FACULTY OF ENGINEERING AND TECHNOLOGY

REGULATIONS-2016

CHOICE BASED CREDIT SYSTEM
CURRICULUM FROM I TO VIII SEMESTERS FOR

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (REGULAR)
SEMESTER –I

Sl.No	Course Code	Course Title	Dept. offering the course	L	T	P	C
	THEORY						
1.		Calculus for Engineers (common to MECH, ECE, CSE, CSSE, EEE, EIE, CIVIL, IT, MECHT, AERO, ETC & AUTO)	Mathematics	3	1	0	4
2.		English for Engineers (common to all branches)	English	3	0	0	3
3.		Physics for Engineers (common to all branches)	Physics	3	0	0	3
4.		Essentials of Computer Science and Engineering (common to all branches)	CSE	3	1	0	4
5.		Essentials of Civil and Mechanical Engineering (common to ECE,BME,EEE, MECT)	Civil/Mechanical	3	0	0	3
	PRACTICAL						
6.		Physics Lab (common to all branches)	Physics	0	0	3	2
7.		Computer Lab (common to all branches)	CSE	0	0	3	2
8.		Workshop Practices (common to all branches except BT & BIF)	Mechanical	0	0	3	2
9.		Yoga And Meditation (common to all branches)	Yoga	0	0	3	2
		TOTAL		**15**	**2**	**12**	**25**

SEMESTER -II

Sl.No	Course Code	Course Title	Dept. offering the course	L	T	P	C
	THEORY						
1.		Transforms & Matrices (common to MECH,ECE,CSE, CSSE,EEE,EIE,CIVIL,IT,MECHT,AERO,ETC & AUTO)	Mathematics	3	1	0	4
2.		Business English (common to all branches)	English	3	0	0	3
3.		Chemistry for Engineers (common to all branches except BT)	Chemistry	3	0	0	3
4.		C-Programming (common to all branches)	CSE	3	1	0	4
5.		Electronic Devices (common to ECE,BME,MECHT,EEE,CSE)	ECE	3	0	0	3
	PRACTICAL						
6.		Engineering Chemistry Lab (common to all branches except BT)	Chemistry	0	0	3	2
7.		C-Programming Lab (common to all branches)	CSE	0	0	3	2
8.		Engineering Graphics Lab (common to all branches except BT & BIF)	Mechanical	0	0	3	2
9.		Electronic Devices Lab (common to ECE,BME,MECHT,EEE,CSE)	ECE	0	0	3	2
		TOTAL		**15**	**2**	**12**	**25**

SEMESTER –III

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		PDE Applications and Complex Analysis (Common to CIVIL, Mect, Solar &Alt & EEE.)	Mathematics	3	1	0	4
2.		Electric Circuit Analysis (Common to Mect & EEE.)	EEE	3	1	0	4
3.		Power Plant Engineering	MECH	3	0	0	3
4.		Electrical Machines - I	EEE	3	0	0	3
5.		Mathematical Modelling and Simulation	EEE	3	1	0	4
6.		Digital Electronics	ECE	3	1	0	4
	PRACTICAL						
7.		Electric Circuits & Devices Laboratory	EEE	0	0	3	2
8.		Electrical Machines - I Laboratory	EEE	0	0	3	2
9.		Digital Electronics and Simulation Laboratory	ECE/EEE	0	0	3	2
		TOTAL		**18**	**4**	**9**	**28**

SEMESTER -IV

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Numerical Methods (COMMON TO MECH, AERO, AUTO, MECT, CIVIL, & EEE)	Mathematics	3	1	0	4
2.		Transmission & Distribution	EEE	3	0	0	3
3.		Electrical Machines - II	EEE	3	0	0	3
4.		Electro Magnetic Theory	EEE	3	1	0	4
5.		Electronic Circuits **(**COMMON TO BME, ECE EEE)	ECE	3	0	0	3
6.		Measurements and Instrumentation	EEE	3	0	0	3
	PRACTICAL						
7.		Electrical Machines - II Laboratory	EEE	0	0	3	2
8.		Electronic Circuits Laboratory	ECE	0	0	3	2
9.		Measurements and Instrumentation Laboratory	EEE	0	0	3	2
		TOTAL		**18**	**2**	**9**	**26**

SEMESTER -V

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Power Electronics	EEE	3	0	0	3
2.		Power System Analysis	EEE	3	1	0	4
3.		Protection & Switchgear	EEE	3	0	0	3
4.		Linear Integrated Circuits (COMMON TO ECE, BME, EEE)	ECE	3	0	0	3
5.		Control Systems (COMMON TO ECE, EEE)	EEE	3	1	0	4
6.		Elective – I		3	0	0	3
	PRACTICAL						
7.		Power Electronics Laboratory	EEE	0	0	3	2
8.		Linear Integrated Circuits Laboratory	ECE	0	0	3	2
9.		Control Systems Laboratory	EEE	0	0	3	2
		TOTAL		**18**	**2**	**9**	**26**

SEMESTER -VI

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Microcontroller & Applications (COMMON TO BME, EEE, & MECHAT)	ECE	3	0	0	3
2.		Solid State Drives	EEE	3	1	0	4
3.		Digital Signal Processing (COMMON TO ECE, EEE)	ECE	3	1	0	4
4.		Professional Ethics and Human Values	Management	3	0	0	3
5.		High Voltage Engineering	EEE	3	0	0	3
6.		Elective-II		3	0	0	3
	PRACTICAL						
7.		Solid State Drives Laboratory	EEE	0	0	3	2
8.		Microcontroller Laboratory	ECE	0	0	3	2
9.		Creative and Innovative Project	EEE	0	0	3	2
		TOTAL		**18**	**2**	**9**	**26**

SEMESTER -VII

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Disaster Mitigation and Management (COMMON TO ALL)	Civil	3	0	0	3
2.		Power system Operation and Control	EEE	3	0	0	3
3.		Embedded System (COMMON TO EEE, MECHT & IT)	ECE	3	0	0	3
4.		Environmental Science & Engineering	Chemistry	3	0	0	3
5.		Non Conventional Energy Sources and Applications	EEE	3	0	0	3
6.		Elective-III		3	0	0	3
	PRACTICAL						
7.		Solar and Wind Energy Laboratory	EEE	0	0	3	2
8.		Power System Simulation Laboratory	EEE	0	0	3	2
9.		Comprehension	EEE	0	0	3	2
		TOTAL		**18**	**0**	**9**	**24**

SEMESTER -VIII

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Elective -IV		3	0	0	3
2.		Elective-V		3	0	0	3
3.		Elective-VI		3	0	0	3
	PRACTICAL						
4.		Project Work & Viva Voce	EEE	0	0	12	6
		TOTAL		**9**	**0**	**12**	**15**

TOTAL CREDITS: 195

ELECTIVES

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
THEORY							
1.		Advanced Control System	EEE	3	0	0	3
2.		Advanced Topics in Power Electronics	EEE	3	0	0	3
3.		Artificial Intelligence and Expert System	EEE	3	0	0	3
4.		Biomedical Instrumentation	EEE	3	0	0	3
5.		CAD For Electrical Apparatus	EEE	3	0	0	3
6.		Computer Architecture	CSE	3	0	0	3
7.		Design of Electrical Apparatus	EEE	3	0	0	3
8.		EHV AC & DC Power Transmission	EEE	3	0	0	3
9.		Flexible AC Transmission System	EEE	3	0	0	3
10.		High Voltage Direct Current Transmission	EEE	3	0	0	3
11.		Information Security	CSE	3	0	0	3
12.		Intelligent Controllers	ECE	3	0	0	3
13.		Managerial Economics and Financial Analysis	MGMT	3	0	0	3
14.		Micro Electro Mechanical Systems	EEE	3	0	0	3
15.		Power Electronics For Renewable Energy System	EEE	3	0	0	3
16.		Power Quality	EEE	3	0	0	3
17.		Power System Planning and Reliability	EEE	3	0	0	3
18.		Power System Transients	EEE	3	0	0	3
19.		Principles of Communication Engineering	ECE	3	0	0	3
20.		Robotics and Automation	EEE	3	0	0	3
21.		Special Electrical Machines	EEE	3	0	0	3
22.		Total Quality Management	MGMT	3	0	0	3
23.		VLSI Design	ECE	3	0	0	3
24.		Wind Energy Conversion Systems	EEE	3	0	0	3
25.		Power System Restructuring and Deregulation	EEE	3	0	0	3
26.		Nano Electronics	EEE	3	0	0	3
27.		Advanced Electronics Test Engineering	EEE	3	0	0	3
INDUSTRIAL ELECTIVES							
28.		Learning IT Essentials by Doing	Infosys	3	0	0	3
29.		Business Intelligence and its Applications	Infosys	3	0	0	3
30.		Virtual Instrumentation	National Instruments	3	0	0	3

SEMESTER I	L	T	P	C
CALCULUS FOR ENGINEERS	3	1	0	4

Common to BE First Semester
(MECH, ECE, CSE, CSSE, EEE, EIE, CIVIL, IT, MECHT,
AERO, ETC & AUTO)

AIM:

- To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

OBJECTIVES:

- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I

APPLICATION OF DIFFERENTIAL CALCULUS

Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature – Evolute

UNIT II

FUNCTIONS OF SEVERAL VARIABLES

Partial Derivatives – Total Differential - Maxima and Minima – constrained Maxima and Minima by Lagrangian Multiplier Method.

UNIT III

INTEGRATION

Concept of integration-Integration of Rational and Trigonometric functions – Using Partial Fractions – Integration by parts.

UNIT IV
MULTIPLE INTEGRAL
Double integration –change of order of integration- Cartesian and polar coordinates –Area as a double integral – Triple integration.

UNIT V
VECTOR CALCULUS
Directional derivatives – Gradient, Divergence and Curl – Irrotational and solenoidal- vector fields – Vector integration – Green‟s theorem, Gauss divergence theorem and Stoke‟s theorem (excluding proof).

TEXT BOOK:

1. **“**Engineering Mathematics**”** by Department of Mathematics, VMU
2. Veerarajan, T., “Engineering Mathematics”, Tata McGraw Hill Publishing Co., NewDelhi, 2006.
3. Dr.A .Singaravelu , Engineering Mathematics Volume I & Volume II by Meenakshi Publications.

REFERENCES:

1. Grewal, B.S., “Higher Engineering Mathematics” (36th Edition), Khanna Publishers, Delhi 2001.
2. Kreyszig, E., “Advanced Engineering Mathematics” (8th Edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Kandasamy .P., Thilagavathy. K., and Gunavathy. K., “Engineering Mathematics”, Volumes I & II (4th edition), S.Chand & Co., New Delhi., 2001.
4. T. Veerarajan, “Engineering Mathematics” (for semester III), Third Edition Tata McGraw- Hill Publishing Company limited.

OUTCOMES:

This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

SEMESTER I	L	T	P	C
ENGLISH FOR ENGINEERS	3	0	0	3

(For I year BE- common to all branches)

2015-2016 Regulations – First Semester

AIM:

Strengthens the basic LSRW (Listening, Speaking, Reading and Writing) skills.

Comprehension of English Language and Grammar.

OBJECTIVES:

1. To enable students to develop LSRW skills in English.

2. To become effective communicators in English.

3. To ensure that learners use Electronic media materials for developing language skills.

Unit – I

Self introduction - Simulations using E Materials - Whatsapp, Face book, Hiker, Twitter- Effective Communication with Minimum Words - Interpretation of Images and Films - Identify the different parts of speech– Common Errors in English – Scientific Vocabulary, (definition and meaning) - Listening Skills- passive and active listening, Listening to native speakers, , guided note taking - Characteristics of a good listener– Telephonic conversation with dialogue.

Unit – II

Articles - Phonetics (Vowels, Consonants and Diphthongs) – Pronunciation Guidelines – Listening to Indian speakers from different regions, intrusion of mother tongue – Homophones – Homonyms, Note taking and Note making - Difference between Spoken and Written English- Use of appropriate language - Listening and Responding to Video Lectures (Green India, environment, social talks) - Extempore.

Unit – III

Tense forms- Verbal & Non verbal communication – Describing objects – Process Description- Speaking Practice – Paragraph Writing on any given topic (My favourite place, games / Hobbies / School life, etc.) –Types of paragraphs- Telephone Etiquettes.

Unit – IV

Impersonal Passive Voice- Conditional Sentences – Technical & Non technical Report Writing (Attend a technical seminar & submit a report) – News Letters & Editing –Skimming & Scanning - How to Improve Reading Speed – Designing Invitations & Poster Preparation.

Unit – V

Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding – Informal letters - SWOT analysis– Resume Writing- Difference –Bio – data, Resume and CV.

References:

1. Practical English Usage- Michael Swan (III edition), Oxford University Press
2. Grammar Builder- I, II, III, and Cambridge University Press.

COURSE OUTCOMES:

Learners should be able to:

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using
- appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide
- vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents.

SEMESTER I	L	T	P	C
PHYSICS FOR ENGINEERS	3	0	0	3

AIM:

To familiarize students with the basic concepts of Physics and their application in Engineering & Technology.

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I – Properties of matter **9**

Elasticity – Hooke's law – Stress-strain diagram - Relationship between three moduli of elasticity (qualitative) - Poisson's ratio – Young's modulus by uniform bending and non-uniform bending – Experimental determination of rigidity modulus – I-shaped girders.

UNIT II – Crystal Physics **9**

Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures – Crystal imperfections – point, line, surface and volume defects.

UNIT III – Lasers **9**

Laser characteristics - Stimulated Emission – Population Inversion - Einstein coefficients – Lasing action – Types of Laser – Nd:YAG laser, CO_2 laser, GaAs laser – Applications of Laser – Holography – construction and reconstruction of a hologram

UNIT IV – Fibre Optics **9**

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system – fibre optic displacement sensor and pressure sensor.

UNIT V - Non – Destructive Testing **9**

Introduction – Types of NDT - Liquid penetrant method – characteristics of penetrant and developer - ultrasonic flaw detector – Ultrasonic scanning methods - X-ray Radiography: displacement method – X-ray Fluoroscopy.

Total hours : 45

TEXT BOOK

"Engineering Physics", compiled by Department of Physics, Vinayaka Missions University, Salem.

REFERENCE BOOKS

1. Beiser, Arthur, "Concepts of Modern Physics", 5th Ed., McGraw-Hill, 2009.

2. Halliday.D, Resnick.R, Walker.J, Fundamentals of Physics, Wiley & sons, 2013.

3.Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai publishers, New Delhi, 2001.

4. Avanadhanulu.M.N., Arun Murthy.T.V.S, Engineering Physics Vol. I, S.Chand, 2014.

5. Rajendran. V, "Engineering Physics", Tata Mc Graw Hill Publication and Co., New Delhi, 2009.

COURSE OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, Optics, acoustics etc.,
- They will apply these fundamental principles to solve practical problems related to materials used for engineering applications

SEMESTER I	L	T	P	C
ESSENTIALS OF COMPUTER SCIENCE AND ENGINEERING	3	0	0	3

(Common for All Branches)

AIM:

The aim is to introduce the fundamentals of Computer to the students

OBJECTIVES:

- To provide basic knowledge on hardware and software components of computers.
- To introduce and demonstrate various software applications
- To introduce Problem solving methodologies
- To learn about Implementation of Algorithms
- To learn about HTML

UNIT I - Basics of Computer and Information Technology
10

Computer – Generations, Types of Computers, Block diagram of a computer- Components of a computer system - Hardware and software definitions - Categories of software – Booting - Installing and Uninstalling a Software - Software piracy - Software terminologies - Applications of Computer - Role of Information Technology - History of Internet - Internet Services.

UNIT II - Software Applications (Practical Learning)
7

Office Automation: Application Packages - Word processing (MS Word) - Spread sheet (MS Excel) – Presentation (MS PowerPoint).

UNIT III - Problem Solving Methodologies
10

Problems Solving Techniques - Program Development Cycle – Algorithm Development - Flow chart generation – Programming Constructs (Sequential, Decision-Making, Iteration) - Types and generation of programming languages

UNIT IV Implementation of Algorithms **9**

Implementation of Algorithms-program verification-The efficiency of algorithms-The analysis of algorithms-Fundamental Algorithms

UNIT V HTML **9**

Basics of HTML – Applications of HTML – HTML Fonts – anchor tag and its attributes – Using images in HTML programs – list tag - Table tag – HTML forms

TOTAL HOURS: 45

TEXT BOOKS

1. *Essentials of Computer Science and Engineering – by VMU*

COURSE OUTCOMES:

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

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.

Develop recursive programs.

SEMESTER I	L	T	P	C
ESSENTIALS OF CIVIL AND MECHANICAL ENGINEERING	3	0	0	3

AIM

To familiarize students with the basic concepts of Civil and Mechanical in Engineering & Technology

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering

practices in Civil, Mechanical Engineering.

A - CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – types – classification – principles – measurements of distances – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 9

Foundations: Types – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams

B – MECHANICAL ENGINEERING

UNIT III ENERGY SOURCES 9

Introduction, Classification of Power Plants – Working principle of steam, Diesel, Hydro and Nuclear Power plants – Merits and Demerits – Introduction to Renewable Energy Sources

UNIT IV IC ENGINES & REFRIGERATION AND AIR CONDITIONING SYSTEM 9

Internal combustion engines – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

Basic Terminology of Refrigeration and Air Conditioning-Principle of vapour compression and absorption system.

UNIT V BASIC MANUFACTURING PROCESSES 9

Casting process-Introduction, Principle, Advantages, casting defects

Forging process-introduction, forging, rolling, drawing, extrusion

Welding process- introduction, principle, types-Gas and arc welding

TOTAL: 45 PERIODS

REFERENCES:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

COURSE OUTCOMES:

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipment's to join the structures.

PRACTICALS

SEMESTER I	L	T	P	C
PHYSICS LAB (Real & Virtual)	0	0	3	2

AIM:

To familiarize students with the basic concepts of Physics and theirapplication in Engineering & Technology through experiments

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

List of Experiments

1. Young's modulus of a bar - Non-uniform bending

2. Rigidity modulus of a wire - Torsional Pendulum

3. Viscosity of a liquid - Poiseuille's method

4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer

5. Particle size determination using Laser

6. Wavelength of spectral lines – grating - Spectrometer

7. Thickness of a wire - Air wedge Method

8. Thermal conductivity of a bad conductor - Lee's disc

9. Band gap determination of a thermistor - Post Office Box

10. Specific resistance of a wire – Potentiometer

COURSE OUTCOMES:

The hands-on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials

SEMESTER I	L	T	P	C
WORKSHOP PRACTICES	0	0	3	2

(Common to all Branches - Except Bio-Tech & Bio info)

AIM

The aim of the lab to learn Business fitting, Carpentry and welding technics.

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering

practices in Civil, Mechanical, Electrical and Electronics Engineering.

FITTING

1. Square Joint
2. Dove Tail Joint

CARPENTRY

1. Half Lap Joint
2. Dove Tail Joint

WELDING

1. Arc Welding of butt Joint.
2. Arc Welding of Lap Joint

CASTING

1. Foundry – Mould Preparation using single piece pattern

DEMONSTRATION

1. Sheet Metal – Fabrication of cone

2. Black Smithy – Round to square rod

Reference:

1.“Basic Workshop Practice”, Department of Mechanical Engineering, Vinayaka Missions University

COURSE OUTCOMES:

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipment’s to join the structures.

SEMESTER I	L	T	P	C
COMPUTER LAB	0	0	3	2

(Common for all branches)

AIM

To practice the basics of office automation application, SQL and basic HTML coding

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Implement Mail Merge in MS-Word and send letters to parents regarding the semester fee structure of the student.
2. Using MS-Word, create a leave letter addressed to your faculty advisor
3. A) Using MS-Word, create a table for a list of students with different font sizes and colours
   B) Using MS-Word, create a flow-chart using the basic shapes available. Use page border, a watermark, header and footer
4. Using MS-PowerPoint, create a presentation about the university
5. Using MS-PowerPoint, create a story line with various animations and transition effects.
6. Using MS-Excel, Analyze Students performance using MS-Excel and prepare a chart type report.
7. Using MS-Excel, create a pivot table
8. Using MS-Excel, create look-up tables
9. Using MS-Excel, create graphs for the weather condition in various cities of India
10. Create an HTML page Create an HTML page to
    a) Click on a link and go to the bottom of the page using <a href>
    b) Display an image.
11. Create an HTML page to
    a) Display ordered and unordered lists of your friends names and sports persons
    b) Display a table with 3 columns and 4 rows.

COURSE OUTCOMES:

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

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

SEMESTER II	L	T	P	C
TRANSFORMS AND MATRICES	3	1	0	4

Common to BE - Second Semester

(MECH, ECE, CSE, CSSE, EEE, EIE, CIVIL, IT, MECHT, AERO, ETC & AUTO)

Aim:

- To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

OBJECTIVES:

- To make the student appreciate the purpose of using transforms to create a new domain in

which it is easier to handle the problem that is being investigated.

