ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)
REGULATIONS – 2017

Program Educational Objectives:

Bachelor of Electrical and Electronics Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. have successful professional and technical career
2. have strong foundation in basic sciences, mathematics and computational platforms
3. have knowledge on the theory and practices in the field of electrical power engineering and allied areas
4. engross in life-long learning to keep themselves abreast of new developments
5. practice and inspire high ethical values and technical standards

Program Outcome:

a) Ability to apply knowledge of mathematics, sciences and engineering
b) Ability to understand and apply basic theorems and postulate in circuit, field and control theories
c) Ability to identify, formulate and solve electrical power engineering problems
d) Ability to analyse and apply electronics in the field of electrical power apparatus and systems
e) Ability to understand and apply computational platforms and software tools for engineering applications
f) Ability to understand ethical and professional responsibilities
g) Ability to communicate effectively and work in interdisciplinary groups
h) Ability to review, comprehend and report technological development

PEO \ PO	a	b	c	d	e	f	g	h
1						√	√	√
2	√		√		√			
3		√	√	√				
4						√	√	√
5						√	√	

MAPPING – UG- ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)

			PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h
YEAR 1	**SEM 1**	Applied Mathematics	√							
		Environmental Science and Engineering	√							
		Electric Circuit Analysis	√	√	√	√				
		Electron Devices and Circuits	√		√	√				
		Computer Practice Laboratory	√				√			
	SEM 2	Digital Systems and Microcontrollers	√			√	√		√	
		Electromagnetic Theory	√	√		√				
		Network Analysis and Synthesis	√	√						
		Power Plant Engineering	√						√	
		Integrated circuits and Microcontrollers Laboratory	√			√	√		√	

YEAR 2	**SEM 3**	Control Systems	√	√	√	√				
		Electrical Machines I	√	√	√	√				
		Linear Integrated Circuits	√	√		√				
		Transmission and Distribution	√	√	√	√				
		Control and Instrumentation Laboratory	√	√	√		√			
	SEM 4	Electrical Machines II	√	√	√	√				
		Power Electronics	√		√	√				√
		Power System Analysis	√	√	√					
		Elective I								
		Electrical Machines Laboratory	√	√	√	√				

YEAR 3	**SEM 5**	High Voltage Engineering	√		√	√				
		Power System Operation and Control	√	√	√					
		Protection and Switchgear	√	√	√					
		Elective II								
		Power Electronics and Drives Laboratory	√		√	√				√
	SEM 6	Design of Electrical Apparatus	√		√	√				√
		Solid state Drives	√		√	√				√
		Elective III								
		Elective IV								
		Power System Simulation Laboratory	√	√	√	√	√			

YEAR 4	**SEM 7**	Elective V								
		Elective VI								
		Elective VII								
		Project Work					√		√	√

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2017
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)
CURRICULA AND SYLLABI I - VII SEMESTERS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTGE7153	Environmental Science and Engineering	3	0	0	3
3.	PTEE7101	Electric Circuit Analysis	3	0	0	3
4.	PTEC7104	Electron Devices and Circuits	3	0	0	3
PRACTICALS						
5.	PTGE7111	Computer Practices Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7201	Digital Systems and Microcontrollers	3	0	0	3
2.	PTEE7202	Electromagnetic Theory	3	0	0	3
3.	PTEE7203	Network Analysis and Synthesis	3	0	0	3
4.	PTME7751	Power Plant Engineering	3	0	0	3
PRACTICALS						
5.	PTEE7211	Integrated circuits and Microcontrollers Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7301	Control Systems	3	0	0	3
2.	PTEE7302	Electrical Machines I	3	0	0	3
3.	PTEE7303	Linear Integrated Circuits	3	0	0	3
4.	PTEE7304	Transmission and Distribution	3	0	0	3
PRACTICALS						
5.	PTEE7311	Control and instrumentation Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7401	Electrical Machines II	3	0	0	3
2.	PTEE7402	Power Electronics	3	0	0	3
3.	PTEE7403	Power System Analysis	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICALS						
5.	PTEE7411	Electrical Machines Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7501	High Voltage Engineering	3	0	0	3
2.	PTEE7502	Power System Operation and Control	3	0	0	3
3.	PTEE7503	Protection and Switch gear	3	0	0	3
4.		Elective II	3	0	0	3
PRACTICALS						
5.	PTEE7511	Power Electronics and Drives Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7601	Design of Electrical Apparatus	3	0	0	3
2.	PTEE7602	Solid State Drives	3	0	0	3
3.		Elective III	3	0	0	3
4.		Elective IV	3	0	0	3
PRACTICALS						
5.	PTEE7611	Power system simulation Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.		Elective V	3	0	0	3
2.		Elective VI	3	0	0	3
3.		Elective VII	3	0	0	3
PRACTICALS						
4.	PTEE7711	Project work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL NO. OF CREDITS: 99

