concept of insulation

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

EEEEC 606 ELECTRICAL MACHINE DESIGN**AIM**

The course enables the students to gain an in-depth knowledge about the design of electrical machines.

OBJECTIVES

At the end of the course, students would be exposed to

- (i) Detailed design of electrical machines
- (ii) Limitations and restrictions imposed by the cost, economy, requirements and performance characteristics.

UNIT I INTRODUCTION

Magnetic circuit calculations : magnetisation characteristics - loss curves - estimation of total mmf - mmf for airgap - mmf for teeth - significance of Carter's coefficient - real and apparent flux densities - leakage flux - leakage reactance in transformer - leakage reactance in rotating machines. Heating and cooling : heating and cooling curves - calculations of temperature rise and fall - cooling and ventilation of rotating machines - cooling methods employed in transformers.

UNIT II DC MACHINE DESIGN

Design of dc machines : standard specifications - output equation - output coefficient - choice of specific magnetic and electric loadings - choice of number of poles - length of airgap - design of armature winding and armature core - choice of number of armature slots - dimensions of pole - design of field windings - design of commutator and brushes - design of interpole and its winding.

UNIT III TRANSFORMER DESIGN

Design of Transformers - standard specification - EMF per turn - output equation - window space factor - specific loadings - dimensions of core and yoke - design of winding - cooling of transformers - design of tank with cooling tubes - estimation of no load current of transformer - change of parameters with change of frequency.

UNIT IV INDUCTION MOTOR DESIGN

Design of three phase induction motor - output equation - choice of specific loadings - main dimensions - design of stator windings and core - length of airgap - design of cage rotor - design of wound rotor.

Design of single phase induction motor - output equation - design of main winding – design of auxiliary winding – performance calculations.

UNIT V SYNCHRONOUS MACHINE DESIGN

Design of synchronous machines : standard specifications - output equation - choice of specific loadings - design of salient pole machines - short circuit ratio - length of air gap - armature design - design of rotor - design of damper winding - design of turbo alternator

TEXT BOOKS

1. **Sawhney A.K.** “A course in Electrical Machine Design”, Dhanpat rai & Co,2007.
2. **Agarwal R.K.**, “Principles of Electrical Machine Design” Kataria. S. K & Sons,1997.

REFERENCE BOOKS

1. **Clayton & Hancock** “The Performance and design of DC machines”Oxford and IBH publishing Co, 1988.
2. **Say. M.G.** “The Performance and design of AC machines ,ELBS,1974.
3. **Shanmugasundram .A , Gangadhar .G & Palani R.** “Electrical Machine Design Data Book” Wiley Estern Ltd.,New Delhi;1979.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the various factors which influence the design of electrical machines and select proper material for the design.
2. Analyze the performance of a DC machine with changing parameters and constraints.
3. Design a transformer and estimate its performance characteristics.

4. Relate the output power of an induction motor with its main dimensions and design squirrel cage and slip ring induction motors.
5. Obtain the optimal design of a synchronous machine as per the requirements and the constraints specified.

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

EEEP 607 LINEAR AND DIGITAL IC LAB**AIM**

To impart to the students to gain sound knowledge and practical skill in linear and digital IC's.

OBJECTIVES

To enable the students to gain practical knowledge about the various Linear and digital IC's and their applications.

Course Outcomes

At the end of this course, the students will be able to

- 1) Understand the functional characteristics of linear ICs as rectifiers, converters and amplifiers.
- 2) Acquire the operating theory of combinational and sequential circuits.
- 3) Explore the use of digital logic in integrated circuit applications.
- 4) Understand the functional characteristics OP Amps.
- 5) Apprehend the knowledge about counters.

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

EEEP 608 POWER ELECTRONICS AND DRIVES LAB

AIM

To impart to the students to gain sound knowledge and practical skill in power electronics and drives.

OBJECTIVES

To enable the students to gain practical knowledge about applications of various Power Electronic devices on various machines.

Couse Outcomes

At the end of this course, the students will demonstrate the ability to

1. Develop schemes for generation of firing pulses suitable for the power switches in converter circuits.
2. Formulate procedures for testing the operation of power converters.
3. Evaluate the performance of power converter circuits.
4. Experience the platform for simulation of power electronic circuits.
5. Acquire knowledge on characteristics of switching devices

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

EEEP 609 CONTROL SYSTEMS LAB

AIM

To impart to the students to gain sound knowledge and practical skill in control systems.

OBJECTIVES

To enable the students to gain practical knowledge about the various control System concepts, performance characteristics of different types of controllers in various applications.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the methods involved in the position and speed control of DC machines.
2. Calibrate and Investigate the importance of PID Controllers for analog and temperature control systems.
3. Design and develop various Compensation Schemes for a given plant.
4. Acquire knowledge about the impact of step and continuous command on the Stepper Motor for various modes.
5. Investigate the output performance of the linear and nonlinear analog and digital control systems.

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

SEVENTH SEMESTER**EEEC 701 PROTECTION SWITCHGEAR AND UTILISATION****AIM**

This course enables the students to gain the in-depth knowledge about the power system protection and utilization of Electrical Energy.

OBJECTIVES

The students are expected to gather knowledge about types of relays and circuit breakers applied to the electrical equipments, and also they become familiar about economic utilization of electrical energy.

UNIT I: PROTECTIVE RELAYS

Functional characteristics of a protective relay - operating principles of relays - over current relays - instantaneous and time over current relays – Inverse Definite Minimum Time (IDMT) characteristics - over current relay - Directional over current relay - universal torque equation - performance characteristics of distance relays - Static differential and directional relays - Static under frequency and over frequency relays - translay scheme - HRC fuses for relays.

UNIT II: CIRCUIT BREAKERS

Arc in oil - Arc interruption - Current chopping - Bulk oil and minimum oil circuit breaker - Air circuit breakers - Air blast circuit breakers - Vacuum circuit breakers- SF6 circuit breakers -Rating of circuit breakers - Testing of circuit breakers - Auto reclosure - HVDC circuit breakers - Energy consideration in breaking HVDC system - commutating principle - control of di/dt and dv/dt - surge suppression - main circuit breakers for HVDC switching.

UNIT III: PROTECTION

Feeder protection - distance protection - alternator protection - short circuit protection of stator windings by percentage differential relays - protection against turn to turn faults in stator winding - field ground fault protection - protection of stator windings by overvoltage relays - protection against stator open circuits- loss of synchronism - loss

of excitation - rotor overheating - protection of transformers – Digital Protection Schemes.

UNIT IV: ILLUMINATION

Visible region of the spectrum - laws of illumination - polar curves of different types of sources - determination of MHCP and MSCP - Design of lighting schemes for factories, auditoriums, offices, hospitals and residences - incandescent lamps - Gaseous and discharge lamps - sodium vapor lamp - mercury vapor lamp - Arc lamps - Electric luminescence - street lighting.

UNIT V: ELECTRIC HEATING AND WELDING

Advantage of electric heating - methods - Dielectric heating - induction heating - High frequency eddy current heating - Efficiency and losses - choice of frequency - Heating of buildings Resistance ovens - Induction furnaces - Types of melting furnaces - Arc furnaces. Electric arc welding - comparison between D.C and A.C welding - submerged arc welding - Gas shielded arc welding - atomic hydrogen arc welding - resistance welding - types - control of welding time.

TEXT BOOKS

1. **Sunil S Rao** “Protection and switchgear” Kahanna Publishers - NewDelhi 2006.
2. **Patra S.P,Basu. S.K, Choudhuri.S.,** “Power System Protection”, Oxford & IBM Publishing Co., New Delhi: 1983.
3. **Madhava Rao. T.S,** “Power System Protection - Static Relays with Microprocessor Applications”, Tata McGraw Hill Publishing Co., New Delhi, 2007.

REFERENCE BOOKS

1. **Rabindaranath B, Chander M,** “Protective Relaying”, New age International, 1997
2. **Open show Taylor wheeler & Co,** “Utilisation of Electrical Energy”, 1991.
3. **Wadhwa C.L.,** “Utilisation of Electrical Energy”, Wiley Eastem , New Delhi,1997.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

- 1) Acquire knowledge and understand the principle of operations of various protective relaying schemes
- 2) Study and understand the operation and testing of circuit breakers
- 3) Gain Knowledge about the various protection schemes for power system components.
- 4) Design energy efficient lighting schemes in various applications
- 5) Learn about the various methods of Electric heating and welding

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

EEEC 702 POWER SYSTEM ANALYSIS**AIM**

The course enables the students to gain an in-depth knowledge about the power flow solutions, balanced and unbalanced fault analysis of an interconnected power systems.

OBJECTIVES

At the end of the course the students will gain a very strong knowledge in the following aspects

- (i) Symmetrical components, sequence networks, phase shift in various transformer connections.
- (ii) Graph theory, and optimal ordering techniques
- (iii) Various methods in load flow analysis and short circuit studies.

UNIT I INTRODUCTION

Representation of power system components : Single phase solution of balanced three phase networks - One line diagram - Impedance or reactance diagram - Per unit system - Per unit impedance diagram - Complex power - representation of loads.

Review of symmetrical components - Transformation of voltage, current and impedance (conventional and power invariant transformations) - Phase shift in star-delta transformers - Sequence impedance of transmission lines - Sequence impedance and sequence network of power system components (synchronous machines, loads and transformer banks) - Construction of sequence networks of a power system.

UNIT II BUS IMPEDANCE AND ADMITTANCE MATRIX

Development of network matrix from graph theory - Primitive impedance and admittance matrices - Bus admittance and bus impedance matrices - Properties - Formation of bus admittance matrix by inspection and analytical methods.

Bus impedance matrix - Properties - Formation using building algorithm - addition of branch, link - removal of link, radial line - Parameter changes.

UNIT III POWER FLOW ANALYSIS

Sparsity - Different methods of storing sparse matrices - Triangular factorization of a sparse matrix and solution using the factors - Optimal ordering - Three typical schemes for optimal ordering - Implementation of the second method of Tinney and Walker.

Power flow analysis - Bus classification - Development of power flow model - Power flow problem - Solution using Gauss Seidel method and Newton Raphson method - Application of sparsity based programming in Newton Raphson method - Comparison of both methods - Fast decoupled load flow.

UNIT IV FAULT ANALYSIS

Short circuit of a synchronous machine on no load and on load - Algorithm for symmetrical short circuit studies - Unsymmetrical fault analysis - Single line to ground fault, line to line fault, double line to ground fault (without fault impedances) using sequence bus impedance matrices - Phase shift due to star-delta transformers - Current limiting reactors - Fault computations for selection of circuitbreakers.