UNIT I

MATRICES

Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT II

LAPLACE TRANSFORMS

Laplace transform – transform of elementary functions – basic properties – derivatives and integrals of transforms – transforms of derivatives and integrals – initial and final value theorems – Transform of periodic functions.

UNIT III

INVERSE LAPLACE TRANSFORMS & APPLICATIONS

Inverse Laplace transform – Convolution theorem – Initial and Final value theorem-Solution of linear ODE of second order with constant coefficients and first order simultaneous equation with constant coefficients using Laplace transforms.

UNIT IV

FOURIER TRANSFORMS

Fourier transform pairs - Fourier Sine and Cosine transforms – Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

UNIT V

Z-TRANSFORMS

Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution Theorem – Formation of Difference Equations – Solution of Difference Equations using Z-Transform.

TEXT BOOKS

1. **"**Engineering Mathematics**"** by Department of Mathematics, VMU
2. Veerarajan, T., "Engineering Mathematics", Tata McGraw Hill Publishing Co., NewDelhi, 2006.
3. Dr.A .Singaravelu , Engineering Mathematics Volume I & Volume II by Meenakshi Publications.
4. A.Singaravelu,"Transforms and Partial Differential Equations", Meenakshi Agencies,Chennai

REFERENCE BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics" (36th Edition), Khanna Publishers,Delhi 2001.
2. Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Kandasamy .P., Thilagavathy. K., and Gunavathy. K., "Engineering Mathematics",Volumes I,II & III (4th edition), S.Chand & Co., New Delhi., 2001

COURSE OUTCOMES:

- The subject helps the students to understand the basic concepts of matrix , transform and complex functions.
- Students will be able to solve problems related to engineering applications by using these techniques.

SEMESTER II	L	T	P	C
BUSINESS ENGLISH	3	0	0	3

(For I year BE, Common to all branches)

2015 - 2016 Regulations – Second Semester

Aim

To familiarize students with the basic grammar and learn corporate communication for develop the business knowledge.

OBJECTIVES:

- To impart and enhance corporate Communication
- To enable learners to develop presentation skills.
- To build confidence in learners to use English in Business contexts.

Unit – I

Subject and verb agreement (Concord) – Preposition and Relative Pronoun – Cause and effect- Phrasal Verbs – Idioms and Phrases – Listening comprehension - Listening to Audio Files and Answering Questions – Framing Questions – Negotiation skills, Persuasion Skills and Debating skills.

Unit – II

Stress (Word stress and Sentence stress) – Intonation – Difference between British and American English– Vocabulary – Indianism - Compound Words (including technical terminology).

Unit – III

Reading Skills – Understanding ideas and making inferences – Group Discussion – Types of Interviews, FAQs – e- mail Netiquette, Sample e-mails – Watching Documentary Films and responding to questions.

Unit – IV

Corporate communication – Recommendation - Instruction – Check List- circulars- Inter office memo – Minutes of meeting and Writing agenda – Discourse Markers- Rearranging the jumbled sentences – Technical Articles – Project Proposals, Making Presentations on given topics – Preparing Power Point Presentations.

Unit – V

Critical Reading – Book Review - Finding Key Information and Sifting Facts from Opinions – Business letters (Calling for Quotation, Placing orders and Complaint letters) – Expansion of an Idea. – Creative Writing.

References:

1. Grammar Builder- I, II, III -Cambridge University Press.

Technical English-Writing, Reading and Speaking- Pickett and Lester, Harper and Row publication

COURSE OUTCOMES:

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using
  appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration,
  description, exposition and argument as well as creative, critical, analytical and evaluative writing.

SEMESTER II	L	T	P	C
CHEMISTRY FOR ENGINEERS	3	0	0	3

(Common to all branches except Biotechnology)

B.E / B.Tech. - SECOND SEMESTER –CBCS regulations 2015

Aim

To impart in basic knowledge in chemistry so that the student will understand the engineering concept and they can face the competitive examinations effectively.

OBJECTIVES:

- To impart in basic knowledge in chemistry so that the student will understand the engineering concept and they can face the competitive examinations effectively.
- To improve the knowledge in the instrument applications.
- To inculcate the knowledge of advanced material.

UNIT I : ELECTROCHEMISTRY, BATTERIES AND FUEL CELLS 9 Hrs

Ostwald Law and Debye Huckle's law - Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass)- cells - EMF measurement-emf and galvanic series.

Primary battery (Daniel and dry cell) – secondary battery (lead Acid storage battery and Nickel-Cadmium battery) – Fuel cell (H_2-O_2 fuel cell)

UNIT II : WATER TECHNOLOGY & CORROSION 9 Hrs

Sources of water – impurities – Hardness and its determination (problems to be avoided) – boiler troubles – water softening (zeolite & Demineralisation) – Domestic water treatment – Desalination (Electrodialysis & Reverse Osmosis).

Corrosion – Types – principles – corrosion control methods (Electroplating,Electroless plating, Sacrificial anode and Impressed current method).

UNIT III: CHEMISTRY OF ADVANCED MATERIALS 9 Hrs

Refractories – properties and uses, Portland cement –manufacturing, setting and hardening – Special cement, ceramics.

Organic electronic material, shape memory alloys, smart materials,polymers(PVC,Teflon, Bakelite)- fibers(optical fibre) & composites (FRP,MMC & PMC)

UNIT IV : PHASE EQUILIBRIA & NUCLEAR CHEMISTRY 9 Hrs

Phase rule: statement and explanation of terms involved – One component system (water) – Condensed phase rule – Two component system (Lead-silver) .

Nuclear Chemistry – Fission – Fusion – working of nuclear reactor – Radiations and harmful effects.

UNIT V : CHROMATOGRAPHY AND SPECTROSCOPY 9 Hrs

Chromatography — classification (Paper, Column, Thin Layer, Gas, HPLC). Principle and applications.

Spectroscopy – Electromagnetic radiation – Beer Lambert's law – UV – Visible – IR – Atomic absorption & flame emission spectroscopy (Principle,Instrumentation, block diagram).

TEXT BOOK: Engineering Chemistry by VMU.

References:

1. A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi

2. Engineering Chemistry by Jain & Jain, 15th edition Dhanpatrai Publishing Company (P) Ltd., New Delhi

3. A text book of Engineering Chemistry by Shashi Chawla,Edition 2012 Dhanpatrai & Co., New Delhi.

4. Engineering Chemistry by Dr.A.Ravikrishnan,Sri Krishna Publications, Chennai

COURSE OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

SEMESTER II	L	T	P	C
C PROGRAMMING	3	0	0	3

(Common for All Branches)

AIM:

The aim is to introduce C programming to the students.

OBJECTIVES:

- To introduce Basics of C
- To understand Control Structures & Arrays
- To learn about String concept, Structure and Union in C
- To introduce the concepts of Functions and Pointers
- To introduce Memory and File management concepts in C

UNIT I - Basics of C **9**

Identifiers, variables, expression, keywords, data types, constants, scope of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators - Special operators: size of () & comma (,) operator - Precedence and associatively of operators - Type conversion in expressions.

UNIT II - Control Structures & Arrays **9**

Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche(), putchar() - Formatted input/output: printf() and scanf() – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and two dimensional arrays.

UNIT III String, Structure & Union **9**

Strings: Declaration-Initialization and string handling functions. Structure and Union: structure declaration and definition – Accessing a Structure variable – Structure within a structure – Union.

UNIT IV Functions and Pointers **9**

Function –Function Declaration–function definition- Pass by value – Pass by reference – Recursive function – Pointers - Definition – Initialization – & and * operators - Pointer to functions-Function returning pointers – Pointers and arrays

UNIT V Memory and File management **9**

Static and dynamic memory allocation - Storage class specifier - Preprocessor directives. File handling concepts – File read – write- Functions for file manipulation: fopen, fclose, gets, puts, fprintf, fscan, getw, putw, fputs, fgets, fread, fwrite - Random access to files: fseek, ftell, rewind - File name as Command Line Argument.

TOTAL HOURS: 45

TEXT BOOKS:

1. Balaguruswami.E, "Programming in C", TMH Publications,1997

REFERENCE BOOKS:

1. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science A Structured Programming using C", Cengage Learning, 3rd Edition, 2007

2. Gottfried , "Programming with C", schaums outline series, TMH publications,1997

3. Mahapatra , "Thinking in C", PHI publications, 2nd Edition, 1998.

4. Subbura.R , "Programming in C", Vikas publishing, 1st Edition, 2000

COURSE OUTCOMES:

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

- Design C Programs for problems.

Write and execute C programs for simple application**s**

SEMESTER II	L	T	P	C
ELECTRONIC DEVICES	3	0	0	3

AIM

To develop the students for handle and work on all major Electronic devices .

OBJECTIVES:

The student should be made to:

- Be exposed to basic electronic devices
- Be familiar with the theory, construction, and operation of Basic electronic devices.

UNIT I-SEMICONDUCTOR DIODES AND SPECIAL PURPOSE DIODES (10 hours)

Overview on Physics and Properties of Semiconductors: Intrinsic semiconductor – extrinsic semiconductor – Fermi level in an intrinsic semiconductor – conductivity of a metal, intrinsic semiconductor and extrinsic semiconductor – drift – diffusion – recombination – carrier life time. Semiconductor diodes: Formation of PN junction – working principle – VI characteristics – Zener Diode – VI characteristics.

UNIT II-BIPOLAR TRANSISTORS (6 hours)

Bipolar Transistors: Construction – working – transistor currents – transistor configurations and input-output characteristics – Early effect (basewidth modulation) – Ebers Moll model – transistor as an amplifier – Transistor as a switch

UNIT III-FIELD-EFFECT TRANSISTORS (8 hours)

Field-Effect Transistors : construction, working and VI characteristics of JFET – comparison of BJT and JFET – MOSFET – enhancement MOSFET, depletion MOSFET, their working principle and VI characteristics, comparison of MOSFET with JFET, comparison of D MOSFET with E MOSFET, CMOS, MESFET, CCD.

UNIT IV-DC POWER SUPPLIES (12 hours)

Rectifiers and Filters : Block schematic of a typical DC power supply, single phase HWR, FWR, full-wave bridge rectifier, power supply filters (ripple factor and efficiency analysis), bleeder resistor, voltage dividers

Voltage regulators: voltage regulation, zener diode shunt regulator, transistor series regulator, transistor shunt regulator, switching regulators, design of complete DC power supply circuit.

UNIT V-INTEGRATED CIRCUIT FABRICATION
(9 hours)

Integrated circuit – advantages and drawback of ICs – scale of integration – classification of ICs – definition of linear IC and digital IC with examples – manufacturing process of monolithic ICs – fabrication of components (diode, capacitor, bipolar transistor, resistor and field – effect transistor) on monolithic IC – comparison of MOS ICs and bipolar ICs.

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 9th Edition, 2009.

2. B. Somanathan Nair, "Electronic Devices and Applications", PHI, 2006

REFERENCES

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill, 2010.

2. David A Bell, "Fundamentals of Electronic Devices and Circuits", Oxford Press, 2009. 3. B L Theraja, R S Sedha, "Principles of Electronic Devices and Circuits", S.Chand, 2004

COURSE OUTCOMES:

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

- Explain the theory, construction, and operation of basic electronic devices.
- Use the basic electronic devices

PRACTICALS

SEMESTER II	L	T	P	C
ENGINEERING CHEMISTRY LAB	0	0	3	2

(REAL & VIRTUAL)

(Common to all branches except Biotechnology)

B.E / B.Tech. - SECOND SEMESTER –CBCS regulations 2015

AIM

To impart in basic knowledge in chemistry so that the student will understand the engineering concept.

To improve the knowledge in the instrument applications.

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality
  parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by Vacometry.

LIST OF EXPERIMENTS:

1. Estimation of total hardness of water sample by EDTA method.
2. Estimation of dissolved oxygen by Winkler's method.
3. Estimation of ferrous ion by Potentiometry.
4. Precipitation reaction by Conductometry.
5. Acid base reaction by pH metry.
6. Estimation of copper from its ore.
7. Estimation of iron by spectrophotometer.
8. Estimation of sodium by flame photometer.
9. Separation of mixture of components using thin layer chromatography.
10. Corrosion experiment by weight loss methods.

COURSE OUTCOMES:

The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

SEMESTER II	L	T	P	C
ENGINEERING GRAPHICS LAB	0	0	3	2

(Common to ALL BRANCHES EXCEPT BIOTECH,BIO-INFO)

AIM: -

- An Introduction Of Cad Software And Its Utilities In Engineering Fields

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

Concepts and conventions (Not for Examination)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 9

Conics – Construction of ellipse-Free hand sketching-Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES 9

Projection of points, Projection of straight lines located in the first quadrant: inclined to both planes – Determination of true lengths and true inclinations – rotating line method only.

UNIT III PROJECTION OF SOLIDS 9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones

UNIT V ISOMETRIC VIEW AND PERSPECTIVE PROJECTION 9

Principles of isometric View – isometric scale – isometric view of simple solids- Introduction to Perspective projection

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, (2003).

2. K. V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).

REFERENCES:

1. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).

2. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).

3. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).

4. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).

5. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD"Tata McGraw Hill Publishing Company Limited (2008).

6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

COURSE OUTCOMES:

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

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.

Develop recursive programs.

SEMESTER II	L	T	P	C
C PROGRAMMING LAB	0	0	3	2

(Common for All Branches)

AIM

To practice and develop applications using C Programming languages.

OBJECTIVES:

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

LIST OF EXPERIMENTS:

1. Write a C Program to Implementation of Sine and cosine series
2. Write a C Program to calculate Simple Interest
3. Write a C Program to generate Fibonacci Series using for loop
4. Write a C program to calculate factorial using while loop
5. Write a C Program to
   a) Find the greatest of three numbers using if condition.
   b) Find the greatest of three numbers using conditional operator.
6. Write a C program for finding the roots of a given quadratic equation using conditional control statements
7. Write a C program to
   a) Compute matrix multiplication using the concept of arrays.
   b) Illustrate the concept of string handling functions.
8. Write a C program to
   a) Find the largest element in an array using pointers.
   b) Convert a binary number to decimal or decimal to binary using functions.
9. Write a C program to read data from keyboard, write it to a file named student again read the same data from student file and write it into data file.
10. Write a C program to store employee details using the concept of structures.

COURSE OUTCOMES:

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

- Design C Programs for problems.
- Write and execute C programs for simple applications

SEMESTER II	L	T	P	C
ELECTRONIC DEVICES LAB	0	0	3	2

AIM

To practice and know functions of major Electronic devices.

OBJECTIVES:

The student should be made to:
Be exposed to the characteristics of basic electronic devices
Be familiar Rectifiers & Regulators

List of Experiments

1. Characteristics of PN junction Diode.
2. Characteristics of Zener diode.
3. Input, Output characteristics of CE Amplifier.
4. Input, Output characteristics of CC Amplifier.
5. Transfer characteristics of JFET.
6. Input, Output characteristics of UJT
7. Half wave rectifier.
8. Full wave rectifier.
9. Voltage Regulator.
10. Simulation experiments using PSPICE.

COURSE OUTCOMES:

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

- Learn the characteristics of basic electronic devices
- Design amplifier circuits & power supplies

SEMESTER –III

YEAR	II	PDE APPLICATIONS AND COMPLEX ANALYSIS	L	T	P	C
SEMESTER	III		3	1	0	4

(COMMON TO BE- CIVIL, EEE, B.TECH-SOLAR AND ALTERNATE ENERGY)

Aim:

To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

Objective:

- To provide the students with the concept and an understanding of Differential equations.
- To orient the students to know about the application of Harmonic analysis.
- To teach the students about the solutions of wave and heat equations.
- To motivate the students to know about the applications of Fourier Series
- To provide the students about the basic concepts of the complex variables.
- To provides the students about the concept of analytic functions and complex integration

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation - Solutions of standard types f(p,q)=0, clairauts form, f(z,p,q)=0,f(p,x)=g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

UNIT IV ANALYTIC FUNCTIONS 12

Function of a complex variable – Analytic function – Necessary conditions - Cauchy Riemann equations – Sufficient conditions (excluding proof) – Harmonic conjugate–Constructions of analytic functions-conformal mapping($w=z+c, w=z^2, w=1/z$)-bilinear transformation

UNIT V COMPLEX ANALYSIS 12

Statement and application of Cauchy‟s integral theorem and integral formula – Taylor's and Laurent‟s expansions –Residues – Cauchy‟s residue theorem-contour integration over unit circle.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. A.Singaravelu,"Transforms and Partial Differential Equations", Meenakshi Agencies, Chennai
2. Kandasamy .P., Thilagavathy. K., and Gunavathy. K., "Engineering Mathematics", Volumes I & II (4th edition), S.Chand & Co., New Delhi.

REFERENCES

1. T. Veerarajan, "Engineering Mathematics" (for semester III), Third Edition Tata McGraw- Hill Publishing Company limited.
2. Grewal, B.S., "Higher Engineering Mathematics" (35th Edition), Khanna Publishers, Delhi 2000.
3. Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons, (Asia) Pte Ltd.,Singapore, 2000.

COURSE OUTCOMES:

- Relate the properties of Fourier series with their engineering subjects during their course of study
- Apply the knowledge gathered in the subject to Signal processing
- Gain the knowledge in vibrations of stretched strings.
- Develop the fundamental ideas of D Alembert's solution of the wave equation
- Understand the concepts of Steady state conditions
- Understand the main properties and examples of analytic functions and be able to compute and manipulate series expansions for analytic functions;
- Use the major integral theorems; and able to identify and classify zeroes and poles of functions and find their residues.
- Analyze the spectral characteristics of continuous time periodic and periodic signals using Fourier series.

YEAR	II	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
SEMESTER	III		3	1	0	4

AIM

- To study concepts of basic circuits, Network theorems, resonance and coupled circuits, balanced and unbalanced circuits and transient analysis of circuits.

OBJECTIVE:

- To understand basic circuit concepts.
- To study networks and solution of DC and AC circuits.
- To understand series and parallel resonance concepts and analysis of coupled circuits.
- To study protection of balanced and unbalanced loads and measurement of power and power factor in three phase circuits.
- To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

UNIT I BASIC CIRCUIT CONCEPTS 9

Review of basic concepts- DC & AC circuits - R, L, and C elements phasor diagrams-Complex impedance - Real & Reactive power- Series & Parallel circuits– Formation of matrix equations and analysis of complex circuits using mesh- Current and nodal - Voltage methods.

UNIT II NETWORK THEOREMS AND TRANSFORMATIONS. 9

Voltage – Current – Source transformation. Star Delta transformation - Superposition theorem – Reciprocity theorem – Substitution theorem – Maximum Power Transfer theorems – Thevenin's theorem – Norton's theorem and Millman's theorem with applications.

UNIT III RESONANCE AND COUPLED CIRCUITS 9

Series resonance and parallel resonance – Bandwidth and Q factor. Inductively coupled circuits - Coeffiecient of coupling - Dot convention - Multi winding coupled circuits - Analysis of coupled circuits.

UNIT IV THREE PHASE CIRCUITS 9

Analysis of three phase 3 wire and 4 wire circuits with star and delta connected balanced and unbalanced loads- phasor diagram of Voltages and Currents – Measurement of power and power factor in three phase circuits by using single, two and three Watt meter method.

UNIT V TRANSIENT ANALYSIS 9

Transient response – Natural response- forced response – DC response of RL, RC and RLC circuits – sinusoidal response of RL, RC, RLC circuits

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Dr.S. Arumugam, Premkumar, Circuit Theory - Khanna publishers,1991
2. Sudhakar, A. and Shyam Mohan S.P.,'Circuits and Network Analysis and Synthesis', Tata McGraw-Hill Publishing C.Ltd., New Delhi, 2006.

REFERENCES

1. Prof.T.Nageswara Rao,"Electric circuit analysis" A.R.Publications.
2. Hyatt, W.H. Jr and Kemmerly, J.E., 'Engineering Circuits Analusis', McGraw-Hill International Editions, 2002.
3. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 5th Edition, 2011.

COURSE OUTCOMES :

- To understand basic circuit concepts.
- To study networks and solution of DC and AC circuits.
- To understand series and parallel resonance concepts and analysis of coupled circuits.
- To study protection of balanced and unbalanced loads and measurement of power and power factor in three phase circuits.
- To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

YEAR	II	POWER PLANT ENGINEERING	L	T	P	C
SEMESTER	III		3	0	0	3

(COMMON TO MECHANICAL ENGINEERING & EEE)

AIM:

To Understand the concept of various Power plants , Non conventional and Energy Conversion systems

OBJECTIVE :

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I **9**

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

UNIT II **9**

Steam Power Plants : Layout and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Gas Turbine and Combined Cycle Power Plants : Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles.

UNIT III **9**

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors,

low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

UNIT IV **9**

Power Plant Economics: Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants-incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

UNIT V **9**

Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

TOTAL HOURS : 45

TEXT BOOKS

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
2. Power Plant Engineering: P.K. Nag Tata McGraw Hill second Edition 2001.