ELECTIVES

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTMA7001	Discrete Mathematics	3	0	0	3
2.	PTMA7071	Probability and Statistics	3	0	0	3
3.	PTGE7071	Disaster Management	3	0	0	3
4.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
5.	PTGE7073	Human Rights	3	0	0	3
6.	PTGE7074	Total Quality Management	3	0	0	3
7.	PTGE7075	Intellectual Property Rights	3	0	0	3
8.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
9.	PTMG7001	Managerial Economics and Financial Accounting	3	0	0	3
10.	PTMG7751	Principles of management	3	0	0	3
11.	PTEE7001	Adaptive Control	3	0	0	3
12.	PTEE7002	Advanced Control Systems	3	0	0	3
13.	PTEE7003	Analysis of Electrical Machines	3	0	0	3
14.	PTEE7004	Computer Aided Design of Electrical Apparatus	3	0	0	3
15.	PTEE7005	Data Structures and Algorithms	3	0	0	3
16.	PTEE7006	Digital Signal Processing	3	0	0	3
17.	PTEE7007	EHV Power Transmission	3	0	0	3
18.	PTEE7008	Electrical Measurements and Instrumentation	3	0	0	3
19.	PTEE7009	Embedded Automation Systems	3	0	0	3
20.	PTEE7010	Embedded System Design	3	0	0	3
21.	PTEE7011	Energy Management and Auditing	3	0	0	3
22.	PTEE7012	Flexible AC Transmission Systems	3	0	0	3
23.	PTEE7013	Fundamentals of Computer Architecture	3	0	0	3
24.	PTEE7014	Fundamentals of Object Oriented Programming	3	0	0	3
25.	PTEE7015	High Voltage Direct Current Transmission	3	0	0	3
26.	PTEE7016	Industrial Power System Analysis and Design	3	0	0	3
27.	PTEE7017	Medical Instrumentation	3	0	0	3
28.	PTEE7018	Micro Electro Mechanical Systems	3	0	0	3
29.	PTEE7019	Nano Technology	3	0	0	3
30.	PTEE7020	Operational Research	3	0	0	3
31.	PTEE7021	Power Electronics for Renewable Energy Systems	3	0	0	3
32.	PTEE7022	Power Quality	3	0	0	3
33.	PTEE7023	Restructured Power Systems	3	0	0	3
34.	PTEE7024	Smart Grid	3	0	0	3
35.	PTEE7025	Soft Computing Techniques	3	0	0	3
36.	PTEE7026	Special Electrical Machines	3	0	0	3
37.	PTEE7027	VLSI Design and Architecture	3	0	0	3
38.	PTCS7071	Operating Systems				
39.	PTEI7651	Industrial Data Communication	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES **9**

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION **9**

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- 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.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTGE7153 ENVIRONMENTAL SCIENCE AND ENGINEERING LT P C
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth"s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi,2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PTEE7101	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make the students to understand the concept of circuit elements, lumped circuits, waveforms, circuit laws and network reduction techniques. To analyze the, series and parallel AC circuits, and to solve problems in three phase circuits.

UNIT I INTRODUCTION 9

Types of sources; relation between voltage and current in network elements; concept of active, passive, linear, nonlinear, unilateral, bilateral, lumped, distributed elements; Kirchhoff's laws and their application to node and mesh analysis of networks. Concept of tree, branch, cotree, link, loop, and cutset. Problems involving D.C. circuits only.

UNIT II NETWORK REDUCTION TECHNIQUES AND NETWORK THEOREMS 9

Series parallel circuits; star , delta and reverse transformation; superposition, reciprocity, compensation, Thevenin's, Norton's, Millman's and maximum power transfer theorems; principle of duality. Problems involving D.C. circuits only.

UNIT III AC CIRCUITS 9

Basic definitions; phasors and complex representation; RMS,Average value, form factor peak factor- AC signals ;solution of RLC networks; power and energy relations; application of Kirchhoff's laws, Thevenin's, Norton's, Maximum power transfer theorems to A.C. circuits.

UNIT IV RESONANCE AND APPLICATIONS 9

Resonant circuits-series, parallel, series-parallel circuits-effect of variation of Q on resonance. Relations between circuit parameters- Q, resonant frequency and bandwidth. Inductively coupled circuits-single tuned and double tuned circuits - bandwidth and frequency response.

UNIT V THREE PHASE CIRCUITS 9

Three phase balanced / unbalanced voltage sources phase sequence – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 45 PERIODS

COURSE OUTCOMES

- Learners will be able to analyse the electric circuits with DC and AC excitation by applying various circuit laws.

TEXT BOOKS

1. M Nahvi I J A Edminster "Electric Circuits"; *Schaum's outline series* , Tata Mcgraw Hill companies, 4th Edition, 2009

2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 2013.

3. David A Bell ," Electric circuits ", Oxford University Press, 2011

REFERENCES

1. R.Jagatheesan "Electric Circuit Analysis", Tata Mcgraw Hill ,2014

2. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, 2002.

3. Sudhakar. A, Shyammohan. S.P "Circuits and Networks-Analysis and Synthesis"; Tata McGraw Hill publishers, 2006.

PTEC7104 ELECTRON DEVICES AND CIRCUITS L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis –

FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the structure of basic electronic devices.
- Design applications using basic *electronic devices

TEXT BOOKS:

1. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
2. Sedra and smith, "Microelectronic circuits "Oxford University Press, 2004.

REFERENCES:

1. Rashid, "Micro electronic circuits" Thomson publications, 1999.
2. Floyd, "Electron devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGrawHill, 3rd Edition,2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application ofAnalog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004

PTGE7111	COMPUTER PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENT

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function

10. Program using structures and unions.

TOTAL : 60 PERIODS

OUTCOMES

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

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

30 Systems with C compiler

PTEE7201 DIGITAL SYSTEMS AND MICROCONTROLLERS LT P C
3 0 0 3

OBJECTIVES:

- To introduce the fundamentals of Computational Digital System Technologies
- To introduce digital simulation techniques for development of application oriented logic circuits.
- To study the Architecture, addressing modes & instruction set of 8085 and 8051 and to develop skills in writing simple programs.
- To introduce commonly used peripheral interfacing ICs.
- To study and understand the typical applications of micro-controllers

UNIT I DIGITAL LOGIC FAMILIES 9

Introduction to Digital Logic for Design of adder, subtractor, comparators, code converters, encoders, decoders –Introduction through Comparison to Logic families: RTL ad DTL circuits, TTL, ECL, CMOS family- Basics of Programmable Architectures- PROM, PLA, PLD, FPGA.

UNIT II 8085 PROCESSOR AND ITS PERIPHERAL INTERFACING 9

8085: Functional block diagram –- Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupts - Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8254 Timer/ Counter.

UNIT III PROGRAMMING FUNCTIONALS IN PROCESSORS 9

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions, stack.

UNIT IV MICRO CONTROLLER 8051 9

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Data Transfer, I/O instructions .