UNIT V : SHORT CIRCUIT STUDIES

Phase and sequence admittance matrix representation for three phase, single line to ground, line to line, and double line to ground faults (through fault impedances) - Computation of currents and voltages under faulted condition using phase and sequence fault admittance models - Sparsity based short circuit studies using factors of bus admittance matrix.

TEXT BOOKS

1. **Nagrath. I.J, Kothari. D.P** “Power System Engineering” TMH, New Delhi; 2007.
2. **Pai . M.A.** “Computer Techniques in Power System Analysis” TMH : 2007.

REFERENCE BOOKS

1. **Wadhwa. C.L.** “Electric Power Systems” Wiley Eastern; 2007.
2. **Stagg and El-Abiad** “Computer Methods in Power System Analysis” Mc Graw-Hill International; 1968.
3. **Stevenson W.D.** “Element of Power System Analysis” Mc Graw-Hill; 1975.
4. **Ashfaq Husain** “Electrical Power Systems” CBS Publishers & Distributors; 1992.

5. **Gupta. B.R.** “Power System Analysis and Design , Third edition “, A. H. Wheeler and Co Ltd.. New Delhi 1998

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand and analyze the fundamentals of power system.
2. Form power system matrices.
3. Model various power system components.
4. Apply load flow analysis to an electrical power network and interpret the results of the analysis.
5. Analyze a network under symmetrical and unsymmetrical fault conditions and interpret the results.

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

EEEC 703 COMMUNICATION ENGINEERING**AIM**

To impart to the students the essential knowledge in the area of latest communication system.

OBJECTIVES

To give an exposure of Analog Modulation and Digital Modulation techniques and give an overview about latest communication systems like satellite communication, Broadband communication, Microwave and optical communication systems and computer communication.

UNIT I MODULATION

Need for modulation - Amplitude modulation - Power spectrum - Power relation - Different types of modulation - DSB/SC, SSB and VSB generation. AM transmitters - Block diagram - Amplitude demodulation - Detection of DSB, SSB signals - Automatic volume control - Receiver characteristics - Superheterodyne reception - Tracking, alignment and tuning of receivers.

UNIT II ANGLE MODULATION

Principle of frequency and phase modulation - Generation of FM and PM signals - Direct and indirect methods - FM transmitters - Block diagram - Preemphasis circuit. Frequency demodulation - Detection of FM and PM signals - Automatic frequency control - Receiver characteristics - Deemphasis circuit.

UNIT III PULSE MODULATION

Analog and digital communication systems and techniques: Pulse modulation systems - Sampling theorem - Pulse amplitude modulation - Channel bandwidth - Detection of PAM signals - Cross talk in PAM signals - Pulse time modulation - Generation of PDM and PPM - Conversion of PDM to PPM - Detection of PTM signals - Cross talk in PTM signals.

UNIT IV PCM SYSTEMS

Quantization - Compounding - Pulse code modulation - Sampling and digitizing - Aliasing - Sample and hold circuit - Practical implementation of

sampling and digitizing - Equalization - Multiplexing - FDM and TDM - Data communications - Transmission lines and digital signals - Frequency component of pulse wave forms - Practical line interface circuits, capabilities - Serial synchronous, asynchronous communication protocol - Hardware USARTS - INTEL 8251A - Software USART.

UNIT V : BROADBAND COMMUNICATION SYSTEMS - (BLOCK DIAGRAM APPROACH)

Facsimile system - Telephone system - Cross bar - Electronic exchange - Television system - Microwave communication and Optical communication systems - Principle of satellite communication - Computer communication - Electronic mail.

TEXT BOOKS

1. **Taub H. and Schilling D.L.** "Principle of Communication" Mc Graw- Hill; 1989.
2. **Paul Bates** "Practical Digital and Data Communications" Prentice Hall; 1987.

REFERENCE BOOK

1. **Simon Haykin** "Communication Systems" John Wiley; 1995.
2. **Wayne Tomasi** "Advanced Electronic Communication Systems" Prentice Hall; 1987.
3. **Bruce Carlson** "Communication Systems" Mc Graw-Hill; 1985.
4. **Dennis Roddy & John Coolen** "Electronic Communications" PHI; 1995.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Provide idea about modulation and demodulation techniques employed in communication systems.
2. Understand the angle modulation technique in communication system
3. Understand the pulse modulation technique and its conversion
4. Explain the concepts of pulse modulation systems and multiple access techniques used in communication field applications.
5. Understand the various broadband communication systems and recent advancements in communication systems.

Mapping 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		
CO2	3	1	2			2						3	2		
CO3	3	2	2			2						3	3		
CO4	3	2	1			1						2	3	2	
CO5	3	1	2			2						3		2	

EEEP 707 EMBEDDED SYSTEMS LAB

AIM

To impart to the students to gain sound knowledge and practical skill in embedded systems.

Objectives:

- To understand the operation of programmable controllers practically .
- To have a sound knowledge about different applications of microcontrollers.
- To familiarize the students with the functioning of ARM7 processing system.
- To illustrate the various capabilities of 89C51 and PIC16F877 microcontrollers practically.
- To expose the students to the programming techniques available.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Understand the architecture and operations of MICROCHIP microcontrollers.
2. Write programs in Embedded C for performing specific tasks.
3. Validate the theoretical concepts by performing experiments in practical sessions.
4. Distinguish between the various categories of programmable devices.
5. Acquire knowledge about different interfacing capabilities of 89C51, PIC and ARM7.

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

EEEP 708 ELECTRICAL ESTIMATION LAB**AIM**

To impart to the students to gain sound knowledge and practical skill in electrical estimation.

OBJECTIVES

To develop the knowledge in the field of electrical wiring, estimation and to study various equipments used in electrical engineering.

COURSE OUTCOMES

At the end of this course, the students will demonstrate the ability to

1. Understand the principles of estimation and different types of wiring systems
2. Design the wiring layouts of Pump room and industry.
3. Design and obtain the estimate for a residential wiring layout.
4. Familiarise with a substation layout
5. Understand the concept of office lighting

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

EEEP 709 CADD LAB

AIM

To impart to the students to gain sound knowledge and practical skill in CADD.

OBJECTIVES

To motivate the students in the field of computer aided drawing and drafting for developing electrical equipments.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Understand basic tools of CADD.
2. Estimate of the materials required for wiring different premises.
3. Draw various electrical components.
4. Acquire knowledge on designing wiring systems.
5. Understand the design of lighting schemes.

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

EIGHT SEMESTER**EEEC 801 ETHICS IN ENGINEERING****AIM**

To impart an indepth knowledge about the engineering ethics.

OBJECTIVES

To understand the Ethical Implications of Engineers work, to understand the moral problems, engineers face in the corporate sector, to provide the conceptual tools necessary for performing moral in surrounding engineering practice.

UNIT I INTRODUCTION TO ENGINEERING. ETHICS

Senses of "Engineering Ethics" Variety of Moral issues – Three Types of Inquity - Engineering Ethics and Philosophy.

Need for Engineering Ethics - Moral Dilemmas – Moral Autonomy. Kohlber's Theory - Gilligan's Theory – Concensus and Controversy.

Professions and Professionalism - Professions – Membership Criteria – Persuasive Definitions – Multiple Motives.

Model Reasoning and Ethical Theories –Theories about Virtues - Professional Responsibility - Integrity –Self respect - Senses of "Responsibility"

Theories about Right Action - Utilitarianism - Duty Ethics - Rights Ethics - Testing Ethical Theories.

Self-interest, Customs and Religion – Self Interest and Ethical Egosim -Customs and Ethical Relativism - Religion and divine command Ethics - User of Ethical theories - Resolving Moral dilemmans - Justifying Moral obligations-Relating professional and ordinary Morality.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation- Similarities to Standard Experiments-Learning from the past - Contracts with Standard Experiments - Knowledge Gained.

Engineering as Responsible Experience - Conscientiousness Relevant Information - Moral Autonomy - Accountability.

The challenger Case - Safety issues.

Codes of Ethics - Roles of Codes - Codes and the Experimental Nature of Engineering - Limitations of codes.

A balanced outlook on law - A regulated Society –The trend toward Greater Detail - Industrial Standards -- Problems with the Law in Engineering - The proper Role of law in Engineering. .

Safety and Risk - The concept of Safety - Risks – Acceptability of Risk - Lessons for the Engineers.

Assessment of Safety and Risk - knowledge of risk - Uncertainties in Design - Testing for Safety - When testing is inappropriate.

Risk - Benefit analyses and reducing risk – Personal Risk - Public risk and public acceptance – accounting publicity for benefits and risks - incentives to reduce risk – some example of improved safety - liability.

Three Mile island Chernobyl and safe exits – Three Mile Island - Prior warnings Chernobyl -Three Mile Island, Chernobyl, and a Foreunner - Safe Exit.

UNIT III RESPONSIBILITIES TO EMPLOYERS

Collegiality and Loyalty - Collegiality – Two Senses of Loyalty – Obligations of Loyalty - Misguided Loyalty - Professionalism and Loyalty.

Respect for Authority - Institutional Authority – Morally Justified authority - Accepting Authority – Paramount Obligations.

Collective Bargaining - Historical Note – Faithful Agent Argument - Public Service Argument - Conclusion.

Confidentiality - Definition - Justification and Limits - Changing jobs - Management policies.

Conflicts of Interest - Impairment of Judgment and Service - Gifts and Bribes - Interest in Other Companies –Insider information - Moral Status.

Occupational Crime - Industrial Espionage - Price Fixing –Endangering lives.

UNIT IV ISSUES OF PROFESSIONAL RIGHTS

Basic Right of Professional Conscience - Institutional Recognition of Rights - Specific Rights.

Recognition and Conscientious Refusal - Foundation of Professional rights.

Whistle - Blowing - Definition - Three cases – Moral Guide lines – protecting whistle - Blowers – Commonsense Procedures - The right to Whistle – Blow - Beyond Whistle - Blowing.

The Bart Case - background - responsibility and Experimentation – Controversy - Aftermath - Comments.

Employee Rights- Employee Bill of Rights – Choice of outside Activities – Privacy - Drug testing - Due process.

Discrimination - Examples - Definitions – Antidiscrimination laws - Moral. Justification of Nondiscrimination laws – preferential Treatment --Sexual Harassment.

Multinational Corporations Three Senses of "Relative values " When in Rome" - International Rights –Promoting

Morally Just Measures - Technology Transfer and Appropriate Technology - Bhopal.

Environmental Ethics - Case Studies – The Commons and Livable Environmental - Guilty until proven Innocent - Internalizing cost of environmental Degradation - Technology Assessment - Philosophical view of Nature.