REFERENCE BOOKS

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

COURSE OUTCOMES:

- Able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

YEAR	II	ELECTRICAL MACHINES – I	L	T	P	C
SEMESTER	III		3	0	0	3

AIM:

- To study the fundamental principles of Electrical machines and the characteristics of D.C Machines and Transformer

OBJECTIVE:

- To understand the basic concepts of magnetic circuits, induced emf and torque.
- To familiarize the constructional details, principle of operation, performance, methods of
- testing of transformers and three phase transformer connections.
- To introduce the principles of electro mechanical energy conversion in single and multiple excited systems.
- To study the working of electrical machines using the concepts of electro mechanical energy conversion principles and derive expressions for generated voltage and torque produced.
- To study the working principles of DC machines as generator and motor, determination of their no load/load characteristics, starting and speed control of DC motors.

UNIT I INTRODUCTION 6

Electrical machines types – Magnetic circuits – Inductance – Statically and dynamically induced EMFs - Torque – Hysteresis – Core losses – AC operation of magnetic circuits.

UNIT II TRANSFORMERS 12

Principle of operation,types,constructional features of single phase transformer- EMF equation- transformer on no load and on load- effects of resistance and leakage reactance of the windings- phasor diagram- equivalent circuit – regulation and efficiency – Three phase transformer – constructional features and connection zig-zag connection- auto transformer- all day efficiency- Sumpner's test- parallel operation of transformer- off load and on load tap changing transformers.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION 9

Principles of energy conversion – Energy in magnetic systems – Field energy, co-energy and mechanical force -coupling field reaction- energy storage in singly and multiple excited systems- electromechanical transducers.

UNIT IV BASIC CONCEPTS IN ROTATING MACHINES 9

Generated voltages in AC and DC machines – mmf of distributed windings –concepts of rotating machines – rotating mmf waves – Torque in AC and DC machines.

UNIT V DC MACHINES 9

Constructional features of DC machines- EMF equation – armature winding fundamentals- characteristics of different types of dc generators- commutation and armature reaction in DC machines –torque equation- types – characteristics –starters- speed control - Swinburne's test-

Hopkinson's test- retardation test- load test- electric braking- parallel operation of DC generators.

LECTURE HOURS : 45

TEXT BOOKS

1. Dr.S.K.Bhattacharya, " Electrical Machines" Tata McGraw Hill Publishing, New Delhi,1998

2. Nagrath I.J. And Kothari D.P. "Electric Machines "Tata McGraw Hill Publishing, New Delhi, 2002

REFERENCES

1. Dr.K. MurugeshKumar,"Dc Machines & Transformers" Vikash Publishing House Pvt Ltd, 2nd Edition,2000

2. FitzgeraldA.E.,CharlesKingsleyjr,Stephen D.Umans,"Electric Machinery" Tata Mc Graw Hill, 6 rev edition, 2002

3. Syed a. Nassar," Electric Machines and Power Systems" volume-1 Electric Machines, Tata McGraw Hill,Newyork-1995

COURSE OUTCOMES :

Upon the completion of the course, the student will be able to

1. Understand the constructional details and principle of operation of DC machines and Transformers.
2. Analyze the performance of the DC Machines under various operating conditions using their various characteristics.
3. Evaluate the performance of Transformers using phasor diagrams and equivalent circuits.
4. Select appropriate DC motor as well as to choose an appropriate method of speed control for any industrial application.

YEAR	II	MATHEMATICAL MODELLING AND SIMULATION	L	T	P	C
SEMESTER	III		3	1	0	4

AIM:

To study the fundamentals of SCILAB and its programme to solve the mathematical and analytical solutions of electrical and science problems

OBJECTIVE:

- To understand the basic environments of SCILAB.
- To study and familiarize graphical tools of SCILAB.
- To study and understand the programmers of mathematical solution of SCILAB.
- To understand the interfacing tools of SCILAB , latex techniques.
- To design the real time applications of basic electrical circuits.

UNIT I INTRODUCTION 9

Introduction to SCILAB – Constants – Data types – SCILAB Syntax – Data type related functions – Overlaoading.

UNIT II GRAPHICAL ANALYSIS USING SCILAB 9

The media – global plot parameters – 2D and 3D plotting – examples – printing graphics and exporting to Latex.

UNIT III SCILAB PROGRAMMING 9

Linear algebra – Polynomial and rational function manipulation – Sparse matrices – random numbers – cumulative distribution functions and their inverse – building interface programs – inter SCI – dynamic linking – static linking.

UNIT IV SCILAB TOOLS 9

Systems and control toolbox – improper systems – system operation – control tools classical control – state space control – model reduction – identification – linear matrix inequalities – integrating ODEs – integrating DAEs.

UNIT V APPLICATIONS 9

Resistive circuits – inductive and capacitive circuits – transients – steady state analysis – logics circuits – electronic devices - DC machines

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Claude Gomez Engineering and Scientific Computing with SCILAB, Birkhauser publications

REFERENCE BOOKS

1. Simulation of ODE / PDE models with MATLAB, OCTAVE AND SCILAB : Scitific And Engineering Applications, A. Vande Wouwer, P. Saucez, C.V. Fernandez 2014 Isbn: 978-3319067896
2. http:// www.scilab.org/

COURSE OUTCOMES :

Upon the completion of the course, the student will be able to

- Understand the software of scilab.
- Design and develop the basic programmers of electrical science problems.
- Design the latex interfacing techniques.
- Design a suitable program for real time electrical applications .

YEAR	II	DIGITAL ELECTRONICS	L	T	P	C
SEMESTER	III		3	1	0	4

AIM

- The Aim of this course is to develop a strong foundation in analysis and design of digital electronics.

OBJECTIVES

- Understand the basic concepts.
- Understand concepts of logic gates constructional features.
- To understand the concepts of gate-level minimization & combinational logic.
- To analyze synchronous sequential logic.

UNIT I NUMBER SYSTEM 9

Digital System, Binary Numbers, Number-Base Conversions, Octal & Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage And Registers, Binary Logic

UNIT II BOOLEAN ALGEBRA, LOGIC GATES & GATE –LEVEL MINIMIZATION 9

Introduction, Boolean algebra, basic theorem & properties of Boolean algebra, Boolean functions, canonical & standard forms, logic operations, logic gates, integrated circuits, map method, four variable K-maps, product of sums simplification, don't care conditions, NAND & NOR implementations, Exclusive-OR Function, Hardware Description Language.

UNIT III COMBINATIONAL LOGIC 9

Introduction, Combinational Circuits, Analysis Procedure, Design Procedure ,Binary Adder-Subractor , Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders , Multiplexers , HDL Models Of Combinational Circuits.

UNIT IV SYNCHRONOUS SEQUENTIAL LOGIC, REGISTER & COUNTERS 9

Sequential circuits, storage elements: latches, flip flops, analysis of closed sequential circuits, synthesizable HDL Models of sequential circuits, state reduction assignment, design procedure, shift registers, ripple counters, synchronous counters, HDL for registers and Counters.

UNIT V DESIGN AT THE REGISTER TRANSFER LEVEL 9

Register Transfer Level Notation, Register Transfer Level In HDL, ASM, Sequential Binary Multiplier, Control Logic, HDL Description Of Binary Multiplier, Design With Multiplexers, Race Free Design, Latch Free Design.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Morris Mano, “Digital Design(with an introduction to the verilog HDL)", Prentice-Hall of India, (UNITS-I,II,III,IV,V)

REFERENCE BOOKS

1. William I. Fletcher, “An Engineering Approach to Digital Design ", Prentice-Hall of India, 1980
2. Floyd T.L., “Digital Fundamentals ", Charles E. Merrill publishing Company, 1982.
3. Tokheim R.L., “Digital Electronics - Principles and Applications ", Tata McGraw Hill, 1999.
4. Jain R.P., “Modern Digital Electronics ", Tata McGraw Hill, 1999.

COURSE OUTCOMES :

Upon completion of the course, the student will be able to

1. Interpret, convert and represent different number systems.

2. Manipulate and examine Boolean algebra, logic operations, Boolean functions and

their simplification.

3. Design and analyze combinational and sequential logic circuits.

YEAR	II	ELETRIC CIRCUITS AND DEVICES LABORATORY	L	T	P	C
SEMESTER	III		0	0	4	2

(COMMON TO EEE& MECHT)

AIM

- To verify practically, the fundamental characteristics of Electron Devices and various theorems.

OBJECTIVES

- To verify the various theorems
- To study experimentally the characteristics of diodes, BJT's and FET's.
- To verify practically, the response of various special purpose electron devices.

LIST OF EXPERIMENTS

1) Verification of Thevenin's and Norton's Theorem.
2) Verification of super position and compensation Theorem.
3) Verification of Reciprocity and Maximum Power Transfer Theorem.
4) Series and Parallel Resonance Circuits.
5) Transients in RLC Circuits.
6) Series and Parallel AC Circuits and Phasor Diagram.
7) Coupled Circuits and Tuned Circuits.
8) Characteristics of Transistor under common Emitter configuration.
9) Characteristics of Transistor under Common Base Configuration.
10) Characteristics of Transistor under Common collector configuration.
11) Characteristics of UJT and FET.
12) Characteristics of SCR, DIAC and TRIAC.

TOTAL HOURS 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

Students are exposed to experimental knowledge on analysing the electric circuits and electronic devices

YEAR	II	ELECTRICAL MACHINES – I LABORATORY	L	T	P	C
SEMESTER	III		0	0	4	2

AIM : To acquire fair knowledge on the working of various DC machines and Transformers.

OBJECTIVES:

1. Rig up circuits for testing a given Electrical machine.
2. Obtain the performance characteristics of Electrical machines.
3. Simulate the circuits of DC machines

1. Load test on dc shunt motor

Aim: To conduct load test on dc shunt motor and plot its performance characteristics.

2. Load test on dc series motor

Aim: To conduct load test on dc series motor and plot its performance characteristics.

3. Speed control of dc shunt motor

Aim: To control the speed of a dc shunt motor by (i) armature control and (ii) field control methods.

4. OCC & load test on dc self and separately excited generator

Aim: To conduct OCC and load test on dc self and separately excited generators.

5. OCC& load test on dc shunt generator

Aim: To conduct OCC and load test on dc shunt generator.

6. Load test on dc compound generator

Aim: To conduct load test on dc compound generator.

7. Load test on single phase transformer

Aim: To conduct load test on single phase transformer and determine its efficiency and regulation.

8. OC&SC test on single phase transformer

Aim: To conduct open circuit and short circuit tests on single phase transformer and hence determine the parameters of the equivalent circuit.

9. Swinburne's test

Aim: To conduct Swinburne's test on a dc shunt motor and predetermine its efficiency as a (i) generator and (ii) motor.

10. Separation of Losses in single phase transformer.

Aim: To determine the no load losses in a single phase transformer.

11. Hopkinson's test

Aim: To conduct Hopkinson's test and predetermine its efficiency of a dc machine as a

(i) generator and (ii) motor.

12. Sumpner's test on 1-phase transformer

Aim: To conduct Sumpner's test on a single phase transformer and predetermine its efficiency.

13. Study of three phase transformer connections.

Aim: To study the various three phase transformer connections.

14. Study of DC Starters.

Aim: To study the different types of DC motor starters.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

- Complete performance characteristics of DC machines and transformers are obtained.
- Speed control of DC shunt motor above and below rated speed is studied.
- DC motor starters and Three phase transformer connections are studied.

YEAR	II	DIGITAL ELECTRONICS AND SIMULATION LABORATORY	L	T	P	C
SEMESTER	III		0	0	4	2

DIGITAL ELECTRONICS LABORATORY

AIM:

- To provide the knowledge of design and implementation of digital circuits using logic gates and flip flops.

OBJECTIVES:

- Designing the basic digital circuits like adders, subtractors, code converters, magnitude converters using logic gates and counters using flip flops.

LIST OF EXPERIMENTS:

1. Design and implementation of Adders using logic gates
2. Design and implementation of Subtractors using logic gates
3. Design and implementation of BCD to Excess -3 code converter using logic gates
4. Design and implementation of Binary to Gray code converter using logic gates
5. Design and implementation of 4 bit BCD adder using IC 7483
6. Design and implementation of 2 Bit Magnitude comparator using logic gates

SIMULATION LABORATORY

AIM:

To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation using MATLAB

OBJECTIVES:

To gain the practical hand-on experience of various operations using MATLAB

LIST OF EXPERIMENTS:

1. Calculate area of the triangle USING MATLAB
2. Perform Multiple operation on matrix using MATLAB
3. Perform Arithmetic operation using MATLAB.
4. Write a program to demonstrate the use of plot command.
5. Write a program to demonstrate the use of hold command
6. Division of figure windows into sub windows in MATLAB

TOTAL HOURS: 45

REFERENCE BOOKS: Laboratory reference manual.

COURSE OUTCOMES:

- To understand and examine the structure of various number system and its application in digital design
- Ability to understand analyse and design various combinational and sequential circuits
- will have a thorough understand of the fundamental concepts and techniques used in MATLAB

SEMESTER -IV

YEAR	II	NUMERICAL METHODS	L	T	P	C
SEMESTER	IV		3	1	0	4

(COMMON TO MECH, AERO, AUTO, MECT, CIVIL, & EEE)

AIM:

To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

OBJECTIVE:

- To provide the knowledge in solving different types of equations.
- To apply appropriate numerical methods to solve a linear system of equations
- To equip the students with interpolation, numerical differentiation and numerical integration techniques.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Method of false position, Newton-Raphson method for single variable, Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss- Seidel methods. Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by Power Method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling's and Bessel's).

UNIT IIINUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th)}$ rules. Rombergs rule, Two and Three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rule.

UNIT IV INITIAL VALUE PROBLEMS OF ODE 12

Solution of equations related to simple harmonic motion, Oscillations of a spring mass system, Simple pendulum, Oscillatory electrical circuit and Deflection of beams with initial conditions - using Taylor series. Euler, Modified Euler and Runge-Kutta methods.

UNIT V BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. N. Subramanian, "Numerical Methods", SCM Publishers, Erode.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.

REFERENCES

1. Sastry, S.S., "Introductory Methods of Numerical Analysis (Third Edition)", Printice Hall of India, New Delhi, 1998.
2. T.Veerarajan, T. Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2004).
3. Grewal, B.S. and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, New Delhi, 1999.
4. A. Singaravelu, "Numerical Methods", Meenakshi Agency, Chennai

COURSE OUTCOMES :

The students will be able to

- Relate their subject knowledge with their experiments during their course of study.
- Understand the use of numerical methods in modern scientific computing with finite precision computation.
- Solve an algebraic or transcendental equation using an appropriate numerical method.
- Solve their engineering problems using interpolation techniques.
- Understand the calculation and interpretation of errors in numerical methods.
- Identify the numerical techniques for their engineering problem.

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YEAR	II	TRANSMISSION & DISTRIBUTION	L	T	P	C
SEMESTER	IV		3	0	0	3

AIM

- To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES:

- To understand structure of electric power systems, its various operating voltages.
- To study transmission line parameters for different systems and corona effect.
- To understand modeling and performance of different transmission lines.
- To study different types of insulators and constructional features of HT & LT cables.
- To understand classification and functions of major components of substations.

UNIT I INTRODUCTION 9

Structure of electric power system – different operating voltages of generation, transmission and distribution –advantage of higher operating voltage for AC transmission. An introduction to HVDC and EHV AC transmission. FACTS Devices Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters resistance, inductance and capacitance calculations – single and three phase transmission lines – single and double circuits - solid, stranded and bundled conductors - symmetrical and unsymmetrical spacing - transposition of lines – concepts of GMR and GMD - Skin and Proximity effects - interference with neighbouring communication circuits – Corona discharge - characteristics – critical voltage and loss. (Simple diagrams of typical towers and conductors for 400, 220 ,110,66 and 33 kV operations)

UNIT IIIMODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Transmission line classification – short line, medium line and long line – equivalent circuits – Ferranti effect – surge impedance, attenuation constant and phase constant – voltage regulation and transmission efficiency – real and reactive power flow in lines – power circle diagrams – shunt and series compensation. An introduction to power angle diagram – surge – impedance loading, loadability limits based on thermal loading; angle and voltage stability considerations.

UNIT IV INSULATORS AND CABLES 9

Classification of insulators for transmission and distribution purpose – voltage distribution in insulator string and grading – improvement of string efficiency. Underground cables – constructional features of LT and HT cables – insulation resistance, capacitance, dielectric stress and grading – tan δ and power loss – thermal characteristics.

UNIT V SUBSTATION , GROUNDING SYSTEM AND DISTRIBUTION SYSTEM 9

Classification functions and major components of substations. Bus-bar arrangements – substation bus schemes – single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker- and - a half with two main buses, double bus-bar bypass isolators. Importance of earthing in a substation. Qualitative treatment to neutral grounding and earthing practises in substations. Feeders, distributors and service mains. DC distributor – 2 - wire and 3 - wire, radial and ring main distribution. AC distribution - single phase and three phase 4 -wire distribution.

TOTAL HOURS : 45

TEXT BOOKS

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCE BOOKS

1. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4. 'Tamil Nadu Electricity Board Handbook', 2003.

COURSE OUTCOMES :

Upon completion of the course, the student will

1. Understand the major components of Transmission and Distribution Systems (TDS) and its practical significance.

2. Have good Knowledge of various equipment specifications and design for TDS.

3. Have awareness of latest technologies in the field of electrical transmission and distribution.

YEAR	II	ELECTRICAL MACHINES-II	L	T	P	C
SEMESTER	IV		3	0	0	3

AIM

- To study the theory, operation and performance of AC machines.

OBJECTIVES

- To impart knowledge on construction and performance of salient and non – salient type synchronous generators.
- To understand the principle of operation and performance of synchronous motor.
- To gain knowledge about construction, principle of operation and performance of induction motor.
- To gain knowledge about the starting and speed control methods of three-phase induction motors.
- To understand the Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONUS GENERATOR 9

Construction - types of rotor - EMF equation - synchronous reactance - synchronous impedance- armature reaction - voltage regulation - EMF,MMF,ZPF and ASA methods -synchronizing - parallel operation –salient pole synchronous machines- two reaction theory - determination of $X_{d\ and}X_q$using slip test - operating characteristics - capability curves.

UNIT IISYNCHRONOUS MOTOR 9

Principle of operation - starting methods - torque equation - synchronous motor on no load and load - operation of synchronous motor at constant load - variable excitation - V curve and inverted V curve – hunting.

UNIT III THREE PHASE INDUCTION MOTOR 9

Construction and types of rotor - principle of operation - slip-torque equation -equivalent circuit - slip torque characteristics - condition for maximum torque - losses and efficiency - load test - no load and blocked rotor tests - circle diagram – cogging and crawling - separation of no load losses - double cage rotors - induction generator - synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting - types of starters - stator resistance and reactance starters, rotor resistance starter, auto transformer and star-delta starters - speed control - change of voltage - change of number of poles - change of frequency - cascade connection - slip power recovery scheme.

UNIT V SINGLE PHASE INDUCTION MOTOR AND SPECIAL MACHINES 9

Construction of single phase induction motor - double revolving field theory - equivalent circuit - load characteristics - starting methods of single phase induction motor - variable reluctance motor -

stepper motor - hysteresis motor - AC series motor -repulsion motor - linear induction motor - permanent magnet DC and AC motors.

TOTAL HOURS: 45

TEXT-BOOK

1. Nagrath I.J and Kothari D.P, "Electrical machines", T.M.H publishing co-Ltd, New delhi,1997
2. B.L .Theraja and A.K Theraja, "A text book of Electrical Technology-volume-II", McGraw Hill, Newyork, 1995.

REFERENCE BOOK

1. Syed A.Narser, "Electrical Machines and Power System-volume-II", McGraw Hill, Newyork, 1995
2. J.B Gupta, "Theory and performance of Electrical Machines", S.K Kataria and sons, Delhi.
3. Fitzgerald , A.E. Charles Kingsley Jr.. Stephen D. Umans , " Electric Machinery ".McGraw Hill Book Company , 1992.

COURSE OUTCOMES :

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

1. Understand the constructional details and principle of operation of AC Induction and Synchronous Machines.
2. Understand and appraise the principle of operation and performance of PMBLDC machines.
3. Analyze the performance of the AC Induction and Synchronous Machines using the phasor diagrams and equivalent circuits.
4. Select appropriate AC machine for any application and appraise its significance.

YEAR	II	ELECTRO MAGNETIC THEORY	L	T	P	C
SEMESTER	IV		3	1	0	4

AIM

- To introduce the fundamentals of electromagnetic fields and their applications in Engineering.

OBJECTIVE:

- To impart knowledge on electrostatics, electrical potential, energy density and their applications.
- To familiarize the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To understand Faraday's laws, Maxwell's equations, induced emf and their applications.
- To understand the concepts of electromagnetic waves and pointing vector.
- To understand the concepts of field modelling and computation.

UNIT I ELECTROSTATICS 9

Introduction– Charge - Coulomb's law - Continuous charge distribution - Electric field intensity - Electric flux - Gauss's law – Potential - boundary value problems - Laplace and Poisson's equations - Electrostatic energy – dielectrics - Capacitance.