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises - key board and display interface – Manipulation, Control of Temperature control system - stepper motor control.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse, comprehend, design and simulate microprocessor and microcontroller based systems used for control and monitoring.

TEXT BOOKS:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Penram International (P) ltd., Mumbai, 5th edition, 2008.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 2007.

REFERENCES:

1. N.Senthil Kumar, M.Saravana, S.Jeevananthan, 'Microprocessors and Microcontrollers', Fifth Edition, Oxford Higher Education, 2013.
2. Douglas V. Hall, 'Micro-processors and interfacing' Tata McGraw Hill, 2nd Edition, New Delhi, 2009
3. Kenneth Ayala, 'The 8051Microcontroller', Thomson, 2005.
4. Krishna Kant, 'Microprocessors and Microcontrollers', Prentice Hall of India Pvt. Ltd. 2007.
5. M. Morris Mano, 'Digital Design', Pearson Education, 2008.

PTEE7202 ELECTROMAGNETIC THEORY LT P C
3 0 0 3

OBJECTIVES:

To impart knowledge on the concepts and the computation of Electro-magnetic fields which is essential for understanding the working principle, design and analysis of Electrical machines and Systems.

UNIT I ELECTROSTATICS I 9

Sources and effects of electromagnetic fields, Vector fields, Vector Calculus- Gradient, Divergence, Curl – theorems and applications. Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS II 9

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectric -Dielectric polarization - Dielectric strength - Electric fields in multiple dielectrics – Boundary conditions, Capacitance, Energy density, Poisson's and Laplace's equations – solutions by Direct Integration method, Applications.

UNIT III MAGNETOSTATICS 9

Lorentz force, magnetic field intensity (**H**) – Biot– Savart's Law - Ampere's Circuit Law – **H** due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (**B**) – **B** in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, Scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 9

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Time varying potential – Relation between field theory and circuit theory , Applications

UNIT V ELECTROMAGNETIC WAVES 9

Electromagnetic Wave Generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossless and lossy dielectrics, conductors-skin depth , Poynting vector , Plane wave reflection and refraction – Standing Wave , Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand Electro-magnetic field theory and apply them for modelling and analysis of electrical equipment.

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4th Edition, Oxford University Press Inc. First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009

REFERENCES:

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
2. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory fundamentals", Cambridge University Press; Second Revised Edition, 2009.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
5. B N Basu,' Electromagnetic essentials' , Universities Press, 2015

PTEE7203 NETWORK ANALYSIS AND SYNTHESIS LT P C
3 0 0 3

OBJECTIVES

- To analyse the relationship between various two port parameters, ladder and lattice networks.
- To analyse the transients in electrical networks with DC and AC excitation
- To synthesise RL, RC & RLC networks by Foster and Cauer form
- To design different types of passive filters.

UNIT I INTRODUCTION TO GRAPH THEORY 9

Linear Graphs in Electrical Networks, Basic Definitions, Incidence, Loop and cut-set matrices, Fundamental Loop and Fundamental Cut-Set Matrices, Graph Theoretic version of KCL and KVL, Loop Impedance and Node Admittance Matrices, Duality in Electrical Networks.

UNIT II TWO PORT NETWORK 9

Network functions - Poles and Zeros of network functions - Complex frequency - Two port parameters Z,Y,H and ABCD - Scaling network functions -T and π equivalent circuits - Bridged

networks - Analysis of ladder and lattice networks - Coupled circuits as two port network - Tuned circuits.

UNIT III TRANSIENT RESPONSE OF RLC CIRCUITS 9

Transient response of RL,RC,RLC, circuit for DC input and AC input with sinusoidal excitation.

UNIT IV TRANSFER FUNCTION SYNTHESIS 9

Properties of LC,RL,RC driving point functions, Synthesis of driving point LC,RC and RL functions - Foster and Cauer forms- Synthesis of transfer admittance, transfer impedance with a one ohm termination - Synthesis of constant-resistance network.

UNIT V DESIGN OF FILTER 9

Design of filters -Low pass filters, high pass filters, band pass filters, band reject filters, Butterworth filters, m-derived filters, constant k-filters

TOTAL: 45 PERIODS

OUTCOMES

- Students can have the ability to analyse various electrical networks in steady & transient states and also equipped to design various types of filters.

TEXT BOOKS

1. Franklin F.Kuo**,** "Network Analysis and Synthesis (5th Edition ,2012)" Wiley International;2010
2. Andreas Antoniou," Digital filters (Analysis, Design and Application)", McGraw-Hill; 2nd edition (May 15, 2000)

REFERENCES

1. M.E.Van Valkenberg, "Introduction to Modern Network Synthesis", *Wiley Eastern;.*
2. Umesh Sinha "Network Analysis and Synthesis"Satya Prakashan Publishers , 4th Edition 2013
3. David A Bell,"Electric Circuits Oxford Press, ", (7thEdition, 2011).

PTME7751 POWER PLANT ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the working of power plants and analyse their performance.
- To learn the economics of power generation.

UNIT I HYDRO POWER PLANTS 9

Energy scenario – Global and National. Essential elements and classification of hydro power plants. Typical Layout and associated components. Selection of turbines. Pumped storage plants.

UNIT II COAL, OIL AND GAS TURBINE POWER PLANTS 9

Cycle analysis - Layout of modern coal based power plant. Super Critical Boilers - FBC Boilers. Subsystems – Water and Steam, Fuel and ash handling, Air and Gas, Draught system. Diesel and Gas Turbine power plants- Layout and Functioning. Environmental impact and Control.

UNIT III NUCLEAR POWER PLANTS 9

Layout and subsystems. Fuels and Nuclear reactions. Boiling Water Reactor, Pressurized Water Reactor, Fast Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors – working and Comparison. Safety measures. Environmental aspects.

UNIT IV RENEWABLE ENERGY POWER PLANTS 9

Solar power plants – Photovoltaic and Thermal. Wind power plants – Vertical and Horizontal axes Wind Turbines. Biomass power plants – Gasification and combustion. Tidal and Ocean Thermal Energy plants. Geothermal plants. Fuel cell – Types. Hybrid power plants.