Computer Ethics - Power Relationships – Property -- Privacy - Professional Issues.

Weapons Development - The Weapons Seesaw - the Engineer's Involvement in Weapons Work-Defense Industry Problems - Decommissioning weapons and lasting Effects.

UNIT V ENGINEERS AS MANAGERS

Consultants and Leaders - Engineers as Managers - Managers as professional Promoting and Ethical Climate - Managing Conflict.

Consulting Engineers - Advertising – Competitive Bidding - Contingency fees - Safety and Client needs – Provision for Resolutions of Disputes.

Engineers as Expert witness and Advisers – Experts Witnesses in the courts - Abuses - Advisers in Planning and policy making - Normative Models of Advisers.

Moral leadership - Morally - Creative Leaders – Participation in Professional Societies Leadership in Communities -Ideals of Voluntary Service

Concluding Remarks - Intenuity -Citicorp Skyscraper.

TEXT BOOK

1. **Mike W.Martin Roland Schinzinger**, "Ethics in Engineering - Third Edition" Tata McGraw -Hill Publishing Company Ltd, New Delhi, 2003.

COURSE OUTCOMES

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

1. Understand and build the relationship between the Engineer and the Society
2. Describe the importance of Developing ethical codes in engineering practice.
3. Develop the knowledge on the legal, moral and ethical aspects in Engineering.
4. Construct the moral and ethical dimensions in engineering.
5. Improve the Knowledge about Multinational Corporation.

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

EEEEC 802 COMPUTER AIDED POWER SYSTEM ANALYSIS**AIM**

To impart a sound knowledge to the students regarding the mathematical modeling Of power system analysis and the simulation techniques used in power system.

OBJECTIVES

At the end of course the students are expected to have a wide knowledge in,

- i) Economic load dispatch of power systems.
- ii) Load frequency control.
- iii) Steady state and transient stability of power systems.
- iv) Power system reliability
- V) State estimation and security analysis.

UNIT I ECONOMIC LOAD DISPATCH

System constraints - Economic dispatch neglecting losses - Optimum load dispatch including transmission losses - Exact transmission loss formula - Modified co-ordination equations - Automatic load dispatch.

Optimal system operation – optimal unit commitment dispatch – restructured systems - economic issues and mechanisms in a deregulated market.

Load frequency control - Load frequency problem - Speed governing system - P-F and Q-V control loops - Control of single area and two area cases.

UNIT II POWER SYSTEM STABILITY

Steady state, transient and dynamic stability - Power angle curve and swing equation of single machine connected to infinite bus - Equal area criterion - Critical clearing angle - Two finite machines - Numerical solution of swing equation of single-machine system by Kimbark's point by point method - Factors affecting transient stability - The role of automatic voltage regulator in improving stability - Effect of grounding on stability - Prevention of steady state pull-out.

UNIT III MULTI MACHINE STABILITY

Formation of multimachine transient stability problem - Swing equation - solution techniques, flow charts and algorithms for direct method and alternate cycle

method using modified Euler, Fourth order Runge Kutta and trapezoidal rule numerical procedures. Concept of coherency and coherent groups.

UNIT IV POWER SYSTEM RELIABILITY

General reliability function - the exponential distribution meantime to failure - series and parallel systems - markov processes - continuous markov processes - recursive techniques - Probability array for two systems - loss of load approach - load forecast uncertainty - interconnection benefits.

UNIT V STATE ESTIMATION AND SECURITY ANALYSIS

Principles of power system state estimation from redundant data - Algorithm for WLS state estimation (without proof) - Problems using d.c. model.

Security analysis by simulation of line and generator outages - line outage distribution factors and generation shift factors for d.c. model of power systems (without derivation) - Evaluation of overloads by outage simulation using these factors.

TEXT BOOKS

1. **Nagrath I.J., Kothari D.P** “Power System Engineering” TMH, Delhi; 2007.
2. **Wood and Wollenberg** “Power System Generation, Operation and Control”, John Wiley and Sons; 2006.

REFERENCE BOOKS

1. **Wadhwa C.L.** “Electrical Power Systems”, Wiley Eastern; 2007.
2. **Elgerd O.I** “Electric Energy Systems Theory - An Introduction” TMH; 2006.
3. **Murty PSR** “Power System Operation and Control”, TMH;1984.
4. **Loe Lei Lai** “ Power System Restructuring and Deregulation “ John Wiley and sons March 2001
5. **Roy Billington** “Power System Reliability Evaluation” Gordon and Breach Science Publishers, New York,1970.

Course Outcomes

At the end of the course, the students will be able to

- 1) Understand the economic operation of power system operation.
- 2) Acquire the Skills to develop the policies for optimal load flow using various methodologies.
- 3) Acquaint with the expertise to design Unit Commitment under various strategies.
- 4) Gain knowledge in load-frequency control and in designing various types of Controllers.
- 5) Analyse the transient stability conditions for power system using various techniques.

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

EEEC 803 QUANTITATIVE MANAGEMENT TECHNIQUES**AIM**

The course enables the students to gain in-depth knowledge about the optimization techniques applied to the operation research.

OBJECTIVE

The students are expected to acquire knowledge about resource allocation, evolve inventory control strategies and develop planning tools and methodologies.

UNIT I: INTRODUCTION

Development of scientific management - Application of operations research – Classification of operation Research(OR)models – Procedures to obtain optimum solution – Scope of OR - Management information systems (MIS)- Classification of MIS - Cost volume and profit(CVP)analysis - Relationships - Various approaches – Limitation of CVP analysis.

UNIT II: PROBABILITY ANALYSIS

Decision making: Analysis for decision making - Cautions about use of decision making under uncertain future conditions - Review of probability techniques and applications - Calculation of conditional and expected profits - Expected value with perfect information -Use of marginal analysis - Utility as a decision criterion. Probability distributions -Normal distribution and cost, volume, profit analysis - Unit monetary values with probability distribution - Decision tree analysis.

UNIT III: INVENTORY AND PRODUCTION MODELS

Inventory decisions - Selective approach to management inventory - EOQ - Different models - Application of EOQ to production process. Reordering - Determination of optimum level - Optimal level of safety stock - Joint ordering - Reordering with planned stockouts - discounts.

UNIT IV: LINEAR PROGRAMMING

Introduction - Simplex method - Maximisation and minimisation - Duality in linear programming - Sensitivity analysis - Transportation method - Unbalanced problem - Degeneracy - Assignment method - Applications.

UNIT V: CPM - PERT ANALYSIS

Introduction - Definition of PERT - Network replanning and adjustment - CPM - Time estimate - Crashing - Indirect and utility project costs - PERT cost analysis - Project budgeting - Control of project cost - Network scheduling - Maximal flow problem – Limitation of PERT and CPM.

TEXT BOOK

1. **Levin and Kirkpatrick** “Quantitative Approaches to Management”, Mcgraw Hill Int.St.Ed., 2002.

REFERENCE BOOKS

1. **Samir Kumar Chakravorthy**, “Theory and problems on Quantitative Techniques, Management Information system and Data processing” Central Educational Enterprises, 1989 (First Edition)
2. **Chidambaram, I.A., Sridhar. N.D. and Paramasivam. B.**, “Quantitative Management Techniques”, Sci Tech Publications 2009.
3. **Sundaresan V., Ganapathy Subramanian K.S., Ganesan K.** “Resource Management Techniques (Operation Research)” A.R.Publications:1999.
4. **Gupta P.K, Manmohan**, “Problems in Quantitative Techniques”, Sultan Chand & Sons, 2nd Edition, 1990.

Course Outcomes

On completion of this course the students will be able to

1. Understand the principle and tools of operation research
2. Solve Decision making Problems
3. Solve various inventory problems
4. Solve Linear Programming Problems, Transportation and Assignment Problems
5. Understand the usage of CPM and PERT

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

EEEEC 804 POWER PLANT ENGINEERING**AIM**

To impart an indepth knowledge in the field of high voltage transmission system.

OBJECTIVES

At the end of course, student are expected to have the wide knowledge in

- (i) Conventional & non - conventional Sources of energy for power generation
- (ii) Principle and operation of hydro, thermal and Nuclear power plants. Also to impart a knowledge in deciding of location, type and capacity of power plants at the economic point of view.

UNIT I INTRODUCTION

Historical background - power development and growth of power industry in India - sources of energy - conventional sources of energy - hydro - steam and nuclear energy - non - conventional sources of energy - solar energy - windenergy - ocean energy - geo thermal energy - energy from waste - magneto hydro dynamic (MHD) generation - sources of energy in India.

UNIT II HYDRO - ELECTRIC PLANT

Water power - applications of hydro power plant - essential feature of elements of hydro - electric power plant - selection of site for a Dam - the power house and equipment - layout of hydro power plant - classification of hydro - electric power plants - advantages of hydro - electric power plant - mini and micro hydro power plants - draft tube - surge tanks - safety measures in hydro power station - hydraulic turbines - choice of turbines - comparison of pelton wheel and francis turbines - turbine governing - performance of water turbine - site selection - comparison of hydro electric power plant and steam power plant - cost of hydro power - hydro steam interconnected steam - cost of hydro electric power plant - hydrograph - mass curve - run of estimation - controls in hydro electric plants - hydro power plants in India - preventive maintenance of hydro electric power plant - hydro thermal mix.

UNIT III STEAM POWER PLANT

Essentials of steam power plant equipment - power station design - characteristics of steam power plant - coal handling - methods of fuel mixing - automatic boiler control - pulverised coal - ball mill - pulverised coal mixing - pulverised coal burners - ash disposal - smoke and dust removal - types of dust collections - draught - comparison of forced and induced draughts - chimney - methods of burning fuel oil - slag removal - economiser and air preheater - super heater - advantages of super - heated steam - super - heat control - feedwater treatment - feedwater heater - steam condensers - types of steam condensers - condenser cooling water supply - maintenance of cooling towers - condenser efficiency - selection of condenser - steam separator - steam trap - steam turbines - steam turbine - governing - steam turbine performance - steam turbine generators - boilers - type of boilers - boiler mountings and accessories - boiler performance - boiler maintenance - high pressure boilers - advantages of high pressure boilers - modern trends in generating steam - gas fixed boilers - piping system - materials for pipes - valves - principle of steam power plant design - factors affecting steam plant design - site selection - controls of steam power plant - industrial steam turbines - cost of steam power plant - plant layout - modern steam power station - thermal power stations in India - super thermal power stations - thermal power plants environmental control.