UNIT II MAGNETOSTATICS 9

Current Density - Magnetic field - Magnetic flux - Magnetic flux density - Biot-Savart's law - Ampere's law - torque – force - vector potential - boundary value problem.

UNIT IIIELECROMAGNETIC FIELDS 9

Faraday's law - Lenz's law - Self inductance - mutual inductance - co-efficient of coupling - Dot rule for coupled circuits - series, parallel - inductance of solenoid, Toroid, Maxwell's equations (boundary conditions) - displacement current - eddy current - Difference between field theory and circuit theory .

UNIT IV ELECTROMAGNETIC WAVES 9

Introduction - Solution of wave equation in free space - Conducting media -Uniform plane wave propagation, phase velocity, Group velocity - Conductors and transmission lines - Pointing vector - Skin effect.

UNIT V FIELD MODELLING AND COMPUTATION 9

Problem formulation - boundary conditions – solutions - analytical methods - variables separable methods - conformal transformation - method of images - numerical methods - finite difference method - finite element method - charge simulation method

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. John D Kraus, 'Electromagnetics', McGraw-Hill Book Co., New York, Third Edition, 1989.
2. Joseph A Edminister, 'Theory and Problems of Electro magnetics', Schaums outline series McGraw-Hill book company New York, 1995.
3. William H.Hayt, Jr., 'Engineering Electromagnetic,' Tata McGraw-Hill Edition, New Delhi, 1998.

REFERENCES

1. David J Griffith, 'Introduction to Electrodynamics,' Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 1997.
2. Richard E. Dubroff, S.V.Marshall, G.G.Skitek, 'Electromagnetic Concepts and Applications', Fourth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1996.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw-Hill International Editions Fifth Edition 1999.

COURSE OUTCOMES :

- Ability to understand Electro-magnetic field theory and apply them to electrical engineering problems

YEAR	II	ELECTRONIC CIRCUITS	L	T	P	C
SEMESTER	IV		3	0	0	3

(COMMON TO BME, ECE EEE)

AIM

- The aim of this course is to introduce to the students the rectifiers, power supplies, basics of biasing transistor circuits, low frequency amplifiers, multi stage amplifiers, power amplifiers, tuned amplifiers, feedback amplifiers and oscillators.

OBJECTIVES

- To study the biasing circuits and analyze the small signal BJT amplifiers
- To understand the working and to find the efficiency of different types of large signal amplifiers
- To understand the basic concept and working of various types of feedback amplifiers and oza\za\0 scillators.
- To understand the working of types of tuned amplifiers and multi vibrators and their analysis.

UNIT I BIASING CIRCUITS AND SMALL SIGNAL MODELS 9

Biasing circuits: DC load line and bias point – BJT biasing circuits – FET biasing circuits. Small-signal models: AC load line, BJT models and parameters – hybrid equivalent model – hybrid π model, FET small-signal model and parameters.

UNIT II SMALL SIGNAL AMPLIFIERS - ANALYSIS AND FREQUENCY RESPONSE 9

BJT amplifiers: CE, CB and CC amplifiers – multistage amplifiers - differential amplifier – designing BJT amplifier networks.(Analysis using hybrid –π model) FET amplifiers: CS, CG and CD amplifiers –designing FET amplifier networks Frequency response: low frequency response of BJT and FET amplifiers – Miller effect capacitance – high frequency response of BJT and FET amplifiers.

UNIT III FEEDBACK AND OSCILLATOR CIRCUITS 9

Feedback circuits: concept of feedback – effects of negative feedback – feedback connection types – practical feedback circuits – phase and frequency considerations – designing feedback amplifier circuits – Applications of feedback circuits. Oscillator circuits: oscillator principles – LC oscillators – RC oscillators – crystal oscillators – designing oscillator circuits – Applications of oscillators in real time circuits.

UNIT IV POWER AMPLIFIERS AND TUNED AMPLIFIERS 9

Power amplifiers: definitions and amplifier types – Q point placement – maximum dissipation hyperbola – Class A amplifier – Class B and Class AB push-pull amplifiers – Class C amplifiers – Amplifier distortions – heat sink – designing power amplifier circuits. Tuned amplifiers: need for tuned circuits – single tuned – double tuned – synchronously tuned amplifiers – impedance matching to improve gain – design of basic tuned amplifier – Real Time Applications of amplifiers.

UNITV SOLID STATE SWITCHING CIRCUITS 9

Types of waveforms – transistor switching times – multivibrators – astablemultivibrator – monostablemultivibrator – bistablemultivibrator – schmitt trigger – design of multivibrators and Schmitt trigger – Applications of switching circuits.

TOTAL HOURS: 45

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 9th Edition, 2009.
2. David A Bell, "Fundamentals of Electronic Devices and Circuits", Oxford University Press, 2009.
3. David A. Bell, "Solid State Pulse Circuits", Oxford University Press, 2007.

REFERENCES

1. Jacob Millman, Christos C Halkias, SatyabrataJit, "Electron Devices and Circuits", Tata McGraw Hill, 2010.
2. Thomas L. Floyd, "Electronic Devices", 9th edition, Pearson Education, 2011.
3. Albert P. Malvino, David J. Bates, "Electronic Principles", 7th edition, Tata McGraw Hill, 2007.

COURSE OUTCOMES :

- Able to explain the structure of the basic electronic devices.
- Able to design applications using the basic electronic devices.

YEAR	II	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
SEMESTER	IV		3	0	0	3

AIM

To provide adequate knowledge in Electrical and electronic measurements and instrumentation

OBJECTIVES:

- To make the students to gain a clear knowledge of the fundamental elements of an instrument and static and dynamic characteristics.
- Emphasis is laid on the meters used to measure current & voltage and instrument transformers.
- To have an adequate knowledge in the measurement techniques for power and energy meters are included.
- To have basic knowledge about output display devices.
- Elaborate discussion about transducer and its classification.

UNIT I INTRODUCTION 6

Functional elements of an instrument - static and dynamic characteristics – errors in measurement - statistical evaluation of measurement data - standard and calibration**.**

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 12

Principle and types analog and digital ammeters and voltmeters – single and three phase Wattmeters and Energy meter– instrument transformers – instruments for measurement of frequency and phase.

UNIT III SIGNAL CONDITIONING CIRCUITS 9

Bridge circuits – differential and Instrumentation amplifiers - filter circuits - V/f and f/V converters – A/D and D/A converters - multiplexing and demultiplexing - data acquisition systems – grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 8

Magnetic disc and tape recorders – digital plotters and printers – CRT displays – digital CRO – LED, LCD and Dot matrix displays. Data Logger

UNIT V TRANSDUCERS 10

Classification of transducers – selection of transducers – resistive, capacitive and inductive transducers – piezo electric transducers – optical and digital transducers. - transducers for measurement of displacement, temperature, level, flows, pressure, velocity, torque, speed. Smart sensor.

TOTAL HOURS: 45

TEXT BOOKS

1. Doebeling, E.O., 'Measurement Systems – Application and Design', McGraw Hill Publishing Company, 1990.
2. H.S. Kalsi, ‘Electornic Instrumentation’, TMH Co., 1995.

REFERENCES

1. John P. Bentley, ‘Principles of Measurement Systems’, III Edition, Pearson Education, 2000.
2. Stout M.B., 'Basic Electrical Measurement', Prentice Hall of India, 1986.
3. Dalley, J.W., Riley, W.F. and Meconnel, K.G., 'Instrumentation for Engineering Measurement', John Wiley & Sons, 1993
4. Moorthy, D.V.S., 'Transducers and Instrumentation', Prentice Hall of India Pvt. Ltd., 1995.

COURSE OUTCOMES :

Upon completion of the course, the student will be able to

1. Describe the working principle of different measuring instruments.

2. Choose appropriate measuring instruments for measuring various parameters in their laboratory courses.

3. Correlate the significance of different measuring instruments, recorders and oscilloscopes.

4. Develop a micro-processor based measuring unit for any practical application.

YEAR	II	ELECTRICAL MACHINES – II LABORATORY	L	T	P	C
SEMESTER	IV		0	0	4	2

AIM:

To understand the various performance characteristics of motors and generator and methods of starting .

OBJECTIVES

- To study the performance characteristics of induction motors and synchronous induction
- motor.
- To study the predetermination of voltage regulation of synchronous generator.
- To study the variation in reluctance in salient pole machine.

- To predetermine the characteristics of single phase and three phase induction motors.

LIST OF EXPERIMENTS

1. **Regulation of 3-phase alternator by EMF and MMF methods.**
   Aim: To predetermine the regulation of 3-phase alternator by EMF and MMF methods.
2. **Regulation of 3-phase alternator by ZPF and ASA method.**
   Aim: To predetermine the regulation of 3-phase alternator by ZPF and ASA methods.
3. **Slip test on 3-phase alternator.**
   Aim: To predetermine the regulation of 3-phase alternator by conducing slip test.
4. **Load characteristics of 3-phase alternator by bus bar loading**
   Aim: To synchronize 3-phase alternator with bus bar and determine its load characteristics.
5. **V and inverted V curve of synchronous motors.**
   Aim: To draw the V and inverted V curves of synchronous motor.
6. **Load test on 3-phase induction motor (s).**
   Aim: To conduct load test on 3-phase squirrel cage induction motor and determine its performance characteristics.
7. **No load and blocked rotor test on 3-phase induction motor.**
   Aim: To conduct no load and blocked rotor tests on 3 phase squirrel cage induction motor and obtain the parameters of the equivalent circuit.
8. **Study of Synchronous induction motor.**
   Aim: To study the operation of Synchronous induction motor.
9. **Study of induction motor starters.**
   Aim: To study the various induction motor starters
10. **Separation of losses in three-phase induction motor.**
    Aim: To determine the no load losses in three-phase induction motor.
11. **Load test on 1-phase induction motor.**
    Aim: To conduct load test on single phase induction motor and determine its performance characteristics.

12. **Equivalent circuit and pre – determination of performance characteristics of single-phase induction motor.**
    Aim: To conduct no load and blocked rotor tests on single phase induction motor and determine the parameters of equivalent circuit.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

- Characteristics of induction and synchronous machines are studied using direct and in
- direct methods.
- Regulation of three phase alternator is predetermined using optimistic, pessimistic and
- accurate method are done.
- Saliency nature of synchronous machine is studied.
- Performance of single-phase induction motor is obtained.

YEAR	II	ELECTRONIC CIRCUITS LABORATORY	L	T	P	C
SEMESTER	IV		0	0	4	2

(COMMON TO BME, ECE EEE)

AIM

- To provide the ability to design the electronic circuits using the basic electronic components.

OBJECTIVE

- To study the characteristics of basic amplifiers and power supply.
- To verify practically, the response of various oscillators.
- To study of different Multivibrator circuits.

LIST OF EXPERIMENTS

Design

1. Fixed Bias amplifier circuits using BJT.
2. BJT Amplifier using voltage divider bias (self-bias) with un bypassed emitter resistor.
3. Class B Complementary symmetry power amplifier.
4. Differential amplifier using BJT.
5. Power supply Full wave rectifier with simple capacitor filter.
6. Series and Shunt feedback amplifiers Frequency response, Input and output impedance calculation.
7. Design of RC Phase shift oscillator:
8. Design Wein Bridge Oscillator.
9. Design of Hartley and Colpitts Oscillator.
10. Design of Astable and Monostable and BistableMultivibrators.

TOTAL HOURS : 45

REFERENCE BOOKS: Laboratory reference manual.

COURSE OUTCOMES:

- Operating principles, characteristics of semiconductor devices
- are studied, simulated and verified.
- Features of amplifiers and oscillators are verified.

YEAR	II	MEASUREMENTS AND INSTRUMENTATION LABORATORY	L	T	P	C
SEMESTER	IV		0	0	4	2

AIM

- To acquire skills on using Measuring devices and Instruments.

OBJECTIVES:

- To understand the operation of AC and DC Bridges
- To calibrate the different types of meters and special instruments

LIST OF EXPERIMENTS

1. Study of temperature measuring transducers (Thermocouples).
2. Study of displacement and pressure transducers (LVDT).
3. AC Bridges.
4. DC Bridges.
5. Instrumentation amplifiers..
6. A/D and D/A converters.
7. Study of Transients.
8. Torque and angle measurement.
9. Calibration of Single phase Energy meter.
10. Calibration of Three phase Energy meter.
11. Measurement of Three phase power and power factor.

TOTAL HOURS : 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES:

- Will be able to understand and apply basic science, circuit theory, theory control theory signal processing and apply them to electrical engineering problems.

SEMESTER -V

YEAR	III	POWER ELECTRONICS	L	T	P	C
SEMESTER	V		3	0	0	3

AIM

- To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, IGBT, MOSFET – Computer simulation of PE circuits.

UNIT II PHASE CONTROLLED CONVERTERS 9

2 pulse / 3 pulse and 6 pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters.

UNIT III DC TO DC CONVERTERS 9

Stepdown and stepup chopper – Forced commutation techniques – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost – concept of resonant switching.

UNIT IV INVERTERS 9

Single phase and three phase [120^o & 180^o mode] inverters – PWM techniques – Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – current source inverter.

UNIT V AC TO AC CONVERTERS 9

Single phase AC voltage controllers – Multistage sequence control – single phase and three phase cycloconverter – power factor control – Matrix converters.

TOTAL HOURS : 45

TEXT BOOKS

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCES

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

COURSE OUTCOMES :

Upon completion of the course, the student will be able to

1. Understand the principle of operation of commonly employed power electronic converters.
2. Analyze non -linear circuits with several power electronic switches.
3. Equipped to take up advanced courses in Power Electronics and its application areas.

YEAR	III	POWER SYSTEM ANALYSIS	L	T	P	C
SEMESTER	V		3	1	0	4

AIM

- To understand the necessity and to become familiar with the modelling of power system and components. And to apply different methods to analyse power system for the purpose of system planning and operation.

OBJECTIVES:

- To model the power system under steady state operating condition.
- To study the power flow models and apply efficient numerical methods to solve the power flow problem.
- To model and analyse the power systems under abnormal (or) fault conditions.
- To model & analyse the transient behaviour of power system when it is subjected to a fault.
- To the study the Importance of stability analysis in power system planning

UNIT I INTRODUCTION 9

Modern power system (or) electric energy system - Analysis for system planning and operational studies – basic components of a power system. Generator models Transformer model transmission system model - load representation. Single line Diagram – per phase and per unit representation – change of base. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix.

UNIT II POWER FLOW ANALYSIS 9

Importance of power flow analysis in planning and operation of power systems. Statement of power flow problem - classification of buses into P-Q buses, P-V (voltagecontrolled) buses and slack bus. Development of Power flow model in complex variables form and polar variables form. Iterative solution using Gauss-Seidel method including Q-limit check for voltagecontrolled buses – algorithm and flow chart. Iterative solution using Newton-Raphson (N-R) method (polar form) including Q-limit check and bus switching for voltage-controlled buses - Jacobian matrix elements – algorithm and flow chart. Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart; Comparison of the three methods.

UNIT III FAULT ANALYSIS – BALANCED FAULTS 9

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS 9

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions. Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – (algorithm and flow chart.).

UNIT V STABILITY ANALYSIS 9

Importance of stability analysis in power system planning and operation – classification of power system stability - angle and voltage stability – simple treatment of angle stability into small-signal and large-signal (transient) stability Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method. Algorithm and flow chart.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Publishing Company, New Delhi, 2002.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2003.

REFERENCES

1. P. Kundur, 'Power System Stability and Control, Tata McGraw Hill, Publications,1994.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', McGraw Hill International Book Company, 1994.
3. I.J. Nagrath and D.P. Kothari, 'Modern Power System Analysis', Tata McGraw-Hill Publishing Company, New Delhi, 1990.
4. .K.Nagasarkar and M.S. Sukhija Oxford University Press, 2007

COURSE OUTCOMES :

Upon completion of the course, the student will be able to

1. Carry out load flow study of a practical system.
2. Simulate and analyze fault.
3. Study the stability of power systems**.**

YEAR	III	PROTECTION & SWITCHGEAR	L	T	P	C
SEMESTER	V		3	0	0	3

AIM

To understand the various protection schemes in electrical system, theory of arc interruption and operation of various circuit breakers.

OBJECTIVE

- To study the basic principles, construction and operation of various protection relays.
- To understand the protection schemes of various electrical equipments and application of CTS and PTS.
- To study the theory of arc phenomena and arc interruption.
- To understand construction, operation and capacitive merits of various types of circuit breakers.
- To study protection schemes against over voltages.

UNIT I RELAYS -PRINCIPLES &OPERATION 9

Need for protection – relay terminology – definitions – zones of protection - essential qualities of protective relays. Over current relays directional, distance and differential, under frequency, negative sequence relays - static relays – microprocessor-based relays.

UNIT IIAPPARATUS PROTECTION 9

Apparatus Protection - generator and Transformer Protection, Protection of bus bars, transmission lines, CT's & PT's and their application in protective schemes.

UNIT III THEORY ARC QUENCHING 9

Theory of arcing and arc quenching – RRRV – Current Chopping and Capacitive Current breaking – D.C. circuit breaking.

UNIT IV CIRCUIT BREAKERS 9

Switchgear – fault clearing and interruption of current - various types of circuit breakers - selection of circuit breakers - testing of circuit breakers- intelligent circuit breakers

UNIT V PROTECTION AGAINST OVERVOLTAGES 9

Protection against over voltages due to lightning and switching - arcing grounds - Peterson coil - ground wires - surge absorber and diverters Power system earthing – neutral earthing - basic ideas of insulation coordination

TOTAL HOURS : 45

TEXT BOOKS

1. Veerappan.N and Krishnamurthi .S.R,' Power Systems Switch Gear and Protection' , S.Chand Edition 2009.
2. Ravindranath, B and Chander, N, 'Power System Protection and Switchgear', Wiley Eastern Ltd., 1977.
3. Chakrabarti .A, Soni .M.L, Gupta .P.V, 'A text book on power system Engineering', Dhanpat rai & Co. pvt. Ltd., 1998.

REFERENCE BOOKS

1. Wadhwa, C.L., 'Electrical Power Systems', New Age International (P) Ltd., Publishers, 1995.
2. Patra, S.P., Basu , S.K. and Chowduri, S., 'Power systems Protection', Oxford and IBH Publishing Co, 1983.
3. Sunil.S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 1986

COURSE OUTCOMES :

Upon completion of the course, the student will be able to

1. Classify and describe the working of various relaying schemes.
2. Identify and implement an appropriate relaying scheme for different power apparatus.
3. Illustrate the function of various CBs and related switching issues.
4. Describe the causes of overvoltage and protection against overvoltage.

YEAR	III	LINEAR INTEGRATED CIRCUITS	L	T	P	C
SEMESTER	V		3	1	0	4

(COMMON TO ECE, BME, EEE & MECHAT)

AIM

- To provide the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

OBJECTIVES:

- To introduce the basics of Integrated Circuits and its fabrication.
- To familiarize with operational amplifiers and its Characteristics.
- To introduce the applications of Operational Amplifier
- To Introduce about the regulator and filters.
- To introduce ADC/ DAC and PLL.

UNIT I INTEGRATED CIRCUIT FABRICATION 9

Classifications of ICs – IC chip size and Circuit Complexity – Fundamentals of Monolithic IC Technology – Basic Planar Process – Fabrication of Typical Circuit – Active and Pasive Components of ICs – Fabrication of FET – Thick and Thin Film Technology – Technology Trends.

UNIT II OPERATIONAL AMPLIFIER AND ITS CHARACTERISTICS 9

Basic Information of operational Amplifier – Ideal Operational Amplifier - Operational Amplifier Internal Circuits – Examples of IC Op Amps – FET Operational Amplifiers – DC Characteristics – AC Characteristics – Analysis of Data Sheets of an Op Amp.

UNIT III OPERATIONAL AMPLIFIER APPLICATIONS 9

Basic Op Amp Applications – Instrumentation Amplifiers – AC Amplifiers – V to I and I to V Converters – Op Amp Circuits Using Diodes – Sample and Hold Circuits – Log/Antilog Amplifiers – Adder/ Subtractor – Multiplier and Divider – Differentiator and Integrator – Operational Trans conductance Amplifier – Comparators – Multivibrators – Square, Triangular and Sawtooth wave Generators.

UNIT IV REGULATORS AND FILTERS 9

Series Op Amp Regulators – IC Voltage Regulators – 723 General Purpose Regulators – Switching regulators – RC Active Filters – Transformation – State variable Filter – Switched Capacitor Filters – Active Filters using OTA's.

UNIT V D/A AND A/D CONVERTERS, TIMERS AND PLL 9

Timer – Description of Functional Diagram – Monostable and Astable Operation – Schmitt Trigger – PLL – Basic Principles – Phase Detectors/ Comparators – Voltage Controlled Oscillator – Low Pass Filter – Monolithic PLL – PLL Applications – Basic DAC Techniques – A–D Converters – DAC/ ADC Specifications.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOK

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 3rd Edition 2007.