UNIT V ECONOMICS OF POWER GENERATION 9

Load and load duration curves. Electricity billing – costing of electrical energy – Tariff structures. Economics of power plant – Fixed and variable cost. Payback period. Net Present Value, Internal Rate of Return. Emission calculation and carbon credit.

TOTAL:45 PERIODS

OUTCOME:

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

- Understand the working of different power plants
- Arrive at cost of power generation, electricity billing and rate of return on power plant investments

TEXT BOOKS:

1. P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill, 2014.
2. Paul Breeze, “Power Generation Technologies”, Elsevier Ltd., 2014.

REFERENCES:

1. Black and Veatch, “Power Plant Engineering”, Indian edition, CBS Publishers and Distributors, New Delhi, 1998.
2. M.M.El.Wakil, “Power Plant Technology”, Tata McGraw Hill, 2010.
3. K.Rajput, “Power Plant Engineering”, Laxmi Publications, 2005.
4. Janet Wood, “Nuclear Power”, The Institution of Engineering and Technology, 2007.
5. James Momoh, Smart Grids - Fundamentals of Design and analysis, Wiley Press, 2012.

PTEE7211 INTEGRATED CIRCUITS AND MICROCONTROLLER LABORATORY L T P C 0 0 4 2

OBJECTIVES:

- To develop an in-depth understanding of the operation of microprocessors and microcontrollers
- To program microprocessor/microcontroller using assembly languages
- To understand the standard microprocessor/ microcontroller interfaces
  To design combinational logic circuits using digital IC’s
  To analyse and design various applications of Op-Amp

LIST OF EXPERIMENTS

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.

2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.

3. Interface Experiments:

   - A/D Interfacing.
   - D/A Interfacing.
   - Traffic light controller.

4. Interface Experiments:

   - Simple experiments using 8251, 8279, 8254.

5. Demonstration of basic instructions with 8051 Micro controller execution, including:

   1 Conditional jumps, looping

   2 Calling subroutines.

   3 Stack parameter testing

6. Parallel port programming with 8051 using port 1 facility:

   1 Stepper motor and D / A converter.

7. Implementation of Boolean Functions, Adder/ Subtractor circuits.

8. Combination Logic: Adder, Subtractor, Code converters, Encoder and Decoder.

9. Sequential Logic: Study of Flip-Flop, Counters (synchronous and asynchronous), Shift Registers

10. Op-Amp Linear Application: Comparator, Differentiator, Integrator, Adder, Subtractor. Op-amp, Non Linear Application: Clipper, Clamper, Peak detector,

11. Timer IC application, astable multi-vibrator and VCO circuit.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

1. 8085 – Microprocessor student trainer kit – 15 Nos
2. 8051 – Micro controller student trainer kit – 15 Nos
3. DAC, ADC interface cards – 5 Nos
4. Traffic light controller interface board – 5 Nos
5. Stepper motor drive interface – 5 Sets
6. Keypad – display interface card – 5 Nos
7. Oscilloscope (CRO) – 5 Nos
8. Regulated Power supply ± 12V, 0.5A and +5V, 2A along with Bread – board and analog digital IC, as per the above list – 5 sets

TOTAL:60 PERIODS

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
- Design and conduct experiments using digital IC's and Op-Amp

PTEE7301 CONTROL SYSTEMS LT P C
3 0 0 3

OBJECTIVES:

To emphasize the importance of control and empower the students with basic concepts on modelling, analysis and design of control systems restricted to linear continuous time system. The specific objectives of each unit are

- To introduce the classical way of modelling systems, commonly used control components and their mathematical models from physical laws
- To introduce the time domain analysis of transfer function models and understand the concepts of poles, zeros and movement of poles under feedback
- To introduce the various graphical methods available to analyse and asses systems in frequency domain
- To impart knowledge in the modern state variable approach, closed form solution methods and analysing system properties
- To educate on drawing of specification, choosing of control structures and methods of designing the controllers

UNIT I INTRODUCTION 9

Control system - Basic components - Open and closed Loop - Effect of feedback - System representations - Transfer functions of single input & single output and multivariable systems – Block diagrams – Signal flow graphs – Gain formula – Modelling of control components – Mechanical and electrical systems

UNIT II TRANSFER FUNCTION MODEL AND ANALYSIS 9

Standard test signals- steady state error and error constants - Time response – Damping ratio - Natural frequency – Effects of adding poles and zeros – Dominant poles - Stability – Routh Hurwitz criterion – Root locus plots of typical systems – Root locus analysis

UNIT III FREQUENCY DOMAIN ANALYSIS 9

Frequency response – Resonant peak – Bandwidth – Effect of adding poles and zeros – Magnitude and phase plots of typical systems – Nyquist stability criterion – Gain margin – Phase margin - Bode plot - Polar Plot - M & N Circles.

UNIT IV STATE VARIABLE MODEL AND ANALYSIS 9

State variable formulation – Non-uniqueness – Solution - State transition matrix – Eigen values – Eigen vectors – Stability - Controllability – Observability

UNIT V DESIGN OF CONTROL SYSTEMS 9

Design Specification – Controller configurations – PID controller - Design using reaction curve and Ziegler-Nichols technique – Compensation schemes - Effect of providing Lag, Lead and Lag- Lead compensation on system performance and design. State variable design

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse systems using transfer function and state space models
- Ability to design controllers and compensators using conventional techniques

TEXTBOOKS

1. Benjamin C. Kuo, Automatic Control Systems, PHI Learning Private Ltd, 2010.
2. J. Nagrath and M. Gopal, Control Systems Engineering, Tata McGraw-Hill Education Private Limited, Reprint, 2010.