UNIT IV NUCLEAR POWER PLANT

Introduction - Radioactive isotopes - Nuclear reaction - Fusion reaction - Nuclear fission. Nuclear reactors - Types - Homogeneous and heterogeneous reactors - Fast breeder reactor - Gas cooled graphite moderated reactor - Ordinary and heavy water reactor - Radiation shielding - Neutron shielding - Effect of radiation.

Reaction materials - fuel materials - Moderators and coolants - Shielding material - Reactor control - Temperature and barometric effects - Control rods - Start up and shut down of reactor - Nuclear, heat electric power cycle.

UNIT V POWER PLANT ECONOMICS

Comparison and selection of thermal power plants - Load curves and plant location
- Effects of variable load on power plant design and operation - Selection of prime movers - Comparison and selection of different types of power plants - Diesel, gas turbine, steam and nuclear plants.

Economics - Capital - Interest - Depreciation - Choice of plants - System of tariffs
- The need for different tariffs and basis.

TEXT BOOKS

1. **Nagpal G.R.** “Power Plant Engineering”, Khanna Publishers : 2007.
2. **Singhai D.K.** “Fundamentals of Nuclear Power Engineering” Khanna Publishers : 2007.

REFERENCE BOOKS

1. **Uppal S.L.** “Electrical Power”, Khanna Publishers : 2007.
2. **Arora S.C. and Domakundwar S.** “A Course in power plant engineering” Thanpat Rai & Co (P)Ltd., Delhi: 2005.

Course Outcomes

At the end of this course, the students will be able to

1. Acquire knowledge about various types of renewable and non-renewable energy sources.
2. Compare the performance of different turbines in a Hydro-electric plant.
3. Familiarize with the various components of a steam power plant and the factors affecting steam plant design.
4. Understand the concepts of various types of nuclear power plants and their operation and maintenance.
5. Exhibit wide knowledge on the subject of power plant economics.

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

**EEEP 807 ADVANCED PROCESSOR BASED SYSTEM DESIGN AND
COMPUTATION LAB**

AIM

To impart to the students to gain sound knowledge and practical skill in microcontroller and computation.

OBJECTIVES

To enable the students to gain practical knowledge about various micro controllers and their applications and provide training in various computation exercises on PC using C++.

Course Outcomes

At the end of this course the students will be able to

1. Understand the hardware and programming concepts.
2. Familiarise with the programming concepts
3. Acquire knowledge in controlling the programmable device using PC.
4. Develop skills to analyze the problem
5. Inscribe suitable programs for a problem.

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

EEEV 808 PROJECT WORK AND VIVA-VOCE

AIM

To impart to the students to gain overall knowledge and experience in planning and executing the project work and also to prepare the report.

OBJECTIVES

To bring out the practical knowledge in the area of Electrical, Electronics, computer and other allied courses by implementing the various ideas of their own.

Course Outcomes

At the end of this course the students will be able to

- 1) Identify the problem by applying acquired knowledge
- 2) Analyze and Select a suitable problem with an attention to real life problems faced by the society.
- 3) Find solution either through simulation or through practical work.
- 4) Combine all the modules through effective team work after efficient testing.
- 5) Elaborate the completed task and compile the project report

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

LIST OF ELECTIVES

- 1) Biomedical Electronics and Instrumentation
- 2) Static Relays
- 3) Personal Computer Systems
- 4) Highvoltage Transmission Systems
- 5) Nonlinear Systems
- 6) Artificial Intelligence and Expert Systems
- 7) Digital Signal Processing
- 8) Fibre Optics and Laser Instrumentation
- 9) Robotics And Automation
- 10) Soft Computing Techniques
- 11) Wireless Network Communication
- 12) Satellite Communications Systems
- 13) Internet and Java Programming
- 14) VLSI Design
- 15) Computer Communication
- 16) Embedded Networks

1. BIO MEDICAL ELECTRONICS AND INSTRUMENTATION**AIM**

The aim of this course is to understand thoroughly the students about the bio-medical instruments used to measure monitor the different parameter related the medical field.

OBJECTIVES

At the end of the course the students are expected to have knowledge in the following:

- (i) Electro physiology
- (ii) Instrumentation
- (iii) Bio - electrical potential and cardiovascular measurements
- (iv) Respiratory and pulmonary measurements
- (v) Recent trends in Bio medical instrumentation

UNIT I: ELECTROPHYSIOLOGY

Brief review of physiology and anatomy - Resting potential - Action potential - Propagation of action potentials - Bioelectric potentials -Cardiovascular dynamics - Electrode theory - Bipolar and unipolar electrodes - Surface electrodes - Physiological transducers - System approach to biological systems.

UNIT II: INSTRUMENTATION

Biopotential amplifiers - Instrumentation amplifier -Lowpass and notch filters - Linear phase digital filters - Sources of noise - Recorders - CRT displays - Computer based instrumentation - Telemetry - Safety of biomedical equipment.

UNIT III: BIOELECTRIC POTENTIAL AND CARDIOVASCULAR MEASUREMENTS

ECG - Phonocardiography - Vector cardiography - BP -Blood flow - Cardiac output - Plethysmography -Impedance cardiology - Cardiac arrhythmias - Pacemakers - Defibrillators - EEG - Evoked potential response - EMG - Foetal monitor.

UNIT IV: RESPIRATORY AND PULMONARY MEASUREMENTS AND REHABILITATION

Physiology of respiratory system - respiratory rate measurement - Temperature - Pulmonary function measurement - Oximeter - Hearing aids - Functional neuromuscular simulation - Physiotherapy - Diathermy -Nerve simulator/pain killer.

UNIT V: RECENT TRENDS

Medical imaging - LASER applications - Ultrasound scanner - Echo cardiography - CT scan - MRI/NMR -Central monitor - Cine angiograms - Colour doppler systems - Holter monitoring.

TEXT BOOKS

1. **Leslie Cromwell, Fred J.Weibell and Erich A.Pfeiffer** “Biomedical Instrumentation and Measurements”, Prentice Hall of India, New Delhi, 2006.
2. **Geddes L.A. and Baker L.E.** “Principles of Applied Biomedical Instrumentation” John Wiley : 1975.

REFERENCE BOOKS

1. **Richard Aston** “Principles of Biomedical Instrument and Measurement” Merrill Publishing Company, Columbus,1990.
2. **Kandpur R.S.** “Handbook of Biomedical Instrumentation” Tata McGraw Hill, New Delhi, 1987.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Explain the anatomy and physiology of various subsystems of human body.
2. Provide idea about different types of physiological transducers used in medical engineering which can be used to acquire biological signals from the human body
3. Obtain knowledge about acquiring biological signals and the safety features to be incorporated
4. Understand the principles of cardiovascular, respiratory and therapeutic assisting devices used in bio-medical field.
5. Describe the recent trends used in medical imaging.

Mapping with Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3						1						3		
C02	2	2				2							2	1	
C03	2	2											2	2	
C04	2		2										2	2	
C05						2							2	2	

2. STATIC RELAYS

AIM

This course enables the students to gain a vast knowledge about the power system protection with reference to the static relay.

OBJECTIVES

To impart knowledge on the following topics

- i) Basics of Static relays
- ii) Comparators
- (iii) Over current, differential, pilot wire relays and applications.

UNIT I COMPARATORS

Phase and amplitude comparators - Duality between them. Types - Direct and integrating, rectifier bridge, circulating current, opposed voltage coincident type phase comparator, direct or block spike phase comparator, phase splitting technique, integrating type phase comparator with transistor AND gate. Hybrid comparator - Hall effect type and magneto resistivity type, vector product type - Zener diode phase comparators - Multi-input comparators - Three input coincidence comparator/phase sequence detector.

UNIT II RELAYS

Basic principle of instantaneous and time overcurrent relays - Definite time and inverse time characteristics Principle and practical circuits for time overcurrent relay, direct overcurrent relay. Static directional relay - Directional overcurrent relay.

Performance characteristics of distance relays - Realisation of different characteristics using rectifier bridge amplitude comparator and transistorised phase comparator - Methods of achieving circular, quadrilateral and conic characteristics.

Static frequency relays – Under frequency and over frequency relays.

UNIT III DIFFERENTIAL RELAYS

Static differential relays - Basic principle - Operating characteristics, restraining characteristics - Types of differential relays - Analysis of static differential relays -Application of static differential relays

UNIT IV PROTECTION SCHEMES

Brief introduction to pilot wire and carrier current protective schemes - Digital protection techniques - Introduction - advantages – algorithms - microprocessor based protection schemes

UNIT V POWER SYSTEM APPARATUS PROTECTION

Transformer protection - Biased differential transformer protection, differential relay C.T.connection. Relay solutions to inrush current problem. Protection using harmonic restraint feature. Duo bias transformer protection -Generator protection - Stator protection, protection of rotor winding. Bus zone protection and motor protection.

TEXT BOOKS

1. **Madhava Rao. T.S** “Power System Protection - Static Relays with Microprocessor Applications”Tata McGraw Hill Publishing Co., New Delhi : 2007.
2. **Patra S.P,Basu. S.K, Choudhuri.S.** “Power System Protection” Oxford & IBM Publishing Co., New Delhi: 1983.

REFERENCE BOOKS

1. **Ram. B** “Microcomputers and Microprocessors”, Dhanpat Rai & Sons,New Delhi:2007
2. **Ravindranath. B, Chander. M** “Power System Protection and Switchgear” Wiley Eastern Ltd.: 1977.
3. **Sunil S.Rao** “Switchgear and Protection” Khanna Publishers, New Delhi : 2007.
4. **Badri Ram & Viswakarma** “Power System Protection and Switchgear” Tata McGraw - Hill:2006

Course Outcomes

At the end of this course, students will be able to

1. Understand the concept of comparators
2. Gain a vast knowledge about over current and distance relays
3. Acquire knowledge about operating principle, characteristics and applications of static frequency and differential relay.
4. Study the different types of digital protection system.
5. Know various power system apparatus protection systems.

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

3. PERSONAL COMPUTER SYSTEM**AIM**

The course enables the students to gain knowledge about the personal computer system and interfacing techniques.

OBJECTIVES

To make the students familiar in the following.

- System units
- Various types of Processors, adapters and operating systems in PC
- Networking

UNIT I SYSTEM UNITS

Parts of a PC - PC system units - system overview of Processors - Processor caches - Hardware section - Bus arbitration - Electrical characteristics of Bus- Overview of memory -Memory organisation - Memory management - Expanded memory - System memory map - I/O address map - Disk - Hard disk features and partitions - Detailed Disk structure - PC classifications - Assembler - Linker - Debugger.