REFERENCE BOOKS

1. Segio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill, 2008.
2. Ramakant A. Gayakwad, "OP – AMP and Linear ICs", Prentice Hall, 1994.
3. Botkar K. R., "Integrated Circuits", Khanna Publishers, 1996.
4. Gray and Mayer, "Analysis and design of Analog Integrated Circuits", Wiley International, 1995.

COURSE OUTCOMES:

Upon completion of this course , students will be able to

1. Describe the various ideal and practical characteristics of an OPAMP.

2. Develop simple OPAMP based circuits.

3. Implement various analog signal processing circuits.

4. Analyze and design various types of ADCs and DACs.

5. Analyze and construct various application circuits using 555 timer.

YEAR	III	CONTROL SYSTEMS	L	T	P	C
SEMESTER	V		3	1	0	4

(COMMON TO ECE, EEE, &MECHATRONICS)

AIM

- To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVE:

- To understand the methods of representation of systems and to desire their transfer function models.
- To provide adequate knowledge in the time response of systems and steady state error analysis
- To accord basic knowledge in obtaining the open loop & closed–loop frequency responses of systems.
- To understand the concept of stability of control system and methods of stability analysis.
- To study the three ways of designing compensation for a control system

UNIT I SYSTEMS AND THEIR REPRESENTATION 12

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

UNIT III FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEM 9

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin –Nyquist stability criterion.

UNIT V COMPENSATOR DESIGN 6

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCES

1. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand the concepts of closed loop control systems.
2. Analyze the stability of closed loop systems.
3. Apply the control techniques to any electrical systems.
4. Design the classical controllers such as P, PI, etc., for electrical systems.

YEAR	III	POWER ELECTRONICS LABORATORY	L	T	P	C
SEMESTER	V		0	0	4	2

AIM:

- To study the characteristics of switching devices and its applications in rectifier, inverter, chopper, resonant converter and drives.

OBJECTIVES:

- To study, analyse the performance of different power electronic conveter circuits.
- To simulate different power electronic converter circuits and analyse their performance

LIST OF EXPERIMENTS:

1. Characteristics of SCR& TRIAC

2. Characteristics of MOSFET and IGBT

3. AC to DC Half & fully controlled converter

4. IGBT based choppers

5.Voltage Commutated Chopper

6. IGBT based PWM inverter

7. Resonant dc to dc converter

8. AC Voltage Controller

10.Single Phase Cyclo-converter

11.Converter fed DC Motor Drive.

12. Inverter fed Induction Motor Drive.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES:

Ability to construct test platforms and analyse power electronic circuits.

YEAR	III	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
SEMESTER	V		0	0	4	2

(COMMON TO ECE & EEE)

AIM

- To provide the ability to design simple linear integrated circuits using op-amp and other special purpose registers.

OBJECTIVE

- To study the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To know the applications of special purpose integrated circuits eg: 555 timer

LIST OF EXPERIMENTS

Design and Testing of

1. Inverting, Non inverting and differential amplifiers using Op Amp.
2. Integrator and Differentiator using Op Amp.
3. Instrumentation amplifier using Op Amp
4. Active Low Pass, High Pass and Band Pass filters using Op Amp.
5. Astable & Monostable Multivibrators and Schmitt Trigger using Op Amp.
6. Phase shift and Wien Bridge Oscillators using op-amp.
7. Astable and Monostable Multivibrators using NE555 Timer.
8. PLL characteristics and its use as Frequency Multiplier.
9. DC power supply using LM317 and LM723.
10. Study of SMPS.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

- Define significance of Op Amps and their importance
- Build circuits using Analog IC's.
- In-depth knowledge of applying the concepts in real time applications.
- Ability to use OP Amp as Summer, Subtractor, Multiplier and Divider.
- Able to use OP Amp to generate sine waveform, Square wave form, Triangular wave forms
- Able to use OP Amp to as analog to digital and digital to analog converter.
- Design and explain the Analog to Digital conversion operation and vice versa.

YEAR	III	CONTROL SYSTEMS LABORATORY	L	T	P	C
SEMESTER	V		0	0	4	2

(COMMON TO EEE & MECHATRONICS)

AIM:

To get the knowledge on applications of machines & electronic devices with control systems.

OBJECTIVES

- To provide knowledge on analysis and design of controller for the system
- To get the basic knowledge on practical control system and PLC applications.

LIST OF EXPERIMENTS

1. **Transfer function of self and separately excited DC Generator.**
   Aim : To determine the transfer function of self and separately excited DC generator.

2. **Transfer function of Armature and Field controlled DC Motor.**
   Aim : To determine the transfer function of armature and field controlled DC motor.

3. **Transfer function of AC Servomotor.**
   Aim : To derive the transfer function of the given A.C Servomotor and experimentally determine the transfer function parameters.
4. **Frequency response of Lag, Lead & Lag – Lead networks.**
   Aim : To obtain the Frequency response of Lag, Lead & Lag – Lead networks.
5. **Study of Synchros and DC Stepper Motor**
   Aim : To study the working of Synchros & stepper motor
6. **Transfer function of Ward – Leonard method of speed control of DC motor.**
   Aim : To determine the transfer function parameters of Ward – Leonard method of speed control of DC motor.
7. **Study of DC Position Control system and study of various transducers**
   Aim : To study the DC position control system and draw the error characteristics between set point and error and to study the various Transducers.
8. **Study of P, PI and PID Controllers (First Order).**
   Aim : To determine the Time Response characteristics of the controllers.
9. **Analog and simulation of type – o and type – 1 systems**
   Aim: To simulate the time response characteristics of I order and II order, type 0 and type-1 systems.
10. **Stability analysis of Linear Systems**
    Aim : To analyse the stability of linear systems using Bode / Root locus / Nyquist plot.
11. **Digital simulation of first order systems**
    Aim : To digitally simulate the time response characteristics of first -order system

12. Digital simulation of second order systems

Aim : To digitally simulate the time response characteristics of second -order system

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

- Ability to formulate transfer function for given control
- system problems.
- Ability to find time response of given control system model.
- Plot Root Locus and Bode plots for given control system model
- Ability to design Lead, Lag, Lead-Lag systems in control systems
- Ability to design PID controllers for given control system mode

SEMESTER -VI

YEAR	III	MICROCONTROLLER & APPLICATIONS	L	T	P	C
SEMESTER	VI		3	1	0	4

(COMMON TO ECE, BME, EEE, & MECHAT)

AIM

- To provide the knowledge about the processors and controllers and its functioning

OBJECTIVES :

- To learn the concepts of microprocessors.
- To get knowledge in interfacing devices.
- To know the concepts of microcontroller and its applications.
- To develop skill in simple program writing.

UNIT I INTEL 8086 MICROCPROCESSOR 9

Architecture of 8086-Register organization – Signal Description of 8086 - 8086 Instructions set – Addressing modes – Assembler directives and operators- simple programs.

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UNIT II PERIPHERAL INTERFACING 9

Programmable Peripheral Interface 8255 – Programmable Communication Interface 8251 USART – Programmable Interrupt Controller 8259A - Programmable Interval Timer 8253 – Keyboard/Display Controller 8279 – A-to-D converter – D-to-A converter.

UNIT III INTEL 8051 MICROCONTROLLER 9

Introduction to 8 bit microcontroller – architecture of 8051- Signal descriptions of 8051- Role of PC and DPTR- Flags and PSW- CPU registers- Internal RAM & ROM- Special Function Register-Counter & Timers- Serial Communication.

UNIT IV ASSEMBLY LANGUAGE PROGRAM OF INTEL 8051 9

Interrupt- Addressing Mode- Data Transfer Instruction- Arithmetic Instruction- Logical Instruction- Jump Loop & Call Instruction- I/O Port Programming.

UNIT V INTERFACING AND APPLICATION OF INTEL 8051 9

LCD Interfacing - A/D and D/A Interfacing- Sensor Interfacing- Relays and Optoisolators- Stepper Motor Interfacing- DC Motor Interfacing.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXTBOOKS

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, programming and system Design using 8085, 8086, 8051 and 8096". PHI2007. (Unit I & II).
2. Muhammad Ali Mazidi and JanicaGilliMazidi, The 8051 microcontroller and embedded systems, Pearson Education, 5th Indian reprint, 2003. (Unit III to V)

REFERENCE BOOKS

1. Rafiquzzaman M. – Microprocessors – Theory and Applications Intel and Motorola, PHI Pvt. Ltd., New Delhi 2001.
2. Douglas V.Hall – Microprocessors and Interfacing programming and hardware, Tata McGraw Hill Edition 1997.
3. A.K Roy, K.M Bhurchandi, Intel Microprocessors Architecture, Programming and Interfacing McGraw Hill International Edition – 2001

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Have a clear understanding of the architecture and instruction set of 8085 and 8051.

2. Be able to interface peripherals and memories with 8085 and 8051.

3. Be able to understand the application of 8085 and 8051 in waveform generators.

YEAR	III	SOLID STATE DRIVES	L	T	P	C
SEMESTER	VI		3	1	0	4

AIM

- To study and understand the operation of electrical machines controlled by a power electronic converter and to introduce the controller design concepts.

OBJECTIVES:

- To understand the basic concept of DC and AC Drives.
- To understand the various control techniques involved with both DC and AC Drives.
- To brief about the working principle of Special Electrical Drives.

UNIT I DRIVE CHARACTERISTICS 9

Equations governing motor load dynamics - steady state stability - Multi quadrant dynamics - Acceleration, deceleration, starting and stopping - load torque characteristics of various drives.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction Time ratio and current limit control - 4 quadrant operation of converter.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor, load and converter – Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control, Design of controllers: Current controller and speed controller - Converter selection and characteristics - Use of simulation software package.

UNIT IV INDUCTION MOTOR DRIVES 9

Stator voltage control – energy efficient drive - v/f control, constant air-gap flux – field weakening mode - voltage/current fed inverters - Block diagram of vector control - closed loop control.

UNIT V SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor – Marginal angle control and power factor control - Permanent magnet synchronous motor Black diagram of closed loop control.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS

1. Gopal K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, 1992.
2. Bimal K.Bose. "Modern Power Electronics and AC Drives", Pearson Education, 2002.

REFERENCES

1. S.K.Pillai, "A First course on Electrical Drives", Wiley Eastern Limited, 1993.
2. Murphy J.M.D and Turnbull, "Thyristor Control of AC Motor", Pergamon Press, Oxford 1988.
3. Gopal K.Dubey, "Power semiconductor controlled Drives:, Prentice Hall Inc., New Jersey, 1989.
4. R.Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", Prentice hall of India, 2001.

COURSE OUTCOMES:

Upon completion of this course, the student

1. Learns the fundamental concepts of power electronic converter fed DC and AC machines.
2. Can analyze the converter fed motor under different torque/speed conditions.
3. Will be able to design converter fed drives with existing/new control techniques.

YEAR	III	DIGITAL SIGNAL PROCESSING	L	T	P	C
SEMESTER	VI		3	1	0	4

(COMMON TO ECE, EEE, & MECHAT)

AIM

- To introduce the concepts of Digital signal processing and DSP Processor. The mathematical analysis of FIR and IIR filter design and simulation using MATLAB are dealt with in detail.

OBJECTIVES:

- Structures of Discrete time signals and systems.
- Frequency response and design of FIR and IIR filters.
- Finite word length effect.
- DSP Processor- TMS320C5X.

UNIT I REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS 12

Overview of signals and systems – DFT–FFT using DIT and DIF algorithms – Inverse DFT-FFT using DIT and DIF algorithms – Applications – Circular convolution – MATLAB programs for DFT and FFT.

UNIT II DESIGN AND IMPLEMENTATION OF IIR FILTERS 12

Design of analog filters using Butterworth and Chebyshev approximations – IIR digital filter design from analog filter using impulse invariance technique and bilinear transformations – Matlab programs for IIR filters.

UNIT III DESIGN AND IMPLEMENTATION OF FIR FILTERS 12

Linear phase response – Design techniques for FIR filters – Fourier series method and frequency sampling method –Design of Linear phase FIR filters using windows: Rectangular, Hanning and Hamming windows – Matlab programs for FIR filters.

UNIT IV FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 12

Fixed point arithmetic – effect of quantization of the input data due to Finite word length. Product round off – need for scaling – Zero input limit cycle oscillations - Limit cycle oscillations due to overflow of adders – Table look up implementation to avoid multiplications.

UNIT V PROCESSOR FUNDAMENTALS 12

Features of DSP processors – DSP processor packaging (Embodiments) – Fixed point Vs floating point DSP processor data paths – Memory architecture of a DSP processor (Von Neumann – Harvard) – Addressing modes – pipelining – TMS320 family of DSPs (architecture of C5x).

LECTURE HOURS : 45
TUTORIAL HOURS : 15

TOTAL HOURS : 60

TEXT BOOKS

1. John .G. Proakis and Dimitris C. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, Fourth edition, 2007.
2. B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003.

REFERENCES

1. SanjitMitra, "Digital Signal Processing – A Computer based approach", Tata McGraw Hill, New Delhi, 2011.
2. M.H.Hayes, "Digital Signal Processing", Tata McGraw Hill, New Delhi, Edition, 2009.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand the operations on digital signals.

2. Analyze the signal processing concepts.

3. Design the systems required for digital signal processing.

YEAR	III	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
SEMESTER	VI		3	0	0	3

AIM:

- To create ethical vision and achieve harmony in life.

OBJECTIVE

- To create an awareness on Ethics and Human Values in engineering professions and to inspire moral and social values and Loyalty to appreciate the rights of others

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of Engineering Ethics - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

TOTAL HOURS: 45

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics: Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Naagarazan. R. S, A Textbook on Professional Ethics and Human Values , New Age Publications.

COURSE OUTCOME

- After completing the course the learner should know how to maintain code of conduct in work places and respect to each other.

YEAR	III	HIGH VOLTAGE ENGINEERING	L	T	P	C
SEMESTER	VI		3	0	0	3

AIM

- To expose the students to causes and various types of over voltage Transients in Power system and its effects on power system.
- To understand the Generation of over voltages in Laboratory.
- To know about the Testing of power apparatus and system.

OBJECTIVES

- To understand the various types of over voltages in power system and protection.
- Generation of over voltages in laboratories.
- Measurement of overvoltage.
- Nature of Breakdown mechanism in Solids.
- Testing of Power apparatus and insulation coordination.

UNIT I OVER **VOLTAGES AND INSULATION COORDINATION 6**

Natural causes of over voltages-Lightning phenomena-Over voltages due to switching surges - System faults and other abnormal conditions-Principles of insulation co-ordination.

UNIT II ELECTRICAL BREAKDOWN IN GASES AND SOLIDS 12

Classical gas laws- Ionization and decay process- Secondary effects- Paschen's law-Streamer theory- Breakdown in non-uniform fields and corona discharges- Electromechanical breakdown- Thermal breakdown- Breakdown in composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGE AND HIGH CURRENT 9

Generation of high DC voltage, alternating voltage , impulse voltage and impulse currents.

UNIT IV MEASUREMENT OF HIGH VOLTAGE AND HIGH CURRENT 9

Measurement of high voltages and high currents - Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING 9

High voltage testing of electrical power apparatus - Power frequency, Impulse voltage and DC, International and Indian Standards.

TOTAL HOURS : 45

TEXT BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill,1995.

2. Kuffel,E and Zaengl, W.S, ‘High Voltage Engineering Fundamentals’, Pergamon Press, Oxford , Londan,1986

REFERENCE BOOKS

1. Kuffel, E and Abdullah..M, ‘High Voltage Engineering Fundamentals’, Pergamon Press, Oxford ,Londan,1970.
2. Gallghar, P.J and Pearmain,A.J., ‘High Voltage Measurement’,Testing and Design,John Wiley and Sons, Newyork,1982

COURSE OUTCOMES:

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

1. Describe the causes and types of overvoltage.
2. Illustrate different methods of generating and measuring various high voltages and currents.
3. Explain various breakdown phenomena occurring in gaseous, liquid and solid dielectrics.
4. Identify appropriate testing method(s) for various high voltage apparatus.

YEAR	III	SOLID STATE DRIVES LABORATORY	L	T	P	C
SEMESTER	VI		0	0	4	2

AIM: To study about different AC and DC drives.

OBJECTIVES

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

LIST OF EXPERIMENTS:

1. Converter fed DC Motor Drive.
2. Inverter fed Induction Motor Drive.
3. V/F Control of VSI Fed Induction Motor.
4. Rotor Resistance Control of Induction Motor.
5. Simulation of PWM inverter fed single phase induction motor control
6. Simulation of PWM inverter fed three phase induction motor control
7. Simulation of CSI fed induction motor drive analysis
8. Simulation of VSI fed induction motor drive analysis
9. Simulation of PWM inverter fed three phase induction motor control

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES:

Upon completion of this course, the student

1. Learns the concepts of power electronic converter fed DC and AC machines.
2. Can analyze the converter fed motor under different torque/speed conditions.
3. Will be able to design converter fed drives with existing/new control techniques.

YEAR	III	MICROCONTROLLER LABORATORY	L	T	P	C
SEMESTER	VI		0	0	4	2

(COMMON TO BME, ECE, EEE, & MECHT)

AIM

- To provide the knowledge of assembly language programming of microprocessors and microcontrollers and interfacing peripheral devices with microprocessors.

OBJECTIVE

- To write the assembly language program for 8085, 8086 and 8051.
- To write the programs for communication between microprocessor and peripheral devices.
- To interface ADCs, DACs with microprocessor and learn the real time applications like stepper motor control, key board etc

LIST OF EXPERIMENTS

1. 8085 & 8086 Assembly Language Program (ALP) for Arithmetic Operations.
2. 8051 Assembly Language Program (ALP) for Arithmetic Operations.
3. 8051 Assembly Language Program (ALP) for Logical Operations.
4. 8051 Assembly Language Program (ALP) for Bit Manipulation Operations.
5. 8051 Assembly Language Program (ALP) for arrange the numbers in Ascending and Descending order.
6. 8051 Assembly Language Program (ALP) for Interrupt & UART Operations.
7. Interfacing an ADC to 8051 Controller.
8. Interfacing DAC to 8051 Controller and generate Square, Triangular & Saw-tooth waveform.
9. Interfacing a Stepper motor to 8051 Controller and operate it in clockwise and anti-clockwise directions.
10. Interfacing a Keyboard & Display controller (8279) to 8051 Controller.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

The students are able to

- Understand and apply the fundamentals of assembly level programming of microprocessors/ microcontrollers
- Work with standard microprocessor/ microcontroller interfaces implement real-time systems

YEAR	III	CREATIVE AND INNOVATIVE PROJECT	L	T	P	C
SEMESTER	VI		0	0	3	2

AIM: To Create a new innovative ideas to design and implementing a model

OBJECTIVES

1. The students in batches (not exceeding three in a batch) have to take up a project in the area of their own interest related to their specialization.

2. Each batch is guided by a faculty member. The students have to select a suitable problems, design, prepare the drawings, produce the components, assemble and commission the project.

3. The students have to prepare and present a detailed project report at the end of the VI semester.

4. The evaluation will be made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.

STRATEGY:

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs.

COURSE OUTCOMES:

- Obtain the skills of conducting literature survey.
- Learn different field problems pertaining to Electrical Engineering and the existing solutions to them.

TOTAL HOURS: 45

SEMESTER -VII

YEAR	IV	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
SEMESTER	VII		3	0	0	3

AIM

- To impart awareness on disasters and preparedness during disasters.

OBJECTIVE:

- To Engage in activities which may help in minimizing the damages caused by disasters specially in rural areas.
- To make endeavors towards creating awareness among the people about disasters and its consequences and to prepare them in advance to face such situations and to ensure their participation in the disaster mitigation plans.
- Existing institutional arrangements, interdepartmental linkages, role of NGO's, voluntary agencies and local communities so as to understand their capabilities to mitigate specific disasters which will also facilitate effective coordination in their activities in times of need.
- To act as an agency for the execution of disaster management schemes of the Government and the NGOs.
- To undertake studies which will facilitate in the preparation of rural development schemes and their effective implementation.

UNIT 1 INTRODUCTION **9**

Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Natural and man-made hazards.

UNIT 2 RISK ASSESSMENT AND VULNERABILITY ANALYSIS **9**

Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors;

vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards.

UNIT 3 DISASTER MANAGEMENT MECHANISM 9

Concepts of risk management and crisis management; Disaster management cycle ; Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief .

UNIT 4 DISASTER RESPONSE 9

Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management ;Minimum Standards of Relief; Managing Relief; Funding.

UNIT 5 DISASTER MANAGEMENT IN INDIA 9

Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans.

TOTAL HOURS: 45

TEXT BOOKS

1. Alexander, D. *Natural Disasters,* ULC press Ltd, London, 1993.
2. Carter, W. N. *Disaster Management: A Disaster Management Handbook,* Asian Development Bank, Bangkok, 1991.
3. Chakrabarty, U. K. *Industrial Disaster Management and Emergency Response*, Asian Books Pvt. Ltd., New Delhi 2007.