REFERENCES

1. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Pearson Education, Third Impression, 2009.
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA. ISBN: 0-521-47239-3.
3. John J. D'Azzo, Constantine H. Houpis and Stuart N. Sheldon, Linear Control System Analysis and Design with Matlab, CRC Taylor & Francis, Reprint 2009
4. S. Palani, Control System Engineering, Tata McGraw-Hill Education Private Limited, First Reprint, 2010.
5. Yaduvir Singh and S. Janardhanan, Modern Control, Cengage Learning, First Impression 2010.
6. Katsuhiko Ogata, 'Modern Control Engineering', PHI Learning Private Ltd, 5 th Edition 2011

PTEE7302 ELECTRICAL MACHINES I L T P C
3 0 0 3

OBJECTIVES:

- To study the fundamental principles of Magnetic Circuits, Electro-mechanical energy conversion.
- To study the theory, operation and complete steady state behaviour of stationary and rotating transformers.
- Starting and speed control of three-phase induction motors.
- Principle of operation and performance of single phase induction motors.

UNIT I MAGNETIC CIRCUITS AND ELECTRO-MECHANICAL ENERGY CONVERSION 9

Ampere's circuit law - Faraday's and Lenz's law - B-H relations – flux linkage, inductance – magnetization curve - AC excitation - hysteresis loss and eddy current loss – characteristics of permanent magnet and its materials - energy balance, energy and co-energy – force and torque – singly excited system.

UNIT II TRANSFORMERS: THEORY 9

Principle of operation - Construction – equivalent circuit - phasor diagrams – determination of equivalent circuit parameters - efficiency - all-day efficiency - back to back test - voltage regulation.

UNIT III TRANSFORMERS: PERFORMANCE 9

Auto-transformer – three phase connections – phasor group – parallel operation of transformers - harmonics – three winding transformers – per unit system - tap changing - phase conversion – instrument transformer - concept of rotating transformers.

UNIT IV INDUCTION MACHINES: THEORY 9

Rotating magnetic field - principle of operation - construction – types of rotors – EMF, torque and power flow equations – equivalent circuit – Slip-torque characteristics – determination of equivalent circuit parameters - circle diagram – losses and efficiency - harmonics, cogging and crawling.

UNIT V INDUCTION MACHINES : PERFORMANCE 9

Three phase induction motor: starting methods - double cage rotors – Speed control - temperature rise – standards – induction generator. Single phase induction motor: Constructional details– Double revolving field theory - equivalent circuit – No load and blocked rotor test - starting methods – Shaded pole induction motor – AC servo motor.

TOTAL: 45 PERIODS

OUTCOMES:

- Understanding of fundamental concepts of magnetic circuits and energy conversion.
- Application knowledge of steady state performance analysis of induction machines.
- Knowledge on various starting and speed control methods of induction motor.
- Knowledge principle and operation of single-phase induction motor.

TEXT BOOKS:

1. Fitzgerald, A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', McGraw Hill Book Company, Sixth Edition 2003.
2. Nagrath, I.J. and Kothari.D.P., Electric Machines', T.M.H. publishing Co. Ltd., New Delhi, Fourth Edition, 2010.

REFERENCES:

1. Say M.G "Performance and Design of Alternating Machines ' CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007.
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005.
4. P.C.Sen, "Principles of Electric Machines and Power Electronics", Second Edition, Wiley Student Edition, 2007.
5. N.N. Parker Smith, "Problems in Electrical Engineering", 9th Edition, CBS Publisher, 2013.

PTEE7303 LINEAR INTEGRATED CIRCUITS L T P C
3 0 0 3

OBJECTIVES

- To study the IC fabrication procedure.
- To analyse circuit characteristics with signal analysis using Op-amp ICs.
- To design and construct application circuits with ICs as Op-amp, 555,565etc.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator ICs, ADCs.

UNIT I IC FABRICATION 9

IC classification, fundamentals of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types, Sigma- Delta ADC.

UNIT IV SPECIAL ICS 9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase locked loop circuit functioning and applications, Analog multiplier ICs.

UNIT V APPLICATION ICS 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse comprehend and design of analog electronic circuits involving linear ICs.

TEXT BOOKS:

1. Ramakant A.Gayakwad, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2009 / PHI.
2. D. Roy Choudhery, Sheil B. Jain, Linear Integrated Circuits, second edition, New Age publishers, 2010.

REFERENCES:

1. Robert F Coughlin, Fredrick, F. Driscold, Opamp and linear ICs, Pearson education, 4th edition, 2002.
2. James M. Fiore, Op Amps and Linear Integrated Circuits Concepts and Applications, Second Edition, Cengage Learning 2012.

PTEE7304 TRANSMISSION AND DISTRIBUTION LT P C
3 0 0 3

OBJECTIVES
- To impart knowledge about the configuration of the electrical power system
- To analyse and model different components of power system

UNIT I STRUCTURE OF POWER SYSTEM 9
Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors–distributed and concentrated loads–interconnection–EHVAC and HVDC transmission-Introduction to FACTS.

UNIT II TRANSMISSION LINE PARAMETERS 9
Parameters of single and three phase transmission lines with single and double circuits-Resistance, inductance and capacitance of solid ,stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects-interference with neighbouring communication circuits–Typical configurations, conductor types and electrical parameters of 765 kV, 400kV, 220 kV, 110kV, 66kVand33kVlines, corona discharges.

UNIT III MODELLINGAND PERFORMANCEOF TRANSMISSION LINES 9

Classification of lines–short line, medium line and long line-equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power-circle diagrams, surge impedance loading, methods of voltage control ;Ferranti effect.

UNIT IV INSULATORS ANDCABLES 9

Insulators-Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables-Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3-core belted cable, D.C cables.

UNIT V MECHANICALDESIGN OFLINES ANDGROUNDING 9

Mechanical design of transmission line–sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Sub-station Layout (AIS,GIS),Methods of grounding.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand transmission line models, insulations types and distribution schemes.

TEXTBOOKS:
1. S.N.Singh, ‘Electric Power Generation ,Transmission and Distribution’, Prentice Hall of India Pvt.Ltd, New Delhi, 2008.
2. B.R.Gupta,‘ Power System Analysis and Design’, S.Chand, New Delhi, Fifth Edition2005-08.