UNIT II PC PROCESSORS

Pentium Processor - Signal differences between Pentium II,III, IV and Pentium Pro - MMX - Matrix math extensions - 32 bit code optimization - Multi-processor capability - Power conservation modes - TAP test access port - Pentium II,III chip set -Software characteristics of processors - Overview of Intel Pentium chipsets – Parallel computer model.

UNIT III ADAPTERS IN PC

BIOS and DOS interrupts - Key board adapter - Printer adapter - Monochrome , colour graphics adapter and VGA standards - Disk drive adapter - CD drive adapter - Asynchronous communication adapter - PC bus adapter cards - Analog and digital I/O cards- Modem card-Serial interface-Mouse interface-Multimedia Kit interface.

UNIT IV OPERATING SYSTEMS

Introduction to operating system - Personal computer systems - BIOS - DOS kernel - Command processor - Process scheduling - Algorithm evaluation - Primitive & non primitive task schedules - Memory management in operating systems - Swapping - Paging-segmentation - Frame allocation - File systems - File management - File services - Disk organisation - DOS booting process - Windows operating systems - Different versions - Device drivers for Windows-Architecture virtual machine-Virtual hardware-Virtual device drivers- Over view of Linux operating system.

UNIT V NETWORKING

Introduction – Types of Network – LAN, WAN, Wi - Fi Networking system – Architecture – Applications – Introduction to Internet protocol – Types of protocol – application – over view of WAP and its application.

TEXT BOOKS

1. **Tom shenlay** “Pentium pro and pentium II system Architecture - Second edition” ,Mind shere,Inc. - Addition - Wesley.
2. **William Stallings.**, "Computer organisation and architecture" Macmillan publishing Co., 1990.
3. **Mednic SE and Donavan.J.**, "Operating systems" Tata McGraw Hill, 1974.
4. **Yi-Bing Lin and Imrich chlantae.**, "Wireless and Mobile Network Architecture" John wiley, 2001

REFERENCE BOOKS

1. **Govindarajulu B.**, "IBM PC and clones - Hardware, Troubleshooting and Maintenance" Tata Mc.Graw Hill, 1992.
2. **Addison Wesley.**, "An introduction to operating systems”,1985.
3. **Arkady Grinberg.**, "Computer Telecom Integration, McGrawHill,1995.
4. **Bud Bates**, "Wireless Network Communication" McGraw Hill Series on Computer Communication, 1994
5. **Kanch Pallavan, Prahant krishnamoorthy.**, "Principles of Wireless Networks" Pearson Education Publication, 2001

Course Outcomes

At the end of this course, students will be able to

1. Understand the concept of different types of addressing modes & instruction sets.
2. Know about memory organization & different parts of PC.
3. Understand relationship between assembler-linker-debugger.
4. Understand the basic concept of booting & FAT.
5. Understand the principle of interfacing techniques.

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

4. HIGH VOLTAGE TRANSMISSION SYSTEM**AIM**

To impart an indepth knowledge in the field of high voltage transmission system.

OBJECTIVES

At the end of the course students would have an exposure about:

The need to have high voltage transmission systems,

Calculation of various line parameters,

Predetermination of the line performance using mathematical techniques.

Features of DC transmission systems.

Problems faced with high voltage transmission through EHV cables and protection of EHV systems.

UNIT I INTRODUCTION

EHVAC and HVDC transmission -Comparison between HVAC and HVDC overhead and underground transmission scheme - Standard transmission voltages - Factors concerning choice of HVAC and HVDC transmission - Block diagram of HVAC and HVDC transmission schemes.

UNIT II CORONA

Properties of bundled conductors - Inductance and capacitance of EHV line - Surface voltage gradient on single, double, and more than three conductor bundles - Corona effects - Power loss - Increase in radius of conductors - Charge voltage diagram - Qualitative study of corona pulses, their generation and properties.

UNIT III EHVAC TRANSMISSION

Problems of EHVAC transmission at power frequency - Generalised constants - Power circle diagram and its use - Voltage control using compensators - High phase order transmission.

UNIT IV DC TRANSMISSION

Review of rectification and inversion process -Constant current and constant extinction angle modes of operations - Analysis of DC transmission systems -Harmonics on AC and DC sides and filters for their suppression - Multiterminal DC

transmission systems -Parallel operation of AC and DC transmission - Modern developments in HVDC transmission/Introduction to FACTS.

UNIT V OVERVOLTAGE IN EHV SYSTEMS

Origin and types - Ferroresonance overvoltage - switching surges, reduction of switching surges on EHV systems. Introduction to EHV cable transmission, electrical characteristics of EHV cables, properties of cable insulation materials. EHV insulators - characteristics and pollution performance -Protection of HVAC and HVDC systems.

TEXT BOOKS

1. **Rakesh Das Begamudre** “EHV AC Transmission Engineering”, Wiley Eastern Limited : 2006.
2. **Kimbark E.W** “Direct Current Transmission Volume I”, Wley Interscience : 1971.

REFERENCE BOOKS

1. **Sunil S.Rao** “Switchgear and Protection” Khanna Publishers: 2007.
2. **Miller T.J.E.** “Reactive Power Control in Electric Systems” John Wiley and Sons, New York : 1980.
2. **Dubey. G.K, Doralda. S.R. Joshi. A, Sinha. R.M.K.** “Thyristorised Power Controllers”, Wiley Eastern Limited : 2006.
4. **Adamson .C & Hingorani. N.G** “HVDC Power Transmission”, Garroway Limited, England : 1960.
5. **Rao. S** “EHV_AC and HVDC Transmission & Distribution Engg.- 3rd edition”, Khanna Publication-2007.

Course Outcomes

At the end of the course, the students will be able to

1. Understand the factors governing the choice of HVAC and HVDC for overhead and underground transmission system.
2. Discuss about bundled conductors and corona loss.
3. Analyze the problem of EHVAC transmission at power frequency and compensation.
4. Acquire facts about the DC transmission system in case of harmonics and as well as multi-terminal DC transmission system.
5. Impart the knowledge of over voltage problems

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

5. NON LINEAR SYSTEMS**AIM**

The students enabled to gain a vast knowledge about various control system design methods ,Digital control system state space analysis ,optimal and nonlinear control systems.

OBJECTIVES

At the end of the course, students are familiar with

- (i)The design of suitable compensator for a given plant and a set of specifications.
- (ii)The analysis of sampled data control system, Multi-input Multi-output control system, Optimal Control system and Non-linear Control system.

UNIT I MATHEMATICAL DESCRIPTIONS OF SYSTEMS

Transfer function matrix - state space representation using physical, phase and canonical variables - comparison of input-output description and state-variable description - mathematical description of composite systems - Solution of dynamical equation - state transition matrix - - impulse response matrix-controllability and observability- linear independence of time functions – Canonical – form of dynamical equations for single-variable - controllability and observability

UNIT II STATE FEEDBACK

Effects of state feedback, pole placement and feedback gain matrix-State estimators: Full-dimensional state estimator - reduced dimensional state estimator connection of state feedback and state estimator -decoupling by state feedback.

UNIT III PHASE PLANE ANALYSIS

Singular points - construction of phase portraits using Isocline, Lienard, Delta and Pells method - limit cycle analysis – Poin care index and Bendixson's theorems - Closed loop trajectory - systems with non linear damping - effect of non - linearities on the step response of position control system.

UNIT IV DESCRIBING FUNCTION TECHNIQUES

Describing function. of non linearities - gain function and its determination for analytically and graphically defined nonlinearities - multiple nonlinearities – conditions for stability – stability of oscillation - accuracy of Describing function method - stability of systems with multiple non linearities – closed – loop frequency response - dual input describing function and its applications.

UNIT V STABILITY ANALYSIS

Stability in the sense of Liapunov - Liapunov's second method and Liapunov's theorems on stability and instability of non linear systems - Krasovkii's theorem – variable gradient method of generating Liapunov functions - Lure's problem - Popov's stability criterion.

TEXT BOOKS

1. **Katsuhiko Ogata**, “Modern Control Engineering”, Prentice Hall of India Pvt. Ltd., 1980.
2. **Gopal. M.**, “Modern Control System Theory”, Wiley Eastern Ltd., 1984.
3. **Gopal. M.**, Digital Control and state variables methods, Tata McGraw-Hill, 1997.”

REFERENCE BOOKS

1. **Houpis.C.H.**, “Digital Control System- theory Hardware and Software, Wiley Eastern Ltd 1999.
2. **Gibson, J.E.**, “Nonlinear Automatic Control”, McGraw Hill Book Co, 1963.
3. **Cunningham, W.J.**, “Introduction to Nonlinear Analysis” McGraw Hill, 1958.
4. **D Azzo J. and Houpis. C.H.**, “Linear Control System -Analysis & Design”, McGraw Hill, III edition, 1988.

Course Outcomes

At the end of the course, the students will be able to

1. Design of suitable compensator for a given plant and a set of specifications.
2. Analyse sampled data control system, Multi-input Multi-output control system.
3. Understand the concept of Optimal Control system
4. Acquire more knowledge on Non-linear Control system.

5. Analyse the stability system

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

6. ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**AIM**

To impart a sound knowledge in the field of artificial intelligence and expert systems.

OBJECTIVES

At the end of the course the students have knowledge on solving knowledge base related problems of any application by selecting proper representation if problem definition and choosing suitable method of AI based technique. They also given basic knowledge of expert system base representation and solving the advance problems using AI language PROLOG.

UNIT I INTRODUCTION TO AI

Definition of AI-AI problems-AI Techniques-Criteria for success-State space search-Production system-Problem characteristics-Production system characteristics-Heuristic search-Depth first search(DFS)-Breadth first search(CFS)-Hill climbing-Best first search-Staged search-A* Algorithm

UNIT II KNOWLEDGE REPRESENTATION AND RESOLUTION

Representation mapping-Approaches to knowledge representation - Logic representation-Computable function and predicates- Resolution-Basis of Resolution-Unification algorithm - Non monotonic reasoning - Statistical and Probabilistic reasoning.

UNIT III PLANNING, LEARNING AND APPLICATION PROCESSING

Overview of planning-Components of planning system- Introduction to learning-Learning with macro operators- Learning by parameter adjustment-Winston's learning program-Natural language processing-Syntax and semantic analysis-Semantic grammar-Syntax nets-Frames-Conceptual dependancy(CD)- Scripts-Discos and pragmatic processing.