REFERENCES

1. Abarquez I. & Murshed Z. *Community Based Disaster Risk Management: Field Practitioner's Handbook,* ADPC, Bangkok, 2004.
2. Goudie, A. *Geomorphological Techniques,* Unwin Hyman, London 1990.
3. Goswami, S. C. *Remote Sensing Application in North East India,* Purbanchal Prakesh, Guwahati, 1997.
4. *Manual on Natural Disaster Management in India,* NCDM, New Delhi, 2001.

5. *Disaster Management in India*, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. *National Policy on Disaster Management*, NDMA, New Delhi, 2009.
7. *Disaster Management Act. (2005)*, Ministry of Home Affairs, Government of India, New Delhi, 2005.

COURSE OUTCOMES :

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

YEAR	IV	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C
SEMESTER	VII		3	0	0	3

AIM

- To become familiar with the preparatory work necessary for meeting the next day's power system operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

OBJECTIVES:

- Have an overview of system load variation, reserve requirements, operation and control of power system.
- Give an insight into the role of speed governing mechanism in load frequency control, concept of control area, modeling and analysis of load frequency control loop.
- (iii) Give knowledge of excitation systems and the methods of voltage control.
- (iv) Study the economic dispatch of generated power.
- (v) Provide adequate knowledge of the functions of energy control center, SCADA system and the security control.

UNIT I: INTRODUCTION 9

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

UNIT II: REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling – static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

UNIT III: REACTIVE POWER–VOLTAGE CONTROL 9

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control – tapchanging transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT IV: COMMITMENT AND ECONOMIC DISPATCH 9

Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ- iteration method. (No derivation of loss coefficients).Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods – forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

UNIT V: COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

TOTAL HOURS: 45

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
2. Chakrabarti & Halder, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. (For Chapters 1, 2 & 3)
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.
3. Hadi Saadat, "Power System Analysis", (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
4. P.Kundur, 'Power System Stability and Control' MC Craw Hill Publisher, USA, 1994.
5. Olle.I.Elgerd, 'Electric Energy Systems theory an introduction' Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.

COURSE OUTCOMES:

- Ability to understand and analyse power system operation, stability, control and protection.

YEAR	IV	EMBEDDED SYSTEMS	L	T	P	C
SEMESTER	VII		3	1	0	4

(COMMON TO ECE, EEE, MECHAT & IT)

AIM

- To learn the basic concepts of embedded systems and its applications.

OBJECTIVES:

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To explain programming concepts and embedded programming in C and C++
- To introduce the software development tools in embedded systems.
- To introduce the concepts of Real Time Operating System.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition –Processor Embedded into a System – Embedded Hardware Units and Devices in system –Embedded Software in a System – Examples of Embedded system –System on Chip (Soc) and Use of VLSI Design Technology – Complex Design and Processors – Design Process – Formalizations of System Design – Design Process and Design Examples – Classifications of Embedded Systems.

UNIT II DEVICES AND BUSES FOR DEVICES NETWORK 9

Device I/O Types and Examples – Serial Communication Devices – Parallel Devices Ports – Sophisticated Interfacing Features in Devices Ports – Wireless Devices – Timer and Counting Devices – Watchdog Timer – Real Time Clock – Networked Embedded Systems – Serial Bus Communication Protocols – Parallel Bus Device Protocol – Parallel Communication Network Using ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ 9

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler– Optimization of memory codes.

UNIT IVSOFTWARE DEVELOPMENT AND TOOLS 9

Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT V REAL TIME OPERATING SYSTEMS 9

Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

LECTURE HOURS : 45
TUTORIAL HOURS : 15
TOTAL HOURS : 60

TEXT BOOKS:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, Second Edition, Sixth reprint Oct. 2010
2. David E Simon, "An embedded software primer ", Pearson education Asia, Eighth Impression, 2009.

REFERENCE BOOKS:

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
2. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, 2008.
3. Frank Vahid and Tony Givargis, "Embedded Systems Design – A unified Hardware /Software Introduction", John Wiley, 2006.

COURSE OUTCOMES :

Upon completion of this course, students will be able to

1. Remember the concepts of process and controllers.

2. Apply the concepts for real-time applications.

3. Create a real-time system for particular applications.

YEAR	VI	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
SEMESTER	VII		3	0	0	3

AIM :

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make him/her sensitive to the environment problems in every professional endeavour that he/she participates.

OBJECTIVES

- To create awareness on the various pollutions and their impact.
- To provide comprehensive insight in natural resources.
- To educate the ways and means to protect natural resources.
- To impart fundamental knowledge on human welfare measures.

UNIT -I : ENVIRONMENT AND NATURAL RESOURCES 9

Environment - Definition, scope & importance - Public awareness- Forest resources, mineral resources , water resources, food resources , energy resources (uses, over -exploitation & adverse effects in each case) - Scope & role of environmental engineers in conservation of natural resources - Sustainability development.

UNIT - II:ECOSYSTEMS AND BIO – DIVERSITY 9

Ecosystem - Definition, structure and function - Energy flow -Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity :values and uses, hotspots, threats and conservation.

UNIT - III : ENVIRONMENTAL POLLUTION 9

Pollution - Definition , manmade impacts and control measures of air, water and land pollution - Water quality standards & characterization - Importance of sanitation -Nuclear hazards – Hazardous waste management : Solid waste, waste water and biomedical waste - Prevention of pollution and role of individual – Disasters management : Floods, earthquake, cyclone and landslides - Clean technology options.

UNIT-IV:SOCIALISSUESANDENVIRONMENT 9

Urban problems related to energy - Water conservation – Resettlement and rehabilitation of

people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion- Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board.

UNIT- V:HUMANPOPULATIONAND ENVIRONMENT 9

Population growth - Population explosion - Family welfare programme - Environment & human health - Human rights – Value education - Women and child welfare, Role of information technology in environment and human health.

TOTAL HOURS : 45

TEXT BOOKS :

1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.

REFERENCES :

1. Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.

2. BharuchaErach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India

3. Trivedi R.K. " Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II, Enviro media.

4. Environmental Science and Engineering by Dr. J. Meenambal ,MJP Publication , Chennai Gilbert M. Masters : Introduction to Environmental Engineering and Science , Pearson Education PvtLtd., II Edition, ISBN 81-297-0277-0, 2004

5. Miller T.G. Jr Environmental Science Wadsworth Publishing Co.

6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology,Blackwell Science.

COURSE OUTCOMES :

The students should be able to:

- Conserve the resources
- Make the environment useful for the future generations and finally to maintain ecological balance and preserve bio-diversity.

YEAR	IV	NON CONVENTIONAL ENERGY SOURCES AND APPLICATIONS	L	T	P	C
SEMESTER	VII		3	0	0	3

AIM

- To study fundamentals and application of Non-conventional energy sources in the energy sector.

OBJECTIVES

- Introduction to renewable energy and its types
- To understand about solar energy and various methods to conversion of solar energy.
- .To understand about wind energy and various methods to conversion of wind energy
- Basic methods of conversion of Biomass and geothermal energy.
- To understand few evolutionary means of non-conventional energy.

UNIT I INTRODUCTION TO ENERGY SOURCES 9

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.

UNIT II SOLAR ENERGY 9

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.

UNIT III WIND ENERGY 9

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT IV BIOMASS AND GEOTHERMAL ENERGY 9

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, Fuel properties of bio gas, utilization of biogas. geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy.

UNIT V OTHER ALTERNATE ENERGY SOURCES 9

Energy from tides, basic principle of tidal power, Basics of Magneto Hydro Dynamic (MHD) Power Generation, Basic Fuel Cells construction and Operation, hydrogen as alternative fuel for vehicles.

TOTAL HOURS: 45

TEXT BOOKS

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill
3. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

REFERENCES

1. Alternative Energy Sources by B.L. Singhal Tech Max Publication
2. Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma
3. Fuel Cells by Bockris and Srinivasan; McGraw Hill
4. Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison
5. Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley

COURSE OUTCOMES :

- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the exploration of nonconventional energy resources and their

effective tapping technologies

- Effective utilization of available renewable energy resources
- To acquire the knowledge of modern energy conversion technologies

YEAR	IV	SOLAR AND WIND ENERGY LABORATORY	L	T	P	C
SEMESTER	VII		0	0	4	2

AIM

To make the students understand the basic principal in the power generation by various means of renewable energy sources

OBJECTIVE

1. To understand the parameter variation of PV system with change in physical conditions.
2. To understand the power generation and parameter variation in wind turbines.
3. To understand the variation of parameters during grid synchronization in PV system

LIST OF EXPERIMENTS

1. I-V and P-Characteristics with series and parallel combination of modules.
2. To show the effect of variation in tilt angle and shading on PV module power.
3. Workout power flow calculations of standalone PV system of DC load with battery.
4. Grid Synchronization of Solar PV Inverter and it Performance Analysis
5. Evaluation of Active, Reactive Power & Apparent Energy Flow between Grid-Tied Inverter, Grid & Load and Net Metering concept
6. Evaluate the efficiency of charge controller used in the Wind Energy Training System.
7. Evaluate the cut-in speed of wind turbine experimentally.
8. Evaluate the Tip Speed ratio (TSR) at different wind speeds.
9. Draw the turbine Power versus wind speed curve.
10. Draw the curve between TSR and coefficient of power.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES :

On completion of this course students can able to:

Analyse the characteristics of a PV system, explain maximum power point tracking algorithm, and design residential grid connected PV systems, standalone PV systems, and PV based water pumping systems.

Explain the basic working principles of wave, tidal, micro-hydro, concentrated solar, fuel cell and energy storage system in electrical aspects.

Understand the structure and various elements of the distributed generation and their advantages and disadvantages including renewable and non-renewable generators in the context of smart grid

YEAR	IV	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
SEMESTER	VII		0	0	4	2

AIM

- To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

OBJECTIVES

- To develop simple C/MATLAB programs for the following basic requirements:
- Formation of bus admittance and impedance matrices and network solution.
- Power flow solution of small systems using simple method, Gauss-Seidel P.F. method.
- Unit Commitment and Economic Dispatch.
- To acquire experience in the usage of standard packages for the following analysis / simulation / control functions.

LIST OF EXPERIMENTS

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Network Matrices and Solution of Networks.
3. Power Flow Analysis - I: Solution of Power Flow and Related Problems Using Gauss-Seidel Method.
4. Power Flow Analysis II: Solution of Power Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods.
5. Short Circuit Analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multimachine Power Systems.
8. Electromagnetic Transients in Power Systems.
9. Load – Frequency Dynamics of Single and Two-Area Power Systems.
10. Unit Commitment and Economic Dispatch in Power Systems.

TOTAL HOURS: 45

REFERENCE BOOKS

1. Laboratory reference manual.

COURSE OUTCOMES:

- Ability to develop algorithms to study loan flow, short circuit and stability analysis

YEAR	IV	COMPREHENSION	L	T	P	C
SEMESTER	VII		0	0	4	2

AIM

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise. This will enable the students attain the confidence and competence to solve real life engineering problems.

OBJECTIVE:

- The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer.
- While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.
- Class room exercises, group discussions, case studies and topics on how the stuff works are assigned to students on an individual basis and evaluation done by a panel of teachers.
- The students work in groups and solve a variety of problems given to them.
- The problems given to the students should be of real like industrial problems

selected by a group of faculty members of the concerned department.

- A minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.
- The students are required to take-up an end semester examination and obtain a minimum mark for gaining the required credit.

COURSE OUTCOMES :

- Students can able to improve quantitative aptitude techniques
- Students can able to face real life problems
- Students can able to improve the methods of data collection through various sources
- Students can able to improve the computer skills

TOTAL HOURS: 45

SEMESTER -VIII

YEAR	IV	PROJECT WORK & VIVA VOCE	L	T	P	C
SEMESTER	VIII		0	0	12	6

AIM:

The aim of ther project is to test the student's ability to apply the knowledge learned over the years of the course. The emphasis for final year projects may be on the development of a software product or on academic research. Topics for final year projects can, therefore, cover a wide variety of areas.

OBJECTIVE

- The objective of the project work is to enable the students to form the groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study.

- Formation of Group as follows
    - Group A : 8.5CGPA and above
    - Group B : 7 to 8.49 CGPA
    - Group C : 5 to 6.9 CGPA
    - Group A Student will have a choice to take 2 students from Group B&C

- Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

- The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

- This final report shall be typewritten form as specified in the guidelines.

- The continuous assessment shall be made as prescribed in the regulations

COURSE OUTCOMES :

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

- Select a good project and able to work in a team leading to development of hardware/software product.
- Prepare a good technical report and able to present the ideas with clarity.

ELECTIVES

ELECTIVE	ADVANCED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

AIM:

To gain knowledge in design of state variable systems, analysis of non-linear systems and introduction of optimal control

OBJECTIVE:

To study the state variable design

- To provide adequate knowledge in the phase plane analysis
- To study describing function analysis
- To analyze the stability of the systems using different techniques
- To introduce the concepts on design of optimal controller

UNIT I STATE VARIABLE ANALYSIS 9

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and\ observability - Pole Placement – State observer Design of Control Systems with observers.

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

UNIT IV STABILITY ANALYSIS 9

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

UNIT V OPTIMAL CONTROL 9

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

TOTAL HOURS: 45

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.

2. Ashish Tewari, 'Modern control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.

REFERENCE BOOKS

1. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.

2. M.Gopal, Modern control system theory, New Age International Publishers, 2002.

3. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition. 2002.

COURSE OUTCOMES:

Features of tools used for studying the nature of non-linear systems are studied.

 Basics of stability and the assessment of stability are studied.

 Basics of optimal control and its features are studied.

ELECTIVE	ADVANCED TOPICS IN POWER ELECTRONICS	L	T	P	C
		3	0	0	3

AIM

- To study modern power electronic converters and its applications in electric power utility like low power SMPS and UPS technologies

OBJECTIVE

- To study the operation, switching techniques and basics topologies of DC-DC switching regulators
- To understand the operation, characteristics and performance parameters of switching mode power converters.
- To study the operation of resonant converters and concept of Zero voltage Switching.
- To learn the concept and operation of Inverters and different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of various power electronics applications like UPS and filters.

UNIT I DC-DC CONVERTERS 9

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

UNIT II SWITCHING MODE POWER CONVERTERS 9

Analysis and state space modeling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

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

UNIT IV DC-AC CONVERTERS 9

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

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

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

TOTAL HOURS: 45

TEXT BOOKS

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

REFERENCES

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
2. Kjeld Thorborg, "Power Electronics – In theory and Practice", Overseas Press, First Indian Edition 2005.
3. Philip T Krein, " Elements of Power Electronics", Oxford University Press

COURSE OUTCOMES :

- Use circuit principle and magnetic theory to analyze switching converters.
- Design switching converters for given specification.
- Analyze electromagnetic compatibility problem.
- To design the transformers for power electronics applications

ELECTIVE	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

AIM

The aim of this course is to provide an introduction to some basic issues and algorithms in artificial intelligence (AI). The course also provides an overview of intelligent agent design, where agents perceive their environment and act rationally to fulfill their goals. The course approaches AI from an algorithmic, computer science-centric perspective.

OBJECTIVES :

- Know example of how technology has been used in business and other professional domain
- Recognize the major methods of representing knowledge in software

UNIT I INTRODUCTION 9

Introduction to AI and problem solving concepts: Definition- pattern recognition-production systems – problem and production system characteristics – two-pail problem-analysis of AI techniques – criteria for success

UNIT IIREPRESENTATION 9

Knowledge representation – formal and non-formal logic: Representation evaluation criteria -level of representation -formal logic schemes -resolutions -predicate and prepositional logic -conversion to clause form -semantic networks-frames-scripts-production system

UNIT III- PROBLEM SOLVING 9

Problem solving strategies dealing with uncertainty: Defining the problem – control strategies – exhaustive search – generate and test-space transformation models- forward versus backward reasoning -matching – weak methods – hill climbing -breadth and depth first searches – search algorithms.

UNIT IV- EXPERT SYSTEM 9

Expert system development process and knowledge acquisition: Definition – analysis of expert system problem solving – role and analysis of knowledge – architecture of the expert system – problem selection – formalization -implementation –evaluation.

UNIT V- KNOWLEDGE ACQUISITION 9

Knowledge acquisition techniques- cognitive behavior – knowledge representation development. Expert system tools: Expert system shells -narrow tools -large hybrid expert system tools -PC based expert system tools knowledge acquisition tools.

TOTAL: 45 PERIODS

REFERENCES

1. Introduction to AI & Expert System – D. W. Patterson, Prentice hall of India
2. Principles of Artificial Intelligence& Expert Systems Development – David W.Rolston, Tata McGraw Hill
3. Artificial Intelligence – Elaine Rich, McGraw Hill
4. Principles of Artificial Intelligence – Nils J. Nilsson, Springer Verlag
5. Introduction to Artificial Intelligence – Charnaik & McDermott, Addison Wesley

COURSE OUTCOMES :

The students should be able to

- Develop a basic understanding ofthe building blocks of AI
- Understand the main approaches to artificial intelligence such
- as heuristic search, game and search.
- Understand machine learning, neural networks and natural language processing.
- Recognize problems that may be solved using artificial intelligence and implement artificial intelligence algorithms for hands-on experience.
- Develop expert systems for an application.

ELECTIVE	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

(COMMON TO BME, EEE, & MECHAT)

AIM

- To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

OBJECTIVES

- Be able to list the problems associated with the acquisition of Bio potential and list the different types of electrodes.
- To know the various Bio potential recording methods
- To study about various Physiological measurements methods
- Be able to state the purpose, uses, principle of operation and maintenance of blood flow meter and blood cell counter
- Details the various bio chemical measurements and list the different types of Biosensors

UNIT-I: BIO PONTENTIAL ELECTRODES AND TRANSDUCERS 9

Origin of Bioelectric signals, recording electrodes-Electrode Tissue interface, Electrolyte –skin interface, Polarization, Skin contact impedance, motionartifacts. Types of electrodes- surface, Needle electrodes and Micro electrodes, Recording problems, Transducers-characteristics and types.

UNIT-II: BIOPOTENTIAL RECORDING 9

Need for Bio-amplifier, single ended bio amplifier, differential Bio amplifier, Right leg driven ECG amplifier, Band pass filtering, isolation DC amplifier & AC amplifier, chopper amplifier, Power line interface.ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform, frequency spectrum, abnormal waveform.

UNIT III: NON ELECTRICAL PARAMETER MEASUREMENTS 9

Respiration rate, Pulse rate, Temperature, Blood Pressure, O2 , CO2 measurements, Respiratory volume measurement, BMR measurement, Plethysmography technique, Impedance technique-Bipolar and Tetra polar circuits, Detection of various physiological parameters using impedance technique.

UNIT IV: BLOOD FLOW METER AND BLOOD CELL COUNTER 9

EM and ultrasonic blood flow meters, indicator dilution method, Thermo dilution method, Manual and Automatic Counting of RBC, WBC and Platelets.

UNIT V: BIO-CHEMICAL MEASUREMENTS & BIOSENSORS 9

Ph, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, autoanalyser, Biosensors.

TOTAL HOURS: 45

TEXT BOOKS

1.R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2.Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.

REFERENCE BOOKS.

1. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995

COURSE OUTCOMES :

- Ability to understand and analyze instrumentation systems and their applications to various industries.

ELECTIVE	CAD FOR ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

AIM

- To introduce the basics of Computer Aided Design technology for the design of Electrical Machines.

OBJECTIVE

- At the end of this course the student will be able to
- Learn the importance of computer aided design method.
- Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
- Become familiar with Finite Element Method as applicable for Electrical Engineering.
- Know the organization of a typical CAD package.
- Apply Finite Element Method for the design of different Electrical apparatus.

UNIT I INTRODUCTION 9

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II MATHEMATICAL FORMULATION OF FIELD PROBLEMS 9

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III PHILOSOPHY OF FEM 9

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems –Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV CAD PACKAGES 9

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V DESIGN APPLICATIONS 9

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

TOTAL HOURS: 45

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor& Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Software

COURSE OUTCOMES :

After successful completion of the course, student will be able to

- Apply theoretical concepts in designing of transformers, dc machines, induction motors and electromagnets
- Develop computer aided program pertaining to design of transformers, dc machines, induction motors and electromagnets
- Prepare and solve model in FEA simulation software

ELECTIVE	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

(COMMON TO CSE, IT, EEE MECHAT)

AIM:

To understand the basic structure of computers, their control design, memory organizations and an introduction to parallel processing

OBJECTIVES :

To understand the basic concepts and organization of Computers.

• Introduce the CPU architecture and micro programming

• Concepts and importance of parallelism

• Significances of Memory management and Mapping.

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations – Stacks and queues.

UNIT II ARITHMETIC UNIT 9

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations.

UNIT III BASIC PROCESSING UNIT 9

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Microprogrammed control - Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage.

UNIT V I/O ORGANIZATION 9

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

TOTAL HOURS: 45

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition "Computer Organization", McGraw-Hill, 2002.