REFERENCES:
1. D.P.Kothari, I.J.Nagarath, ‘Power System Engineering’ Tata Mc Graw -Hill Publishing Company limited, New Delhi, 2007.

2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009
3. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
4. HadiSaadat, 'Power System Analysis, 'PSA Publishing; Third Edition, 2010.
5. J.Brian, Hardy and Colin R.Bayliss' Transmission and Distribution in Electrical Engineering',Newnes;FourthEdition,2012.
6. Gorti Ramamurthy ,"Transmission and Distribution", Hand book of Electrical Power Distribution, 2009, Universities Press

PTEE7311 CONTROL AND INSTRUMENTATION LABORATORY LT P C
0 0 4 2

OBJECTIVES

- To provide knowledge on analysis and design of controller for the system along with basics of instrumentation

LIST OF EXPERIMENTS

CONTROL SYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modelling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks – AC and DC Bridges
9. Dynamics of Sensors/Transducers
10. a. Temperature
    b. Pressure
    c. Displacement
    d. Optical
    e. Strain
    f. Flow

10. Power and Energy Measurement

11. Signal Conditioning

    a. Instrumentation Amplifier

    b. Analog – Digital and Digital – Analog converters (ADC and DACs)

12. Process Simulation.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

CONTROL SYSTEMS:

1. PID kit – 1 No.
   DSO – 1No.
   CRO Probe – 2 Nos
2. Personal computers
3. DC motor – 1 No.
   Generator--1No.

Rheostats – 2 Nos
Ammeters
Voltmeters
Connecting wires (3/20))

4. CRO 30MHz – 1 No.
   2 MHz Function Generators – 1No.
5. Position Control Systems Kit (with manual) – 1 No.,
   Tacho Generator Coupling set
6. AC Synchro transmitter& receiver – 1No.
   Digital multimeters

INSTRUMENTATION:

7. R, L, C Bridge kit (with manual)

8. a) Electric heater – 1No.
      Thermometer – 1No.
      Thermistor (silicon type)
      RTD nickel type – 1No.

   b) 30 psi Pressure chamber (complete set) – 1No.
      Current generator (0 – 20mA)
      Air foot pump – 1 No. (with necessary connecting tubes)

   c) LVDT 20mm core length movable type – 1No.
      CRO 30MHz – 1No.

   d) Optical sensor – 1 No.
      Light source

   e) Strain Gauge Kit with Handy lever beam – 1No.
      100gm weights – 10 Nos

   f) Flow measurement Trainer kit – 1 No.
      (1/2 HP Motor, Water tank, Digital Milli ammeter, complete set)

9. Single phase Auto transformer – 1No.
10. Watt hour meter (energy meter) – 1No. Ammeter

Voltmeter Rheostat
Stopwatch
Connecting wires (3/20)

11. IC Transistor kit – 1No.

TOTAL: 60 PERIODS

OUTCOMES:

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

PTEE7401 ELECTRICAL MACHINES II LT P C
3 0 0 3

OBJECTIVES:

- To study the machine windings and the MMF curves of armature and field windings and to derive the EMF and torque equations of rotating machines.
- To impart knowledge on Theory and performance of salient and non-salient pole synchronous generators.
- Principle of operation and performance of synchronous motor.
- To study the theory, operation and complete steady state behaviour of DC machines.

UNIT I ROTATING MACHINE THEORY 9

Doubly excited systems - permanent magnets - synchronous and reluctance principle - force, torque and power equation - armature winding - distribution and pitch factors - magnetic leakage - DC and AC windings - coil span - brushes - commutation - symmetry requirement.

UNIT II SYNCHRONOUS MACHINES: THEORY 9

Synchronous generators : Constructional details – Types – principle of operation - concept of space phasor – EMF, torque and Power equations – Armature reaction – Synchronous impedance. Synchronous motor: Principle of operation – Starting methods - Hunting - synchronous induction, reluctance, repulsion motor, stepper motor.

UNIT III SYNCHRONOUS MACHINES: PERFORMANCE 9

Voltage regulation – EMF, MMF, ZPF methods - Two reaction theory, slip test - Synchronization - parallel operation – Effect of change in excitation and mechanical input - Capability curves - variable load and constant excitation - constant load and variable excitation - V curves and inverted V curves - Synchronous condenser.

UNIT IV DC MACHINES: THEORY 9

Construction - Principle of operation - EMF and torque equation – armature reaction – commutation – interpoles and compensating windings – methods of excitation and characteristics.

UNIT V DC MACHINES: PERFORMANCE 9

Losses in machines - Testing and efficiency by direct and indirect methods - starting - speed control, Ward-Leonard control - constant torque and power control - braking - Permanent Magnet DC Motors – universal motor – DC servo motor.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand MMF curves for field and armature windings.
- Ability to formulate generalised form of EMF and Torque equations.
- Application knowledge of steady state performance analysis of synchronous machines.
- Knowledge on predetermination of voltage regulation of salient and non-salient pole generators, V-curves and inverted V-curves, power factor correction.
- Application knowledge of DC machines theory.
- Knowledge on performance on DC machines.

TEXT BOOKS:

1. Fitzgerald, A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', Mc Graw Hill Book Company, Sixth Edition 2003.
2. Nagrath, I.J. and Kothari.D.P., Electric Machines', T.M.H. publishing Co. Ltd., New Delhi, Fourth Edition, 2010.

REFERENCES:

1. Say M.G "Performance and Design of Alternating Machines 'CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007.
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005.
4. P.C.Sen, "Principles of Electric Machines and Power Electronics", Second Edition, Wiley Student Edition, 2007.
5. N. Parker Smith, "Problems in Electrical Engineering", 9th Edition, CBS Publisher, 2013.

PTEE7402 POWER ELECTRONICS LT P C
3 0 0 3

OBJECTIVES:

- To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.
- To get an overview of different types of power semiconductor devices and their dynamic 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 of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations of AC voltage controller.