UNIT IV PROGRAMMING LANGUAGE - PROLOG

Elements of prolog-Bound and free variables-Anonimous variable-Rules-Execution control-Concept of recursion-The repeat predicate and cut predicate. Input and Output in PROLOG-Structures and trees-Lists- Recursive search mapping-Recursive comparison

UNIT V INTRODUCTION TO EXPERT SYSTEM:(ES)

Components of an expert system-Features of ES-ES categories- Basic characteristics of an ES-Basic activities of an ES- Developing and using an ES. Choosing tools for building expert system-Evaluating the system building tools-Acquiring knowledge from experts-The knowledge acquisition process-An example of expert system building process.

TEXT BOOKS

1. **Elain Rich and Kevin Knight.**, "Artificial Intelligence" Tata Mc-Graw Hill 2006.
2. **Nilsson. N J**, "Principles of Artificial Intelligence" Tioga Publishing co., 1980
3. **Donald A.Waterman.** "A Guide to Expert System", International student edition-Addison wesley.

REFERENCE BOOKS

1. **Patrick Henry Winston.**, "Artificial Intelligence" Addison Wesley, 1984.
2. **Clocks W .F. and Mellish C.S.**, "Programming in Prolog", Narosa Publishing House, 1984.
3. **Stuart Russel and Peter Norrig.**, "Artificial Intelligence" A Modern approach" PHI 2006.
3. **Neil C.Rowe.** "Artificial Intelligence Through Prolog" PHI 1998.

Course outcomes

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

1. Understand basics of AI
2. Gain an insight on Knowledge representation and resolution
3. Discuss the Planning, learning and application processing
4. Develop the Programming language - prolog
5. Know the Introduction to expert system

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

7. DIGITAL SIGNAL PROCESSING**AIM**

To enable the students to acquire a knowledge about digital signal processing.

OBJECTIVES

The students are expected to gather knowledge about types of signals, design of filters and tools that serve to realize the response of digital systems.

UNIT I: DISCRETE TIME SIGNALS AND SYSTEMS

Discrete time signals – Properties – Standard test signals -- Operation on signals – Discrete time systems – Properties – Representation of LTI systems – Impulse response – Discrete time Fourier transform (DTFT) – Frequency response – Properties – Sampling analog signals – Shannon’s sampling theorem - Aliasing- Multirate sampling – Up sampler – Down sampler.

UNIT II: FAST FOURIER TRANSFORM (FFT) ALGORITHMS

Discrete Fourier Transform (DFT) – Properties – Circular convolution – Comparison between Linear convolution and Circular convolution – Filtering long duration sequences: Overlap-save method, Overlap-add method – Fast Fourier Transform (FFT): Decimation-in-time (DIT) algorithm – Decimation-in-frequency algorithm – FFT radix-2 DIT, DIF implementation — IDFT using Direct FFT Algorithm – Quantization noise introduced by analog-to-digital conversion – Finite register length effects in the realization of IIR and FIR digital filters and in DFT computation.

UNIT III: DIGITAL FILTER STRUCTURES

Definition of digital filters – Properties of digital filters – Impulse response of FIR and IIR filters – Frequency response of FIR and IIR filters – Linear phase FIR filters – Z-Transforms of FIR and IIR filters – Applications – Definition –Properties – ROC – Transfer function – Poles and Zeros – Z-Transforms and Frequency response relationships – Inverse Z-Transform – Realization of digital filters- direct form- Transposed form – Canonic – Cascade- Parallel and Ladder form.

UNIT IV: DESIGN OF DIGITAL FILTERS

FIR filters - Design criteria – Minimizing design criteria (Fourier design technique), Lengths of the filter- Windowing: window responses - Periodic convolution – Response of uniform window – Von Hann window – Hamming window – Kaiser window – FIR half-band digital filter – Linear phase FIR digital filters – Design of IIR filters: Analog filter approximation, Butterworth, Chebyshev and Elliptic filters – Frequency band transformation – Digital filter design equations low pass, high pass, band pass and band stop – Impulse Invariant technique for IIR filter – Impulse Invariant pole mapping – Bilinear transformation – Bilinear transformation pole mapping – Introduction to computer – aided design of IIR and FIR Digital Filters (Matlab Analysis).

UNIT V: DIGITAL SIGNAL PROCESSORS

Generic DSP Architecture – Architecture of TMS 320 F 2407 and TEXAS 5416 processor – memory and I/O Organization – CPU –Program control – Addressing modes – Assembly Language Instructions – On chip peripherals – Clock, watch dog and real time Interrupt, event manager units – Interface units – Simple Programs.

TEXT BOOKS

1. **Proakis J.G, Manolakis D.G**, “Digital Processing” Principles, Algorithms and Applications, Second Edition, Prentice Hall of India, 1995.
2. **Mitra S.K**, “Digital Signal Processing – A computer Based Approach, Second Edition”, Tata McGraw Hill, 2000.
3. **Toliyat A. Campbell**, “DSP based Electromechanic Motion Control”, CRC Publications, Texas, 2004.

REFERENCE BOOKS

1. **Oppenheim A.Vand Schaffer R.W**, "Digital Signal Processing", Prentice Hall 1987.
2. **Johnson J.R**, “Introduction to Digital Signal Processing” Prentice Hall of India, New Delhi, 1994.
3. **Simon Haykin, Barry Van Veen.**, “Signals & Systems”, John Wiley & Sons (ASIA) Private Limited, 1999.
4. **Venkatramani. B and Bhaskar.M**, “Digital Signal Processors”, TMH, 2002.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Represent signals mathematically in discrete-time.
2. Understand the Fast Fourier Transform algorithms.
3. Analyze discrete-time systems using z-transform.
4. Design digital filters for various applications.
5. Familiarize with the fundamentals of Digital signal processors.

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

8. FIBRE OPTICS AND LASER INSTRUMENTATION.**AIM**

To impart sound knowledge about the fundamentals of fibre optics and laser applications.

OBJECTIVES

With this course the students are given an exposure in fundamentals of fibre optics and relative instrumentation. They also have been taught on fundamentals of Laser and industrial applications of lasers and holography and biomedical application of laser.

UNIT I FUNDAMENTAL CHARACTERISTICS OF LASERS

Laser rate equation - Three level system - Four level system - properties of laser beams - Laser modes - Resonator configuration - Q - Switching and mode locking - Cavity dumping; simple frequency operation. Types of lasers - Gas lasers - Solid state laser - Liquid lasers - Semiconductor lasers.

UNIT II INDUSTRIAL APPLICATIONS OF LASER

Lasers for measurement of distance and length, velocity, acceleration, atmospheric effects, sonic boom, pollutants, current and voltage; Materials processing - Laser heating, melting, scribing, splicing, welding and trimming of materials - Removal and vapourisation - Calculation of power requirements of laser for material processing.

UNIT III THEORY AND CLASSIFICATION OF FIBRE OPTICS

Principles of light propagation through a fibre - Different types of fibres and their properties - Relative merits and demerits. Fibre optics production and components - Technology of preformed fabrication - Fibre drawing - Material consideration - Loss and bandwidth limiting mechanism - Mechanical and thermal characteristics - Fabrications of multicomponent glass fibres - Light sources for fibre optics - Photo detectors - Source coupling, splicing and connectors.

UNIT IV FIBRE OPTIC SENSORS

Fibre optics communication and instrument system - Advantage of optical communication - Different types of modulators - Detectors - Fibre optic communication set up - Application in instrumentation: Optical fibre sensors, Classification of sensor types; Pressure sensors; Electric and magnetic field sensors based on polarisation effects.

UNIT V HOLOGRAPHY

Basic principles; Methods; Holographic interferometry and applications - Holography for non - destructive testing - Holographic components. Medical applications of lasers: Lasers and tissue interaction - Laser instruments for surgery, removal of tumours of vocal cords, brain surgery, plastic surgery, dermatology, gynaecology and oncology.

TEXT BOOKS

1. **Allen H.C.**, "An Introduction of Optical Fibers" McGraw Hill International Book Co.,1993.
2. **Smith W.V. and Sorokin P.P.**, "The Laser" McGraw Hill Book Company, 1996.

REFERENCE BOOKS

1. **Allen L.**, "Essentials of Lasers" Oxford University Press, 1969.
2. **D.C.Oshea and W.Russel Callen.**, "Introduction to Lasers and Application" Addison Wesley,1978.
3. **Koebner H.**, "Industrial Application of Lasers" John Wiley, 1984.
4. **Cuxon J.T. and Parker D.E.**, "Industrial Laser and their Application" Prentice Hall, 1985.
5. **Smith H.M.**, "Principles of Holography" John Wiley & Sons, 1975.
6. **Culshaw B. and Dakin J.(Eds.)**, "Optical Fibre Sensors, Vol.1&2" Artech House, 1989.
7. **Ghatak A.K.**, "Optics" Tata McGraw Hill Book Company.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand the Fundamental characteristics of lasers
2. Gain vast knowledge on Industrial applications of laser
3. Discuss the Theory and classification of fibre optics
4. Acquire the knowledge on Fibre optic sensors
5. Describe the concept of Holography and its application.

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

9. ROBOTICS AND AUTOMATION

AIM

To expose the students to gain the concepts of robotics and their applications in industrial automation.

OBJECTIVES

At the end of the course the students will have knowledge on basic concepts of robots and the related sensors and various systems used . They also have given some basic hardware and software concepts for industrial applications.

UNIT I INTRODUCTION

Robots - Basic components - Classification - Performance characteristics - Drives and control systems - Electric, hydraulic and pneumatic actuators - Control loops using current amplifier and voltage amplifiers.

UNIT II SENSORS AND VISION SYSTEMS

Transducers and sensor - Tactile sensors - proximity and range sensors - Acoustic sensors - Vision systems - Image processing and analysis - Image data reduction - Segmentation feature extraction - Object recognition.

UNIT III PROGRAMMING THE ROBOT

End effectors - Type - Mechanical grippers - vacuum cups - Magnetic grippers - Robot to end effector interface - Software for industrial robots. Point to point program, point to point program and continuous path program.

UNIT IV ROBOT MOTION ANALYSIS AND CONTROL

Manipulator kinematics - Homogeneous transformation and robot dynamics configuration of a robot controller.

UNIT V INDUSTRIAL ROBOTS

Industrial robots - Robots for welding, painting, and assembling - Remote controlled robots for nuclear, thermal and chemical plants - Industrial automation - Typical examples of automated industries.

TEXT BOOKS

1. **Mikell P.Grover, Mitchell Weiss, Roger N.Nagel, Nicholas G.Odrey.,**
"Industrial Robots,Technology Programming and Applications"Mc Graw-Hill; 1990.
2. **Yoran Koren.,** "Robotics for Engineers" Mc Graw-Hill 1980.
3. **Deb.S.R,**"Robotics Technology and Flexible Automation" Tata McGraw-Hill; 1994.