REFERENCES

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
2. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002.
3. John P.Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, 1998.

COURSE OUTCOMES:

Upon completion of this course, students will

1. Describe the general architecture of computers.
2. Be familiar with the history and development of modern computers, the Von Neumann architecture and functional units of the processor such as the register file and arithmetic logical unit.
3. Understand the major components of a computer including CPU, memory, I/O and storage, how computer hardware has evolved to meet the needs of multi-processing systems, the uses for cache memory, parallelism both in terms of a single processor and multiple processors.
4. Design principles in instruction set design including RISC architectures.
5. Analyze and design computer hardware components.

ELECTIVE	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

AIM: To understand the design of main dimensions and other major part of the transformer and DC and AC rotating machines.

OBJECTIVE :

This course offers the preliminary instructions and techniques to design the main dimensions and other major part of the transformer and DC and AC rotating machines. The course also provides the students with an ability to understand the step by step procedure for the complete design of electrical machines.

UNIT I INTRODUCTION 9

Major considerations – Limitations – Electrical Engineering Materials – Space factor – temperature gradient – Heat flow in two dimensions – thermal resistivity of winding – Temperature gradient in conductors placed in slots – Rating of machines – Eddy current losses in conductors – Standard specifications

UNIT II DC MACHINES 9

Magnetic circuit calculations – Net length of Iron –Real & Apparent flux densities – Design of rotating machines – D.C machines output equations – Selection of number of poles – Armature design – Design of commutator and brushes.

UNIT III TRANSFORMERS 9

KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise of Transformers – Design of Tank with & without cooling tubes – Thermal rating – Methods of cooling of Transformers – Design of chokes – Design of welding Transformers – Design of CTs & PTs.

UNIT IV INDUCTION MOTORS 9

Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current – Output equation of Induction motor – Main dimensions –Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings –

Design of wound rotor-Operating characteristics –Short circuit current – circle diagram – Dispersion co-efficient – relation between D & L for best power factor.

UNIT V SYNCHRONOUS MACHINES 9

Runaway speed – construction – output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators – Rotor design - Introduction to computer aided design – Program to design main dimensions of Alternators.

TOTAL HOURS: 45

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

COURSE OUTCOMES:

Upon completion of the course, the student will be

1. Able to understand the design of main dimensions and other major part of the transformer and DC and AC rotating machines.

2. Capable of evaluating the procedure for the design of main dimensions and other major part of the transformer and DC and AC rotating machines.

3. Equipped to apply in-depth knowledge related to the design of electrical machines.

ELECTIVE	EHV AC & DIRECT CURRENT POWER TRANSMISSION	L	T	P	C
		3	0	0	3

AIM

- To study the different types of AC and DC links with its advantages and applications
- To study the different compensation techniques
- To study the concept of travelling waves, types of over voltage in the transmission line
- To study the different components used in EHV system

OBJECTIVE:

- To understand and analyze the HVAC and HVDC transmission systems.
- To plan an appropriate transmission system between two destinations based on the load requirement and anticipated technical performance of power transmission.

UNIT-I **9**

Constitution of EHV AC and DC links, Kinds of DC links, limitations and advantages of AC and DC transmission principal, application of AC and DC transmission , trends EHV AC and DC transmission, power-handling capacity converter analysis Garentz circuit, Firing control, overlapping.

UNIT-II **9**

Extra long distance lines, voltage profile of loaded and unloaded line along the line, compensation of lines, series and shunt compensation, shunt reactors, Tuned power lines, problem of extra compensation lines, FACT concept and application.

UNIT-III **9**

Travelling waves on transmission system, Their shapes, attenuation and distortion, effect of junction and termination on propagation of traveling waves, over voltage in transmission system, lighting, switching and temporary over voltage: control of lighting and switching over voltage.

UNIT-IV **9**

Components of EHV dc system, converter circuits, rectifier and inverter valves, Reactive power requierments, harmonic generation, adverse effects, classification, Remidial measures to suppress, ,filters, Ground return,converter faults& protection harmonics misoperation, commutation failure, Multi-terminal D,C. lines.

UNIT-V **9**

Control of EHV DC system desired features of control ,control charactteristics, constants current control, constant extinction angle control, lgnition angle control, parallel operation of HVAC & DC system, problems and advantage.

TOTAL HOURS: 45

TEXT BOOKS

1. Rakesh Das Begamudre, Extra High Voltage AC Transmission Engineering, Wiley Estern Limited.
2. K.R. Padiyar, HVDC Power Transmission System, Wiley Estern Limited.

REFERENCE BOOK

1. E.W. Kimbark. EHV-AC and HVDC Transmission Engineering & Practice, Khanna Publishers.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Distinguish between the usage of EHVAC and HVDC transmission systems.
2. Judge when and where to use EHAV / HVDC transmission systems in practice.
3. Design implementation circuitry for various controllers used in HVDC transmission systems.
4. Plan an appropriate electric power transmission system between two destinations to satisfy the pre-defined load requirement without compromising the technical performance.

ELECTIVE	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

AIM

- To study the different methods used to control the reactive power in transmission line
- To study the compensation technique for reactive control using static var compensator with its application
- To study about working principle, Different modes of operation and applicatiotns of thyristors controlled series capacitor
- To study the different voltage source converters based FACTS controllers
- To study the coordination of FACTS controller using different techniques

OBJECTIVE :

To familiarize the students with the basic concepts, different types, scope and applications of FACTS controllers in power transmission.

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines –Uncompensated transmission line - series compensation – Basic concepts of static Var Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of svc for power flow and transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping – Prevention of voltage instability.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping-SSR Mitigation.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-Enhancement of transient stability - Prevention of

voltage instability. SSSC-operation of SSSC and the control of power flow –Modelling of SSSC in load flow and transient stability studies. Applications: SSR Mitigation-UPFC and IPFC

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

TOTAL HOURS: 45

TEXT BOOKS

1.K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, 2008

2.R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc

REFERENCES

1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc.

2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi- 110 006

3. K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, 2008

4. A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.

5. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers.

COURSE OUTCOMES :

Upon completion of the course, the students shall be able to

1. Understand various Power flow control issues in transmission lines, for the purpose of identifying the scope and for selection of specific FACTS controllers.

2. Apply the concepts in solving problems of simple power systems with FACTS controllers.

3. Design simple FACTS controllers.

ELECTIVE	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

AIM

- To develop the skills in the area of HVDC power transmission with the analysis of HVDC converters.

OBJECTIVE

- To understand the concept, planning of DC power transmission and comparison with power transmission.
- To analyze HVDC converters
- To study about the multi-terminal DC systems.
- To analyze the power flow in AC/DC systems
- To learn about HVDC simulation tools.

UNIT I DC POWER TRANSMISSION TECHNOLOGY 6

Introduction - Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system - Planning for HVDC transmission – Modern trends in DC transmission – DC breakers – Cables, VSC based HVDC.

UNIT II ANALYSIS OF HVDC CONVERTERS AND HVDC SYSTEM CONTROL 12

Pulse number, choice of converter configuration – Simplified analysis of Graetz circuit - Converter bridge characteristics – characteristics of a twelve pulse converter detailed analysis of converters.
General principles of DC link control – Converter control characteristics – System control hierarchy - Firing angle control – Current and extinction angle control – Generation of harmonics and filtering - power control – Higher level controllers.

UNIT III MULTITERMINAL DC SYSTEMS 9

Introduction – Potential applications of MTDC systems - Types of MTDC systems - Control and protection of MTDC systems - Study of MTDC systems.

UNIT IV POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities - Modelling of DC links - Solution of DC load flow -Solution of AC-DC power flow - Case studies.

UNIT V SIMULATION OF HVDC SYSTEMS 9

Introduction – System simulation: Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation – Dynamic in traction between DC and AC systems.

TOTAL HOURS: 45

TEXT BOOK

1. K.R.Padiyar, , "HVDC Power Transmission Systems", New Age International (P) Ltd., New Delhi, 2002
2. J. Arrillaga , "High Voltage Direct Current Transmission", Peter Pregrinus, London,1983.

REFERENCE

1. Edward Wilson Kimbark, "Direct current Transmission", Vol.I, Wiley interscience, New York, London, Sydney, 1971.

2. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.

3. Erich Uhlmann, "Power Transmission by Direct Current", BS Publications, 2004.

4. V.K.Sood, HVDC and FACTS controllers

COURSE OUTCOMES :

- Basic principles and types of HVDC system are studied108
- Features of converters used in HVDC system are studied.
- Concepts and reactive power management, harmonics and power flow analysis are studied.

ELECTIVE	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

(COMMON TO ALL BRANCHES)

AIM

- To study the critical need for ensuring Information Security in Organizations

OBJECTIVES

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

UNIT 1 INTRODUCTION 9

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Poicy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL HOURS: 45

TEXT BOOK

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

REFERENCES

1. Micki Krause, Harold F. Tipton, “ Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw-Hill, 2003
3. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

COURSE OUTCOMES :

- The students have firm understanding on basic terminology and concepts related to network and system level security, basics of computers and networking including Internet Protocol, routing, Domain Name Service, and network devices.
- They are also exposed to basic cryptography, security management, and network security techniques.
- They also look at policies as a tool to effectively change an organization's culture towards a better secure environment.
- In the end, the students put it all together in the form of a case study for designing and auditing a security system at conceptual level.

ELECTIVE	INTELLIGENT CONTROLLERS	L	T	P	C
		3	0	0	3

(COMMON TO EEE, & MECHAT)

AIM:

- To understand the concepts of neural networks ,generic algorithm and fuzzy logic system

OBJECTIVES :

- To understand the unique mathematical treatment of various soft computing techniques for constructing intelligent systems, in modeling, optimization and control .
- The understand the applications of neural networks, fuzzy logic, evolutionary strategies and genetic algorithms In developing intelligent systems with examples and practical applications.

UNIT I INTRODUCTION 9

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

UNIT III GENETIC ALGORITHM 9

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.

UNIT IV FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT V APPLICATIONS 9

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

TOTAL HOURS: 45

TEXT BOOKS

1. Padhy.N.P.(2005), Artificial Intelligence and Intelligent System, Oxford University Press.

2. KOSKO,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCES:

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico PublishingHouse, 1999.
2. KLIR G.J. & FOLGER T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.
3. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
5. Goldberg D.E. (1989) Genetic algorithms in Search, Optimization and Machine learning, Addison Wesley.

COURSE OUTCOMES :

- Learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.
- Provide detailed theoretical and practical as pects of intelligent modeling, optimization and control of non-linear systems.
- Prepare the student s for developing intelligent systems through case studies, simulation examples and experimental results.

ELECTIVE	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
		3	0	0	3

AIM:

To understand the concepts of Managerial Economics ,Cost analysis ,Markets and Pricing and financial accounting

OBJECTIVES

- To study the features of demand supply analysis.
- To study the pricing objectives and its methods.
- To study the basics of accounting and its types.
- To study the procedures for capital budgeting and investments

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS 9

Definition, Meaning, Nature and Scope Managerial Economics-Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT II THEORY OF PRODUCTION AND COST ANALYSIS 10

Production Function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA) - Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA.

UNIT III INTRODUCTION TO MARKETS & PRICING STRATEGIES 8

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing Strategies

UNIT IV CAPITAL AND CAPITAL BUDGETING 9

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (only theory)

UNIT V INTRODUCTION TO FINANCIAL ACCOUNTING & RATIOS 9

Introduction to Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments only). Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt-Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TOTAL HOURS: 45

TEXT BOOK

1. A R Aryasri: Managerial Economics and Financial Analysis, Tata Mc Graw Hill, 2006
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCES

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi, 2004.
2. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition, Thomson, 2003.
3. Narayanaswamy: Financial Accounting-A Managerial Perspective, Prienceton Hall of India, 2005

COURSE OUTCOMES :

- Basics of demand, supply and cost analysis are studied.
- Different methods of financial accounting and capital budgeting are studied.

ELECTIVE	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

(COMMON TO BME, ECE, EEE, & MECHAT)

AIM

- To students to gain basic knowledge on MEMS (Micro Electro Mechanical System) and various fabrication techniques. This enables them to design, analyze, fabricate and test the MEMS based components.

OBJECTIVES

- Introduction to MEMS and micro fabrication
- To study the Mechanics for MEMS Design.
- To study Electro Static Design and System Issues.
- To know various MEMS Applications
- To know about the optical and RF MEMS

UNIT I INTRODUCTION TO MEMS 9

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication

UNIT II MECHANICS FOR MEMS DESIGN 9

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

UNIT III ELECTRO STATIC DESIGN AND SYSTEM ISSUES 9

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. Bistable actuators. Electronic Interfaces, Feedback systems, Noise, Circuit and system issues.

UNIT IV MEMS APPLICATION 9

Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS 9

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes – design basics, case study – Capacitive RF MEMS switch, performance issues.

TOTAL HOURS: 45

TEXT BOOK

1. Stephen Santeria," Microsystems Design", Kluwer publishers, 2000.

2. N.P.Mahalik, "MEMS",Tata McGraw hill, Sixth reprint, 2012.

REFERENCES

1. Nadim Maluf," An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
3. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002. Liu,"MEMS", Pearson education, 2007.

4. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

COURSE OUTCOMES:

- Able to design and analyse the performance of MEMS devices.
- Able to identify the right MEMS device against the applications.

ELECTIVE	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEM	L	T	P	C
		3	0	0	3

AIM:

- To understand the various types of power converters ,Machines ,Hybrid system

OBJECTIVES

- To study the features of different elements used in renewable energy conversion.
- To study the hybrid operation of wind and PV systems.
- To study the features of MPPT tracking.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECSGrid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind PV Maximum Power Point Tracking (MPPT).

TOTAL HOURS: 45

REFERENCES

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi

COURSE OUTCOMES:

- Features of renewable energy sources are studied.
- Features of electrical machines and converters used in renewable energy conversion are
- studied.
- Wind and PV systems are analysed and its hybrid operation is successfully studied.

ELECTIVE	POWER QUALITY	L	T	P	C
		3	0	0	3

AIM

- To study the various issues affecting power quality, their production, monitoring and suppression.

OBJECTIVES

- To study the production of voltages sags, overvoltage's and harmonics and methods of control.
- To study various methods of power quality monitoring.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES 9

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS 9

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion -voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

TOTAL HOURS: 45

TEXT BOOK

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.(For Chapters1,2,3, 4 and 5)

REFERENCES

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (New York: Wiley, 1999). (For Chapters 1, 2, 3, 4 and 5)

COURSE OUTCOMES :

- Basics of power quality are studied.
- Concepts of sag and swell and harmonics are studied.
- Monitoring parameters of power quality using simulation and hardware are obtained.

ELECTIVE	POWER SYSTEM PLANNING AND RELIABILITY	L	T	P	C
		3	0	0	3

AIM

- To make students become familiar with power system operation and the various control actions to be implemented on the power system for reliability

OBJECTIVES

- To introduce the students ves of power system
- To make the students learn the reliability stability analysis of generation in power system
- To make the students learn the reliability stability analysis of transmission in power
- system
- To familiarize the students with the planning of expansion of power system
- To introduce the students with the overview of planning of distribution system

UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of iso and interconnected generation systems.

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served.

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TOTAL HOURS: 45

TEXT BOOKS

1.Roy Billinton and Allan Ronald, “Power System Reliability.”

2.J.Endreny,”Reliability modeling in electric power systems”John Wiley & sons

REFERENCES

1. Proceeding of work shop on energy systems planning & manufacturing CI.

2. R.L .Sullivan, “ Power System Planning”,.

3. Turan Gonen, Electric power distribution system Engineering ‘McGraw Hill,1986

COURSE OUTCOMES :

- The scope of employability in power utilities will increase. The management skills required in the field of power system engineering is enhanced.

ELECTIVE	POWER SYSTEM TRANSIENTS	L	T	P	C
		3	0	0	3

AIM

- To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also to study propagation, reflection and refraction of these surges on the equipments their impact on the power system grid.

OBJECTIVES

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lighting strokes and the production of lighting surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.
- To study the over voltages faults and switching surges on integrated system.

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients – basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients – ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes –

model for lightning stroke - factors contributing to good line design – protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system – Line dropping and load rejection - voltage transients on closing and reclosing lines – over voltage induced by faults - switching surges on integrated system. Qualitative application of EMTP for transient computation.

TOTAL HOURS: 45

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Interscience, New York, 2nd edition 1991.

2. R.D.Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986..

REFERENCE BOOKS

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 2nd edition, 2000.

COURSE OUTCOMES :

The students will able to

- To understand the causes and effects of switching and lightning surges.
- To identify the protection schemes of power system equipment from overvoltages like ground wire, surge absorbers and arrestors.
- To design of insulation of power system components.
- To carry out the insulation testing procedures.

ELECTIVE	PRINCIPLES OF COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

AIM

- To understand the principles of communication engineering.

OBJECTIVES

- To understand the basic terms in communication systems
- To understand the concept and implementation of amplitude modulation
- To understand the concept and implementation of angle modulation
- To understand basics of information theory and pulse modulation types
- To understand the concepts of digital and broadband communications.

UNIT I INTRODUCTION OF COMMUNICATIONS SYSTEMS 9

Communications systems, Modulation, Bandwidth requirements, Noise- External Noise, Internal Noise, Noise calculations, Noise figure, Noise temperature.

UNIT II AMPLITUDE MODULATION 9

Amplitude modulation theory, Generation of AM, Single- sideband techniques- Evolution and description of SSB, Suppression of carrier, Suppression of Unwanted sidebands, Extension of SSB, Radio receivers - AM receivers, Single and independent Sideband receivers.

UNIT III ANGLE MODULATION 9

Frequency Modulation - Theory of Frequency Modulation and Phase Modulation, Noise, Generation of Frequency Modulation, Radio receivers- FM receivers.

UNIT IV PULSE COMMUNICATIONS 9

Information theory, Pulse modulation types -PWM, PPM and PCM, Pulse systems.

UNIT V DIGITAL & BROADBAND COMMINICATIONS SYSTEMS 9

Digital technology, Fundamentals of data communications systems, Data sets and Interconnection requirements, Network and control considerations, Broadband - Multiplexing, Short and Medium haul systems, Long haul systems, Elements of Long distance telephony.

TOTAL HOURS: 45

TEXT BOOKS

1.George Kennedy and Bernard Davis, “Electronic communication systems”, Tata McGraw – Hill Publication, 1999.

REFERENCES

1.B.P.Lathi, “Analog and Digital Communication systems”, PHI, 1992.

2. Proakis, “Digital Communications”, Tata McGraw – Hill Publication, 1999.

3.A.B.Carlson, “Communication Systems”, Tata McGraw – Hill Publication, 1992.

COURSE OUTCOMES:

- Understand the role of communication in personal and professional success.
- Develop awareness of appropriate communication strategies.
- Prepare and present messages with a specific intent.
- Analyze a variety of communication acts.
- Ethically use, document and integrate sources.

ELECTIVE	ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

(Common to CSE, ECE, EEE& MECHAT)

AIM

- To learn the fundamentals of Robotics and implementation aspects of real time concepts.

OBJECTIVES

- To learn about the Basic concepts of Robots
- To study the Sensor and Vision Systems.
- To learn the Grippers and robot dynamics.
- To know about kinematics and path planning.
- To learn about Robot Programming Languages and applications

UNIT I BASIC CONCEPTS 9

Origin & various generation of Robots - Robot definition - Robotics system components – Robot classification - Coordinate frames - Asimov's laws of robotics – degree of freedom – work volume - Need for Automation – types of automation – fixed, programmable and flexible automation.

UNIT II SENSORS AND VISION SYSTEM 9

Sensing - Range, proximity, position, velocity, acceleration, Touch, Force, Torque, Optical & laser sensors.

Machine vision - Introduction, Image acquisition, Illumination Techniques, Image conversion, Cameras, Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.

UNIT III GRIPPERS AND ROBOT DYNAMICS 9

Introduction - various types of grippers-design considerations. Construction of Manipulator – Introduction to Robot - Dynamics – Lagrange formulation – Newton Euler formulation – Properties of robot dynamic equations.

UNIT IV KINEMATICS AND PATH PLANNING 9

Forward Kinematics – Denavit Hartenberg Representation. Inverse Kinematics – Geometric approach.

UNIT V PROGRAMMING LANGUAGES AND APPLICATIONS 9

Robot programming - Fixed instruction, sequence control, General programming language, Specific programming languages. Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear, thermal and chemical plants.

TOTAL HOURS: 45

TEXT BOOKS

1.Mikell P. Groover ,Weiss G.M. Nagel R.N. Odraj . N.G. , "Industrial Robotics", Tata Mc Graw Hill, 3rd Reprint, Edition 2008.

2.Deb.S.R. "Robotics Technology and flexible Automation", Tata Mc Graw Hill, 9th Reprint 2004.

3.K.S Fu, R C.Gonzalez, CSG Lee- "Robotics", McGraw Hill, Edition 2008.

REFERENCE BOOKS

1.John J Craig "Introduction to Robotics Mechanics & control, Low price Edition, 7th Reprint, 2005.