UNIT I SWITCHING POWER SUPPLIES 9

SCR and MOSFET dynamic behaviour - driver and snubber circuits - low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies – resonant converters - switching loss calculations and thermal design.

UNIT II INVERTERS 9

IGBT : Static dynamic behaviour - single phase half bridge and full bridge inverters - SCR based : six step three phase VSI, ASCI - PWM (both unipolar and Bipolar) – third harmonic injected sine PWM - space vector PWM – selective harmonic elimination.

UNIT III UNCONTROLLED RECTIFIERS 9

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier – voltage doubler circuit – distortion factor – capacitor filter for low power rectifiers – LC filters – Concern for power quality – three phase diode bridge.

UNIT IV CONTROLLED RECTIFIERS 9

Two transistor analogy based turn- ON – turn ON losses – thermal protection – controlled converters (1 pulse, 2 pulse, 3 pulse, 6 pulse) - displacement factor – ripple and harmonic factor - power factor mitigation, performance parameters – effect of source inductance - inverter angle limit.

UNIT V AC PHASE CONTROLLERS 9

TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers - various configurations for SCR based single and three phase controllers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to simulate and design different power converters
- Ability to implement and verify the performance specifications of power converters.

TEXT BOOKS:

1. Ned Mohan, T.M.Undeland, W.P.Robbins, ”Power Electronics: Converters, applications and design”, John Wiley and Sons, 3rd Edition (reprint), 2009.
2. Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3rd Edition, New Delhi, 2004.

REFERENCES:

1. Cyril.W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003.
3. PhilipT.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.

PTEE7403 POWER SYSTEM ANALYSIS LT P C
3 0 0 3

OBJECTIVES

- To model and analyse the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyse the system under balanced and unbalanced conditions.
- To model and analyse the stability of power system when it is subjected to a fault.

UNIT I INTRODUCTION 9

Need for system planning and operational studies–Different types of power system analysis-Modern Power System Operation and Control –Single line diagram–per phase and per unit

analysis–Generator-transformer transmission line and load representation for differentpowersystemstudies.-Primitivenetwork-constructionofY-bususing inspection and singular transformation methods–Z-bus.

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-development of power flow modelling of complex variables form-iterative solution using Gauss-Seidel method-Q-limit check for voltage controlled buses–power flow model in polar form –iterative solution using Newton-Raphson method.

UNIT III FAULT ANALYSIS– BALANCED FAULTS 9

Importance of short circuit analysis-assumptions in fault analysis-analysis using Thevenin's theorem-Z-bus building algorithm-fault analysis using Z-bus–computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS–UNBALANCED FAULTS 9

Introduction to symmetrical components–sequence impedances–sequence circuits of synchronous machine ,transformer and transmission lines-sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT V STABILITY ANALYSIS 9

Importance of stability analysis in power system planning and operation- classification of power system stability-angle and voltage stability–Single Machine Infinite Bus (SMIB) system: Development of swing equation -equal area criterion -determination of critical clearing angle and time–solution of swing equation by modified Euler method and Runge - Kutta fourth order method.

TOTAL: 45 PERIODS

OUTCOMES:

- The students are equipped with power flow, short-circuit and transient stability studies that are useful for transmission expansion planning and day-today operation of power system.

TEXTBOOKS

1. John J.Grainger and W.D.Stevenson Jr.,'Power System Analysis' ,Tata McGraw-Hill, Sixth reprint,2010.
2. Hadi Saadat, 'Power System Analysis', Tata Mc Graw Hill Education Pvt.Ltd., New Delhi, 21st reprint 2010.

REFERENCES

1. NagrathI.J.and Kothari D.P.,' Modern Power System Analysis', Tata McGraw Hill,14th reprint,2009.
2. Kundur P., 'Power System Stability and Control, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi,10th reprint2010.
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition,2007.
4. T.K Nagsarkar ,'Power System Analysis',2nd edition, Oxford Press,2014.

PTEE7411 ELECTRICAL MACHINES LABORATORY L T P C
0 0 4 2

AIM
To study the performance characteristics of DC machines, Transformers, synchronous machines and induction machines

OBJECTIVES
To experimentally verify the principle of operation, performance and characteristics of DC machines, Transformers, Synchronous machines and Induction machines using load tests and predetermination tests.
To study DC motor and three phase induction motor starters.

LIST OF EXPERIMENTS
1. Open circuit and load characteristics of separately excited and self excited D.C. generator
2. Load test on D.C shunt motor
3. Swinburne's test
4. Speed control of D.C shunt motor
5. Load test on single phase transformer
6. Open circuit and short circuit test on single phase transformer (Determination of equivalent circuit parameters)
7. Regulation of three-phase alternator by EMF and MMF methods.
8. V& Inverted V Curves of synchronous motor
9. Load test on three-phase induction motor
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on single-phase induction motor.
12. Study of D.C motor and induction motor starters

TOTAL : 60 PERIODS

OUTCOMES:
Ability to perform experiments on all conventional electrical machines
To study their complete performance characteristics under different operating conditions.
OUTCOMES:
1. Complete performance characteristics of AC machines and transformers are obtained.
2. AC motor starters and three phase transformer connections are studied.

PTEE7501 HIGH VOLTAGE ENGINEERING LT P C
3 0 0 3

OBJECTIVES

- To impart knowledge about causes, effects of over voltages, dielectric breakdown mechanism and to emphasis the need for generation, measurement and testing of High voltages and currents.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – Reflection and Refraction of Travelling waves- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators**.**

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards– Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyze the different electrical stress in a Power System and design & develop appropriate insulation schemes

TEXT BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', 4th Edition Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009.
2. E.Kuffel and W.S. Zaengl, J.Kuffel, High voltage Engineering fundamentals, Newnes Second Edition ,Elsevier , New Delhi 2005.