Course Outcomes

At the end of this course, the students will demonstrate the ability to

1. Understand and design the robotics based automation for various engineering applications
2. Study the Sensors and vision systems
3. Develop the Programming the robot
4. Gai knowledge on Robot motion analysis and control
5. Design the Industrial robots

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

10. SOFT COMPUTING TECHNIQUES

AIM

To enable the students to acquire a thorough knowledge about Soft Computing Techniques

OBJECTIVES

At the end of the course, the students will gain a very strong knowledge in the following:

- i) Basic reaction of Fuzzy set theory, neural networks.
- ii) Applications of back propagation neural nets, and hop field neural nets etc.
- iii) Knowledge about Neuro controllers and Fuzzy logic controllers and its their applications.

UNIT I: ARTIFICIAL NEURAL NETWORKS

Motivation for the development of neural networks- biological neural networks- artificial neural networks – Fundamental Concepts - weights - biases and thresholds - common activation functions. McCulloch-pitts neuron: Architecture, algorithm - Hebb Net- Architecture - algorithm - Perceptron – Architecture- algorithm- applications- Linear separability - Perceptron learning rule convergence theorem - Delta rule.

UNIT II: NEURAL NETWORK ARCHITECTURE AND ALGORITHMS

Backpropagation Neural Net: Standard backpropagation - architecture - algorithm - number of hidden layers - Discrete Hopfield neural net- architecture - algorithm – Competitive Neural Networks -Fixed-weight competitive nets – Kohonen self-organizing Maps – Adaptive Resonance Theory- Basic architecture - Algorithm - Introduction to Neuro controllers - Case Studies.

UNIT III: FUZZY LOGIC

Fuzzy sets - Properties of Classical and Fuzzy sets- Operations on Fuzzy sets- Fuzzy relations- Linguistic variables - Linguistic Hedges- Fuzzy statements- Assignment statements- Conditional statements- unconditional statements- Fuzzy rule base- Canonical rule formation- Decomposition of compound rules.

UNIT IV: FUZZY LOGIC CONTROLLER

- Fuzzy logic controller: Functional diagram - Fuzzification - Membership value assignments using intuition - Membership functions- Defuzzification: Max-Membership principle - centroid method - weighted average method - Inference Engine – Knowledge Base -Rule base -Case studies

UNIT V: GENETIC ALGORITHM

Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Genetic Algorithm – encoding and decoding of variables – GA operators – reproductions – Cross over – mutation – fitness function –fitness scaling.

TEXT BOOKS

1. **Lawrene Faussett**, "Fundamental of neural networks", Prentice Hall, 2004.
2. **Ross T.J.**, "Fuzzy Logic with Engineering Applications", McGraw-Hill, Newyork, 2005.
3. **David Gold berg.E.**,” Genetic algorithms in search optimization and machine learning,” Addison Wesley, Pearson Education, Asia, 2001.

REFERENCE BOOKS

1. **Driankov.Hellendoornarow D.H Reinfrank M.**, "An introduction to Fuzzy Control”, Narosa Publishing co., New Delhi, 2006.
2. **Zurada J.M.**, "Introduction to Artificial Neural Systems", Jaico Publishing House, Delhi, 2001.
3. **Sivanandham. SN and Deepa. SN**, “Neural networks with Matlab”, TMH 2007.

Course Outcomes:

At the end of this course, the students will be able to

1. Analyze and select a suitable ANN technique for the particular problem domain.
2. Recognize the merits and demerits of applying a particular ANN model for a particular problem.
3. Design and apply fuzzy Logic based reasoning to handle uncertainty in engineering problems.
4. Apply Fuzzy Logic Controller for non-linear controlling applications.
5. Solve combinatorial optimization problems using genetic algorithm.

Mapping with Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	2	3											3	2	
C02	3	2	3		2								3	3	
C03		2	3		3				1				2	2	
C04			3	2	3									2	
C05		3	2		3								3	2	

11 WIRELESS NETWORK COMMUNICATION**AIM**

This course enables the students to gain a knowledge about the wireless communication system.

OBJECTIVES

At the end of the course the students will have some knowledge on fundamentals of wireless communication systems. They also given some exposure on cellular communications VSATS and other wireless applications like PBX, E-mail.

UNIT I INTRODUCTION

Fundamentals of wireless communication - history of wireless communication - radio based systems - troposcattor system - micro wave radio - satellite communication - Light based systems - dynamics of laser transmission - licensing requirements - band width capacitors - applications - fiber optic systems.

UNIT II CELLULAR COMMUNICATION

Evolution of cellular technology - dynamics of cellular transmission - cellular components - cellular coverage and channels - routing cellular calls - wireless personal communications - defining personal communication - cordless telephone technology - concept of PCS/PCN - functions of personal communications - evaluation of personal communications - the range of technology - Pcs and cellular markets.

UNIT III PCS

Comparing PCS and cellular technologies - Security concerns with wireless communications - The local exchange carriers - The inter exchange carriers - The international gate way carriers - The cellular operations combating fraud and theft - The encryption process.

UNIT IV: INTRODUCTION TO VSATS

VSATS- Low earth orbiting - iridium concepts - benefits of iridium service - basic system design - wireless LAN applications - wired verses wireless LANS - fixed frequency licensed microwave wireless LANS - spread spectrum radio based services - infrared light systems.

UNIT V WIRELESS APPLICATIONS

Wireless PBX - wireless data communications - packetized data-facsimile transmission - wireless E-mail - Use of wireless in disaster recovery situations.

TEXT BOOK

1. **Bud Bates**, "Wireless network Communications concepts, Technology and Implementations" McGraw Hill International, 1995.

REFERENCE BOOKS

1. **Daylon**, "Telecommunications", McGraw Hill international, 1995.
2. "Cooper Computer and communications security" McGraw Hill international, 1995.
3. **Simonds**, "Lan Communications handbook" McGraw Hill international, 1995.
4. "Bates Disaster Recovery Planning - network, telecommunications and data communications" ; McGraw Hill International, 1990.

Course Outcomes:

At the end of this course, the students will be able to

1. Analyze and select a suitable network communication for the particular problem domain.
2. Recognize the merits and demerits of cellular communication
3. Design and apply personal computer systems of engineering problems.
4. Gain knowledge on VSATs.
5. Solve optimization problems in wireless communication.

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

12 SATELLITE COMMUNICATION**AIM**

To impart a sound knowledge to the students about the satellite communication system.

OBJECTIVES

To impart wide knowledge on satellite fundamental, satellite Link Design, Assess techniques, Laser's in satellite communication and satellite services.

UNIT I SATELLITE FUNDAMENTALS

Satellite construction - Satellite orbit - Orbital mechanics - Equation of orbit - Orbital element - Look angle determination - Limits of visibility - Sub satellite point - Sun transit outage - Space craft technology - Altitude in orbit control - Propulsion telemetry - Tracking and command - Communication & antenna subsystems - Launching procedures - Launch vehicles.

UNIT II SATELLITE LINK DESIGN

Basic transmission theory - satellite uplink and down link - Analysis and design - Link budget - Performance impairments - System noise - Inter modulation interference - Propagation characteristics and frequency considerations - System reliability - Design of life time - Earth station design.

UNIT III ACCESS TECHNIQUES

Types - FDMA concepts - Inter modulation and back off - SPADE system - TDMA concept - Frame and burst structure - Satellite switch - CDMA concept - VS and SH CDMA system - Random multiple access techniques - Packet switching - packet satellite networks - Earth station technology - Terrestrial interface - Receiver and transmitter - Antenna systems - Random access estimating.

UNIT IV LASERS IN SATELLITE COMMUNICATION

Semi conductor and laser sources - semiconductor laser lifetime - Output wavelength control - Direct and indirect modulation techniques - Radiational effects -

Acquisition and tracking systems - Tracking and pointing control systems - Inter-satellite links - Laser crosslink analysis - optical communication for satellite networks.

UNIT V SATELLITE SERVICES

Packet satellite - Fixed satellite services - Broadcast satellite services - Satellite TV systems - Domestic satellite systems(INSAT,INTELSAT & IMMERSAT systems)Mobile satellite services - VSAT - Global positioning satellite systems - Maritime satellite services - Gateways - ATM over satellite - Role of future satellite networks.

TEXT BOOKS

1. **Pratt and Bostian.**, "Satellite Communication" John wiley and sons,2001.
2. **Tri T.Ha.**, "Digital Satellite Communication system" McGraw Hill.

REFERENCE BOOKS

1. **Pritchend and Sciulli.**, "Satellite Communication Systems Engineering" PHI 1986.
2. **Robert M.Gagliendi.**, "Satellite Communication" John wiley and sons, 2003.
3. **Richharia. M.** "Satellite Communication System Design and Analysis" Mc Millian Publishers, 1996.
4. **Agarwal.B.N.**, "Design of Geo Synchronous Space craft" Prentice Hall, 1986.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the Satellite fundamentals
2. Develop the Satellite link design
3. Study the Access techniques
4. Understand the Lasers in satellite communication
5. Acquire knowledge on Satellite services

Mapping with Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	2	3											3		2
C02	3	2	3		2								3		3
C03	3	2	3		3								2		2
C04	3		3		3										2
C05	3	3	2		3								3		2

13 INTERNET AND JAVA PROGRAMMING

AIM

To impart the knowledge of Internet and concepts of Java programming for networking.

OBJECTIVES

By this course the students will gain some knowledge on Internet facilities like E-mail, MUDS, FTP, Modem and world wide web. They also given basic concepts JAVA programming language used for networking.

UNIT I INTRODUCTION

Internet: Introduction - E.mail and mailing lists - newsgroups - multiuser dimension (MUDS) and multiuser dimensions - object- oriented (MDOs) - FTP, xmodem and kermit - navigation with gopher -world wide web: web, mosaic, netscape - web browser - WWW search tools.

UNIT II HTML

Hyper Text Markup Language (HTML): Introduction to standard generalised markup language (SGML) - HTML - document type definitions (DTDs) - HTML and validation - The common gateway interface (CGI) - CGI input and output - designing CGI applications.

UNIT III JAVA

Java: Overview - data types, variables and arrays - operators - control statements - classes - methods - inheritance - packages and interfaces.

UNIT IV PROGRAMMING

Exception handling - multithreaded programming - input/outputs - applets - string handling - exploring java language - utility classes - exploring java.io - networking.

UNIT V APPLET

The applet class - introduction to abstract window toolkit (AWT) - working with windows, graphics and text - AWT controls - layout managers-menus-images - animations.