2.Ghosh, "Control in Robotics and Automation : Sensor Based Integration", Allied Publishers.

COURSE OUTCOMES :

The student must be able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensors, machine vision robot kinematics and programming.

ELECTIVE	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

AIM:

- To Explore the theory and applications of special electrical machines.

OBJECTIVES

- Provide the concept of construction, operating principle and characteristics of synchronous reluctance motor, stepper motor and switched reluctance motor.
- Give basic knowledge about the principle of operation, analysis, emf and torque equation, and control of permanent magnet synchronous motors and brushless DC motors

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance and Hybrid Motors – SYNREL Motors – Voltage and Torque Equations - Phasor diagram - Characteristics.

UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Rotary and Linear SRMs - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensorless operation – Closed loop control of SRM - Characteristics.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Permanent Magnet materials – Magnetic Characteristics – Permeance coefficient - Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Commutation - Power controllers – Motor characteristics and control.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature reaction MMF – Synchronous Reactance – Sinewave motor with practical windings - Phasor diagram Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements.

TOTAL HOURS: 45

TEXT BOOKS

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.

2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCE BOOKS

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.

2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus, London, 1982.

3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

COURSE OUTCOMES:

- Need for special electrical machines are studied.
- Different features of special machines and converter circuits for special machines are

obtained

ELECTIVE	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

AIM:

To understand the tools and techniques of Quality management

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of total quality management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality council – Quality statements –Strategic planning – Deming philosophy – Barriers to TQM implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality –Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy –Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV TQM TOOLS **9**

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment(QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 and other quality systems – ISO 9000:2000 Quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 –Concept – Requirements and benefits.

TOTAL HOURS: 45

TEXT BOOKS

1. Besterfiled, D.H. "Total Quality Management", Pearson Education, Inc. 2003.

2. Zeiri., "Total Quality Management for Engineers", Wood Head Publishers, 1991.

REFERENCES

2. Evans, J. R., and Lidsay, W.M., "The Management and Control of Quality", 5th Edition, South-Western (Thomson Learning), 2002.

3. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford, 1989.

4. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.

COURSE OUTCOMES :

- Able to apply the tools and techniques of quality management to manufacturing and services processes.

ELECTIVE	VLSI DESIGN	L	T	P	C
		3	0	0	3

(COMMON TO BME, ECE, EEE & MECHAT)

AIM

To provide the knowledge on VLSI fabrication and circuit design procedures

OBJECTIVE

- To understand the MOS transistor theory, CMOS technologies and the Layout
- To understand the circuit concepts and scaling of MOS Circuits.
- To understand the concepts of designing combinational and sequential circuit using CMOS logic configuration
- To understand the subsystem design of IC's
- To understand the concepts of CMOS testing

UNIT – I: INTRODUCTION TO MOS TECHNOLOGY 9

A brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues.

UNIT – II: CONCEPTS AND SCALING OF MOS CIRCUITS 9

Sheet resistance – Area capacitances of layers – Delay: Inverter Delays – Driving Large Capacitance loads – Propagation Delay – Wiring Capacitances – Choice of Layers – Scaling of MOS Circuits: Scaling models and factors – Scaling factors of device parameters – Limitation of Scaling.

UNIT – III: COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN 9

Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology-sequencing dynamic circuits – synchronizers

UNIT – IV: DATAPATH AND ARRAY SUBSYSTEMS 9

Addition/ Subtraction – one/Zero Detectors – Comparators – Boolean Logical Operations – Coding – Shifters – Multiplication – Division – Parallel Prefix Computations – SRAM – DRAM – ROM – Serial Access Memory – Programmable Logic Arrays – Array yield, Reliability and Self-test.

UNIT – V: TESTING **9**

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

TOTAL HOURS: 45

TEXT BOOKS:

1. Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education, Third edition, 2006.
2. D.A Pucknell& K. Eshraghian Basic VLSI Design, Third edition, PHI, 2003

REFERENCE BOOKS:

1. Wayne Wolf, Modern VLSI design, Pearson Education, 3rd edition 2003
2. M. J. S. Smith: Application specific integrated circuits, Pearson Education, 1997
3. J. Bhasker: Verilog HDL primer, BS publication, 2001.

COURSE OUTCOMES :

- Expose to HDL language and ability to design PLD devices and simple application.

ELECTIVE	WIND ENERGY CONVERSION SYSTEMS	L	T	P	C
		3	0	0	3

AIM:

The Aim is to present generators, or drives that are used in wind farms with their characteristics, advantages and disadvantages, and their methods and procedures for the control and regulation in order to achieve the pre-defined standards and quality of delivered energy.

OBJECTIVE

- To learn the types of renewable energy sources
- To study the application of electrical machines in renewable energy conversion
- To study the application of semi conductor devices in renewable energy conversion
- To analyze the grid integrated renewable energy.
- To introduce the hybrid renewable energy systems

UNIT I INTRODUCTION 9

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine

UNIT II WIND TURBINES 9

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations-Tip speed ratio-No. of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control-stall control-Schemes for maximum power extraction.

UNIT III FIXED SPEED SYSTEMS 9

Generating Systems- Constant speed constant frequency systems -Choice of Generators-Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor - Drive Train model-Generator model for Steady state and Transient stability analysis.

UNIT IV VARIABLE SPEED SYSTEMS 9

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modeling - Variable speed variable frequency schemes.

UNIT V GRID CONNECTED SYSTEMS 9

Stand alone and Grid Connected WECS system-Grid connection Issues-Machine side & Grid side controllers-WECS in various countries

TOTAL HOURS: 45

REFERENCE BOOKS

1.L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990

2.Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.

3.E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge,1976.

4.S.Heir "Grid Integration of WECS", Wiley 1998.

COURSE OUTCOMES :

The students will be able to

- Apply the knowledge in solar spectrum and solar radiation
- Understand the basic concept of solar photovoltaic energy conversion and different types of solar PV plants.
- Apply the solar power conversion techniques in the field of solar cars, air craft and space statellites .

ELECTIVE	POWER SYSTEM RESTRUCTURING AND DEREGULATION	L	T	P	C
		3	0	0	3

AIM:

Understanding the restructuring process, Entities involved, The levels of competition, The market place mechanisms, Sector-wise major changes required; Reasons and objectives of deregulation of various power systems across the world.

OBJECTIVES :

- To provide electricity for all reasonable demands.
- To encourage the competition in the generation and supply of electricity.
- To improve the continuity of sypply and the quality of services .

UNIT I INTRODUCTION TO DEREGULATION AND RESTRUCTURING 10

Gencos, transcos, discos, customers, ISO, Market operators. privatization, An overview of the restructured powersystem, difference between integrated power system and restructured power system, transmission open access,wheeling, Power systems operation – old Vs new, Key issues associated with the restructuring of ESIs, advantagesof competitive system.

UNIT II DEREGULATION OF POWER SECTOR 8

Separation of ownership and operation, Deregulated models – pool model, pool and bilateral trades model, multilateral trade model.

UNIT III COMPETITIVE ELECTRICITY MARKET 10

Independent System Operator activities in pool market, wholesale electricity market characteristics, central auction,single auction power pool, double auction power pool, market clearing and pricing, Market Power and its MitigationTechniques, Bilateral trading, Ancillary services.

UNIT IV TRANSMISSION PRICING 10

Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, postage stamp method, contract pathmethod, boundary flow method, MW-mile method, MVA-mile method, comparison of different methods.

UNIT V CONGESTION MANAGEMENT 12

Total Transfer Capability – Limitations – Margins – Available transfer capability (ATC) – Procedure – methodsto compute ATC – Static and Dynamic ATC – Bid, Zonal and Node Congestion Principles – Inter and Intra zonalcongestion – Generation Rescheduling – Transmission congestion contracts.

TOTAL HOURS: 45

TEXT BOOKS

1. Loi Lei Loi, " Power System Restructuring and Deregulation – Trading, performance& information technology", John Wiley sons,2001.

2. Kankar Bhattarcharya, et,al., "Operation of restructured power systems", Kluwer academic publishers,2001.

REFERENCE

1. S. A. Khaparde and A. R. Abhyankar, "Restructured Power Systems", Narosa Publishing House, New Delhi, India, 2008.

2. S. C. Srivastava and S. N. Singh, "Operation and Management of Power system in Electricity Market", Narosa Publishing House,New Delhi, India, 2008.

3. M. Shahidehpour and M. Alomoush, "Restructuring Electrical Power Systems", Marcel Decker Inc., Scholarly Transaction Papersand Utility web sites, 2001.

COURSE OUTCOMES:

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

Understand the need for restructuring of power systems, discuss different market models, different stakeholders and market power.

Understand and generalizd the functioning and planning activities of ISO.

Understand transmission open access pricing issues and congestion management.

ELECTIVE	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

AIM:

To undertstand the basic concepts of nano electronics and its application in the research and engineering domain

OBJECTIVE :

This course is intended to cover basics of electronics transistor , band structured models , nano capacitors, coulomb blockade, single electron transistor and nano photonics

UNIT I CONCEPTS OF NANOSTRUCTURES 9

Electronic states in crystal energy bands, Concepts of 2D nanostructures (quantum wells), 1 D nanostructures(quantum wires) OD nanostructures (quantum dots), artificial atomic clusters.

UNIT II PROPERTIES AND ANALYSIS OF NANOSTRUCTURES 9

Size dependent properties, Size dependent absorption spectra, Blue shift with smaller sizes, Phonons innanostructures, Contacts at Nano level, AFM.lSTM tip on a surface.

UNIT III ANALYSIS OF QUANTUM TECHNIQUES 9

Charging of quantum dots, Coulomb blockade, Quantum mechanical treatment of quantum wells, wires and dots,Widening of bandgap in quantum dots, Strong and weak confinement, Properties of coupled quantum dots, Optical scattering from Nan defects.

UNIT IV CHARACTERISTIC OF NANOCOMPOSITES AND ZEOLITES 9

Nanocomposites Electronic and atomic structure of aggregates and nanoparticles Theory and modeling of nanoparticles fictionalization processes.

UNIT V CHARACTERIZATION OF NANOPOLYMERS 9

Nanosystems: Synthesis and chacterization Methods of Synthesis: Molecular beam epitaxy, MOCVD, chemicalroutes, nanoparticles on polymers, pulsed laser deposition, ion beam assisted techniques including embeddednanoparticles, RF sputtering.

TOTAL HOURS: 45

TEXT BOOKS

1. K.Bamam and D.Vvedensky ,Low Dimensional Semiconductor Structures, (Cambrige University Book) 2001.

REFERENCE BOOKS

1. L.Banyai and S.W.Koch ,Semiconductor Quantum Dots, (World Scientific) 1993

2. J.H. Davies, An introduction to the physics-af low dimensional semiconductors, Cambridge Press, 1998.

3. Karl Goser, Peter Glosekotter, Jan Dienstuhl Nanoelectronics and Nanosystems , Springer, 2004

4. Krause P. C. and Wasynczuk O., Electromechanical Motion Devices, McGraw-Hill, New York, 1989.Lyshevski S. E., ElectromechanicalSystems, Electric Machines, andApplied Mechatronics, CRC Press, FL, 1999.

5. Lyshevski S. E., "Integrated control of microactuators and integrated circuits: a new turning approach in MEMS technology,"Proceedings Conference Decision and Control, Phoenix, AZ, pp. 2611-2616, 1999.

COURSE OUTCOME:

- To know nano electronics holds the capacity for mass production of high quality nano devices with an enormous variety of applications from computer to bio sensors, from cell phone to space shuttle and from large display screens to small display electronic toy
- To know the scaling of transistor and other devices to smaller and smaller sizes which has provided the basis for this exponential growth has limits physical technological and economic which will be reached by nano electronics in the next coming decade

ELECTIVE	ADVANCED ELECTRONICS TEST ENGINEERING	L	T	P	C
		3	0	0	3

Aim: To understand the concept of PCB inspection methods, trouble shooting, DFT

OBJECTIVE :

- To study designing of wireless network using Embedded systems
- To learn modeling of sequential digital system using verilog and VHDL
- To understand system design using ASIC

UNIT I INTRODUCTION TO PCB TECHNOLOGY 9

Printed Circuit Boards(PCB)- Construction – Types of PCB- Multilayer – Surface Mount technology – PCB Manufacturing process – PCB Inspection methods – Bare Board Testing – Optical and X – ray Inspection – Electrical tests – Text fixtures – Bed of nails fixtures – Cross talk test – Mock up test – In circuit test – burn in test – Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT II PCB TROUBLE SHOOTING PROCESS 9

Symptom Recognition – Bracketing Technique – Component failure Analysis – Fault types and causes in circuits– during manufacturing – Manual trouble shooting technique – Tools and Instruments DMM – CRO – PCO – Logicprobes – Logic pulsar – Logic Analyzer.

UNIT III AUTOMATED TROUBLE SHOOTING TECHNIQUES 9

ATE Techniques – CPU Emulator technique – ROM amd ROM Emulators – In circuit Comparator – In Circuit Functional test – Trouble shooting digital gates – Testing Linear Integrated Circuits – Guarding Technique – VI trace Technique – Bus Cycle Signature System – Board functional test methods – Boundary scan test basics.

UNIT IV ATE SYSTEM ARCHITECTURE 9

ATE System Components – Digital Pin Electronics – Drive data formats – Digital High way – Analog Highway– Test Vector Generation – Creating test patterns – Fault Simulations.

UNIT V DESIGN FOR TESTABILITY (DFT) 9

MDA test systems – Boundary scan test with I/O pin compatibility – Automatic optical inspection systems –Combinational ATE Systems – Design for testability – Observability and Controllability – Testing Flow diagram – Stuck at fault model – Fault simulation – Ad Hoc technique – Scan design technique – Basics of ATPG – BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing – Output response Analysis – Transition count syndrome checking – Signature Analysis – Circular BIST.

TOTAL HOURS: 45

TEXT BOOKS

1. Michael L.Bushnell et al., Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit, 1st Edition, Academic Press, 2002.

2. Randall L Geiger, Pillip E Allen, VLSI design techniques for analog and digital circuits, MGH, 1990.

REFERENCE BOOKS

1. Parag.K.lala, Digital circuit Testing and Testability, 1st Edition, Academic press, 2001.

2. Alfred L.Crouch, Design for test for Digital ICs and Embedded core systems, 2nd Edition, PHI, 1999.

COURSE OUTCOMES :

Students can able to

- Understand the PCB manufacturing process
- Understand the logic pulsar and logic analyser
- Understand the ROM and ROM emulators.
- Understand the ATE system components.

INDUSTRIAL ELECTIVES

ELECTIVE	LEARNING IT ESSENTIALS BY DOING	L	T	P	C
		3	0	0	3

AIM:

To learn the essentials of information technology

OBJECTIVES

- To get an idea bout the scripting language
- To get an idea about the internet protocols

UNIT I

Fundamentals of Computer architecture-introduction-organization of a small computer, Central Processing Unit - Execution cycle - Instruction categories - measure of CPU performance Memory - Input/output devices - BUS-addressing modes. System Software - Assemblers - Loaders and linkers - Compilers and interpreters, Operating system - introduction - memory management schemes Process management Scheduling - threads.

UNIT II

Problem solving with algorithms- Programming styles, Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies - Software development Models, User interface Design - introduction - The process - Elements of UI design & reports.

UNIT III

RDBMS- data processing - the database technology - data models, ER modeling concept - notations - Extended ER features, Logical database design – normalization, SQL - DDL statements - DML statements - DCL statements, Writing Simple queries - SQL Tuning techniques - Embedded SQL – OLTP

UNIT IV

Objected oriented concepts - object oriented programming, UML Class Diagrams- relationship - Inheritance - Abstract classes –polymorphism, Object Oriented Design methodology - Common Base class, Alice Tool - Application of OOC using Alice tool.

UNIT V

Client server computing - Internetworking - Computer Networks ,Working with TCP/IP - IP address - Sub netting - DNS - VPN - proxy servers World Wide Web - Components of web application - browsers and Web Servers, URL - HTML - HTTP protocol - Web Applications - Application servers - Web Security.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

- Enabling knowledge
- Problem solving
- Communication
- Team work
- responsibility

ELECTIVE	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

AIM: bussines intelling is a broad category of software applications and technologies used to gather,store, analyse and access data

OBJECTIVES:

- Master the basics in business intelligence , data mining and knowledge discovery in databases.
- Learn the role that software tools /application play in BI and DM , with emphasis on industrial care studies and practical applications.

Have an overall understanding of the major issues and applications in business intelligence and data mining, including a basic group of the algorithm classes and best practices for building successful BI projects.

UNIT - I INTRODUCTION TO BUSINESS INTELLIGENCE 9

Introduction to OLTP AND OLAP - BI Definition and BI Concepts - Business Applications of BI - BI Framework- Role of Data Warehousing in BI -BI Infrastructure Components- BI Process Developing Data Warehouse - Management Framework - Business driven approach -BI Technology -- BI Roles & Responsibilities

UNIT - II BASICS OF DATA INTEGRATION (Extraction Transformation Loading) 9

Concepts of Data Integration need and advantages of using Data Integration - Introduction to common data integration approaches - Introduction to ETL using SSIS - Introduction to Data Quality - Data Profiling Concepts and Applications.

UNIT - III INTRODUCTION TO MULTIDIMENSIONAL DATA MODELING 9

Introduction to Data and Dimensional Modeling - Multi Dimensional Data Model - ER modeling Vs Multi Dimensional Model - Concepts of Dimensions - facts - cubes- attributes- hierarchies- star and snowflake schema - Introduction to Business Metrics and KPIs - Creating Cubes using SSAS.

UNIT - IV BASICS OF ENTERPRISE REPORTING 9

Introduction to Enterprise Reporting - Concepts of dashboards - balanced scorecards - Introduction to SSRS Architecture- Enterprise Reporting using SSRS reporting service

UNIT - V BI ROAD AHEAD 9

BI and Mobility - BI and cloud computing - BI for ERP systems - Benefits of BI in ERP- NorthWind_Traders Data-Data Analyses through Excel-Kettle Tool - Conversion of data using Kettle Tool.

TOTAL: 45

TEXT BOOKS

1. RN Prasad, SeemaAcharya, "Fundamentals Of Business Analytics" Wiley India,2011

REFERENCE BOOKS

1. SoumendraMohanty, "Data Warehousing Design, Development and Best Practices", Tata McGraw-Hill, New Delhi, 2007

2. David Loshin, "Business Intelligence", Morgan Kaufmann Publishsers, San Francisco, Fifth edition, 2007

3. Larissa Terpeluk Moss and ShakuAtre, "Business Intelligence Roadmap", Pearson Education, 2007

COURSE OUTCOMES :

- Examine the concepts of data warehousing and OLAP
- Apply the concepts of BI and DM techniques for clustering, association , and classification
- Understand existing data collection and operation system
- Understand key requirements and vision for information management develop proposal for road-map timescale for implementation
- Understand the operation procedure of BI projects in an organization.
- Select appropriate DM tools and methods to manipulate and achieve date

ELECTIVE	VIRTUAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

AIM

- To provide comprehensive knowledge in virtual instrumentation and some of its applications.

OBJECTIVE

- Review background information required for studying virtual instrumentation.
- Study the basic building blocks of DAQ in virtual instrumentation.
- Study the various techniques of interfacing of external instruments of PC.
- Study the various graphical programming environments in virtual instrumentation
- Study a few applications in virtual instrumentation

UNIT I REVIEW OF DIGITAL INSTRUMENTATION 6

Representation of analog signals in the digital domain - Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

UNIT IIFUNDAMENTALS OF VIRTUAL INSTRUMENTATION 10

Concept of virtual instrumentation - PC based data acquisition - Typical on board DAQ card - Resolution and sampling frequency - Multiplexing of analog inputs - Single-ended and differential inputs - Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT IIICLUSTER OF INSTRUMENTS IN VI SYSTEM 10

Interfacing of external instruments to a PC - RS232, RS 422, RS 485and USB standards - IEEE 488 standard - ISO-OSI model for serial bus - Introduction to bus protocols of MOD bus and CAN bus.

UNIT IV GRAPHICAL PROGRAMMING ENVIRONMENT IN VI 10

Concepts of graphical programming - Lab-view software - Concept of VIs and sub VI - Display types - Digital - Analog - Chart Oscilloscopic types - Loops - Case and sequence structures - Types of data - Arrays - Formulae nodes -Local and global variables String and file I/O.

UNIT V ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 9

Fourier transform - Power spectrum - Correlation - Windowing and filtering tools - Simple temperature indicator - ON/OFF controller - P-I-D controller - CRO emulation - Simulation of a simple second order system - Generation of HTML page.

TOTAL HOURS: 45

TEXT BOOKS

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument society of America, 1994.
2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International. 3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

REFERENCE BOOKS

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

COURSE OUTCOMES :

The students will be able to

- Know the basics concepts of instrumentation
- Apply the VI tools to complete the task
- Differentiate the usage of virtual tool from the physical component