TEXT BOOKS

1. **Neil Randall**, "The Internet", second edition, PHI, NewDelhi, 1996
2. **Edittel, Marck Gaither, Sebasian Hassinger & Mike Erwin** "Foundations of world wide web programming with HTML and CGI", comdex computer publishing, New Delhi,1996.
3. **Balagurusamy** "Programming with JAVA", Tata McGraw Hill, 2007.

REFERENCE BOOKS

1. **Douglas E.Comer** "The Internet" , second edition, PHI, New Delhi, 1977.
2. **Robert Ainsley**, "Get Smart in Internet", Pusthak Mahal, Delhi, first edition,1996.
3. **Michael D.Thomas, Pratik R.Patel, Alan D.Hudson and Donald A.Ball J.R** "Java programming for the internet applications",Ventana communications group Inc,USA,1996.
4. **Patrick Naughton and Herbert Schildt**, "The complete reference JAVA", (OBSORNE series) TATA McGraw-Hill publishing limited, New Delhi, 2007.

COURSE OUTCOMES

At the end of the course, the students will be able to

1. Identify new models for market strategic interaction
2. Design business intelligence and information security for WoB
3. Analyze various protocols for IoT
4. Design a middleware for IoT
5. Analyze and design different models for network dynamics

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

14 . VLSI DESIGN**AIM**

To impart the knowledge of Internet and concepts of VLSI design

OBJECTIVES

- To afford an understanding of VLSI Design process and to bring both system and circuit view on design together.
- To familiarize the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit. .
- To acquire knowledge on transistor level CMOS logic design and to understand NMOS and CMOS fabrication process.
- To impart knowledge about designing digital circuits like adders and multipliers.
- To teach programming technologies and architectures of FPGAs and understand the concepts of modeling a digital system using VHDL.

UNIT I: VLSI DESIGN CONCEPTS

Evolution of VLSI – VLSI design flow--Design domains Behavioral, Structural and Physical design – Concept of Regularity, Modularity and Locality-Layout styles: Full custom - Semi custom approaches.MOS structure- MOS current equation –channel length modulation-Body effect –MOSFET capacitance-CMOS Logic Design: Static characteristics of CMOS Inverter, Dynamic behavior of CMOS inverter-static and dynamic power dissipation in CMOS – Basic and Complex gates realization in CMOS- Transistor sizing-Sheet resistance and area capacitance of layers-Wiring capacitance-Driving large capacitive loads.

UNIT II: VLSI FABRICATION TECHNIQUES

An overview of wafer fabrication, Wafer Processing – Oxidation – Patterning – Diffusion – Ion Implantation – Deposition – Silicon gate NMOS process – CMOS processes – N-well, P-well- Twin tub, Silicon on insulator – CMOS process enhancements – Interconnects, Circuit elements-CMOS latch up.Design Rules-Need for Design Rules-CMOS lambda based design Rules-Stick diagram and layout for CMOS inverter.

UNIT III: ANALOG VLSI

Introduction to analog VLSI - Analog circuit building blocks – Switches- active resistors - Current sources and sinks - Current mirrors/amplifiers –Voltage and Current References-- CMOS inverting amplifiers - CMOS Differential Amplifiers -CMOS Two stage op-amp - Modulators and Multipliers-Switched capacitor filter.

UNIT IV: DIGITAL VLSI

Logic design: Switch logic and Gate logic - Dynamic CMOS logic - Structured design examples: Simple combinational logic and Clocked sequential design. Sub-system design: Design of shifters, Design of Adders: Ripple carry adders, Carry select adder, carry save adder, Manchester carry –chain adder, Carry Look- ahead adder, Design of Multipliers: Serial, Parallel and pipelined multiplier arrays, Booth multiplier, Wallace tree multiplier.

UNIT V: PROGRAMMABLE ASICs AND VHDL

Architecture and Programming technologies of ROMs, EPROMs, PLA, PAL, Gate arrays, CPLD and FPGA – Xilinx FPGA’s LCA , I/O block and interconnect –Programming technology. VHDL overview- Hardware modeling issues –VHDL code structure: Library declaration, Entities and Architectures –Data types- Operators-Concurrent and Sequential statements-Signals and Variables-Packages and Libraries - Introduction to behavioral, dataflow and structural modeling-simple VHDL code examples.

TEXT BOOKS

1. **Neil H. E. Weste, David Money Harris**, “CMOS VLSI Design”: A Circuits and Systems Perspective, Pearson Education India, 3rd edition 2012.
2. **Wayne Wolf**, “Modern VLSI Design”, Ip-Based Design, Pearson Education India, 4th edition 2009.

REFERENCE BOOKS

1. **Deepak Garg**, VLSI Design, S.K. Kataria & Sons; 1st edition 2013.
2. **R.Sakthivel**, “VLSI Design”, S.Chand & Company Ltd, 4th edition 2008.
3. **Sarita Chauhan**, “VLSI Design” S.K. Kataria & Sons; edition 2012.
4. **Sharat C. Prasad Kaushik Roy**, “Low-Power CMOS VLSI Circuit Design” Wiley publications, 2009.
5. **AL.Visalatchi, B.Priya, S.Pravenaa**, “Modern VLSI Design”, Anuradha Publications, 1st edition 2010.
6. **Douglas. A. Puknell and Kamran Eshraghian**, “Basic VLSI Design”, PHI, 3rd Edition, 2005.

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Provide comprehensive ideas about the techniques of chip design using programmable devices.
2. Analyze VLSI systems, VHDL and MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit.
3. Design and analyze various analog circuits
4. Design and analyze digital circuits like multipliers, adders and understand the architecture and programming technologies of FPGA.
5. Model a simple digital system using VHDL.

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

15 COMPUTER COMMUNICATION**AIM**

To impart a sound knowledge to the students about the role of computers in communication engineering field.

OBJECTIVES

To impart a wide knowledge on computer communication in the area of computer networks, media access sub layer and data link layer, network and transport layers, Queuing theory and capacity assignment and presentation layer and application layer.

UNIT I COMPUTER NETWORKS

Evolution of data networks, Network architecture, ISO Reference model- Examples of networks, Application of networks, Physical layer, and communication medium characteristics.

UNIT II MEDIUM ACCESS SUB LAYER AND DATA LINK LAYER

Local area networks, conventional channel allocation methods, pure-ALOHA, S-ALOHA, Finite population ALOHA, Controlled ALOHA, Reservation ALOHA, Design issues for packet radio networks-IEEE standard for LAN-Ethernet: CSMA/CD LAN, Token passing ring- Data link layer design issues - Service primitives - stop and wait Sliding window protocols - Comparison of stop and wait and sliding window protocols.

UNIT III NETWORK AND TRANSPORT LAYERS

Network layer -Design issues-Routing algorithm - Congestion control algorithms internetworking. Transport layer design issues - Connection management - A simple transport protocol on top of X.25.

UNIT IV QUEUING THEORY AND CAPACITY ASSIGNMENT

M/M/I Queues/G/I Queues, priority queuing-capacity assignment for terminal networks and distributed networks-Concentration and buffering for finite and infinite buffers-Block storage.

UNIT V PRESENTATION LAYER AND APPLICATION LAYER

Design issues - Abstract syntax notation - Data compression techniques - Cryptography - Remote procedure call. Design Issues - File transfer access and management, Electronic mail - Virtual terminals - Other applications.

TEXT BOOKS

1. **Andrew S.Tanenbaum.** "Computer Networks", Prentice Hall of India,1990.
2. **D.Bertsekas and R.Gallagher,** "Data networks", Prentice Hall of India, 1989.

REFERENCES

1. **Getd E.Keiser,**" Local Area Networks", McGraw Hill Publication, 1989.
2. **M.Schwartz,**"Computer Communication", McGraw Hill, 1983.
3. **Misha Schwartz,** "Telecommunication Networks - Protocols, Modeling and Analysis", Addition Wesley, 1989.
4. **W.Stallings,**" Data and computer Communication", 2'nd Deucaton New York, Macmillan,1988.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Understand the fundamental principles of computer networking.
2. Have basic idea about the outline of the terminologies and concepts of the OSI reference model and the TCP-IP reference model.
3. Point out issues in local area networks and wide area networks.
4. Analyze Wireless networking concepts, contemporary issues in networking technologies, network tools and network programming.
5. Select the most appropriate networking architecture and technologies.

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

16 - EMBEDDED NETWORKS**AIM**

To impart a sound knowledge to the students about the role of computers in embedded systems.

OBJECTIVES

- To familiarize the fundamentals of embedded systems, design paradigms and architectures.
- To comprehend the basics of PIC Microcontroller PIC and their programming.
- To learn the different interfacing capabilities of PIC controllers and their Memory Organization.
- To study about the ARM Architecture and its programming.
- To understand the Real Time Operating Systems, and their Task Management.

UNIT I EMBEDDED CONCEPTS

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioral Description.

UNIT II FRAMEWORK FOR EMBEDDED NETWORK

Basics – Client/server model- Domain Names and IP address – Internet Infrastructure and Routing – URL – TCP/IP protocols - Embedded as Web Client - Embedded Web servers - HTML - Web security - Case study: Web-based Home Automation system.

UNIT III ELEMENTS OF EMBEDDED NETWORKS

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed - Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I²C, CAN Bus, SHARC link supports, Internet.

UNIT IV EMBEDDED PROCESSOR AND COMPUTING PLATFORM

Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging.

UNIT V SYSTEM DEVELOPMENT

Embedded software development tools – Emulators and debuggers. Design methodologies – Case studies – Complete design Telephone PBX- System embedded systems.

TEXT BOOKS:

1. **Wayne Wolf**, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman Publishers-2008.
2. **Frank Vahid and Tony Givargis**, “Embedded System Design: A Unified Hardware/Software Introduction” , John Wiley & Sons-2006.
3. **Jan Axelson** ‘Embedded Ethernet and Internet Complete’, Penram publications- 2003

REFERENCE BOOKS:

1. **Deitel H.M. ,Deitel P.J, Golldberg A.B.** “ Internet and World Wide Web – How to Program” Third Edition , Pearson Education , 2001.
2. **Jane.W.S. Liu**, “Real-Time systems”, Pearson Education Asia-2000.
3. **Krishna C. M. and Shin K. G.**, “Real-Time Systems” , McGraw-Hill, 1997

Course Outcomes:

At the end of this course, the students will demonstrate the ability to

1. Understand the architecture and programming aspects of embedded systems.
2. Distinguish between the general computing system and embedded system.
3. Design real time embedded systems using the concept of RTOS.
4. Acquire knowledge about architecture, registers, instruction set of arm processor.
5. Know about operating system function, resource and task management function.

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