REFERENCES

1. L.L.Alston, High Voltage Technology, Oxford University Press, First Indian Edition 2011.
2. C.L.Wadhwa, High voltage Engineering, New Age International Publishers, Third Edition, 2010
3. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.
4. Subir Ray." An Introduction to High Voltage Engineering "PHI Learning Private Limited, New Delhi, Second Edition-2011

PTEE7502 POWER SYSTEM OPERATION AND CONTROL LT P C
3 0 0 3

OBJECTIVES

- To have an overview of power system operation and control,
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power -voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

UNITI INTRODUCTION 9

An overview of power system operation and control-system load variation-load characteristics-load curves and load-duration curve-load factor-diversity factor-Importance of load forecasting quadratic and exponential curve fitting techniques of forecasting- system reserve requirements –plant level and system level controls .

UNITII REALPOWER-FREQUENCYCONTROL 9

Basics of speed governing mechanism and modelling-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-two-area system – modelling-static analysis of uncontrolled case-tie line with frequency bias control –state variable model –integration of economic dispatch control with LFC.

UNITIII REACTIVEPOWER–VOLTAGECONTROL 9

Generation and absorption of reactive power-basics of reactive power control-excitation systems – modelling - static and dynamic analysis - stability compensation-methods of voltage control:tap-changingtransformer,SVC(TCR+TSC)andSTATCOM–secondaryvoltagecontrol.

UNITIV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Formulation of economic dispatch problem–I/O cost characterization–incremental cost coordination equations with out and with loss (No derivation of loss coefficients)-solution by direct method and λ-iteration method-statement of unit commitment problem–priority-list method-forward dynamic programming.

UNITV COMPUTERCONTROLOFPOWERSYSTEMS 9

Need for computer control of power systems-concept of energy control centre-functions-system monitoring-data acquisition and control-system hardware configuration SCADA and EMS functions-state estimation–WLSE-Contingency Analysis state transition diagram showing various state transitions and control strategies.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to analyse load profiles and EMS functions
- Ability to understand and analyse power system operation, stability, control and protection.

TEXTBOOKS

1. Olle.I.Elgerd, 'Electric Energy Systems theory-An introduction', Tata Mc Graw Hill EducationPvt.Ltd.,NewDelhi,34th reprint2010.

2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation andControl', John Wiley& Sons,Inc.,2003.

REFERENCES

1. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt.Ltd., New Delhi, Third Edition,2010.
2. NagrathI.J.and Kothari D.P.,'Modern Power System Analysis',TataMcGraw-Hill,14th reprint,2009.
3. KundurP., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10threprint2010.
4. Hadi Saadat, 'Powe r System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21streprint 2010.

PTEE7503 PROTECTION AND SWITCH GEAR L T P C
3 0 0 3

OBJECTIVES:

- To discuss about the nature, types and causes of faults in Power System and the construction and operating principle of protective components.

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults– fault current calculation – Methods of Neutral grounding – Zones of protection and essential qualities of protection .

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Application of Current transformers and Potential transformers in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Acquire the knowledge about the faults in Power System and analyze the design of protective scheme with suitable selection of protective components.

TEXT BOOKS:

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008.
2. Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection, Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi – 2010

REFERENCES:

1. BadriRam ,B.H.Vishwakarma, Power System Protection and Switchgear, New Age International Pvt Ltd Publishers, Second Edition 2011.
2. B.Rabindranath and N.Chander, Power System Protection and Switchgear, New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co., 1998.
4. C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P) Ltd., 2010
5. Ravindra P.Singh, " Switchgear and Power System Protection " PHI Learning Private Ltd.,New Delhi 2009.

PTEE7511 POWER ELECTRONICS AND DRIVES LABORATORY LT P C
0 0 4 2

OBJECTIVES:

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

LIST OF EXPERIMENTS

1. Characteristics of SCR,TRIAC, MOSFET and IGBT
2. AC to DC half controlled converter and fully controlled Converters
3. Step down and step up MOSFET based choppers
4. IGBT based single phase PWM inverter and three phase PWM inverter
5. AC Voltage controller
6. Switched mode power converter.
7. Simulation of PE circuits (1Φ&3Φsemiconverter,1Φ&3Φfullconverter,dc-dc converters ,ac voltage controllers).
8. Speed control of converter fed DC motor
9. Speed control of chopper fed DC motor
10. V/F control of three phase induction motor

TOTAL:60 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

1. Device characteristics(for SCR, MOSFET,TRIACand IGBT kitwith built in power supplyandmeters) -2each
2. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter –2each

3. MOSFET based step up and step down choppers –1each
4. IGBT based single phase PWM inverter module–2
5. IGBT based three phase PWM inverter module-2
6. Switched mode power converter module–2
7. SCR&TRIAC based single phase ACcontrolleralongwithlamporrheostatload-2
8. Cyclo-converter kit with firing module–2
9. Dual regulated DC power supply with common ground
10. Cathode Ray Oscilloscope– 10
11. Isolation Transformer –5
12. Single phase Autotransformer–3
13. Components (Inductance, Capacitance) 3setfor each
14. Multimeters–5
15. LCR meter –3
16. Rheostats of various ranges –2sets of10value,Worktables –10
17. DC and AC meters of required ranges - 20

OUTCOMES:

- Ability to design and analyse the performance and applications of various power converters
- Design of power converters using Software.

PTEE7601 DESIGN OF ELECTRICAL APPARATUS LT P C
3 0 0 3

OBJECTIVES

To provide sound knowledge about constructional details and design of various electrical machines, in order

- To study magnetic circuit parameters and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines and synchronous machines.
- To introduce the importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram -Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – 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 -Computer program: Design of Stator main dimensions-Brushless DC Machines

TOTAL : 45 PERIODS

OUTCOMES:

- Understand basics of design considerations for rotating and static electrical machines
- Ability to model and analyse electrical apparatus and their application to Electrical Engineering.

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
2. 'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
3. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications,2008

PTEE7602 **SOLID STATE DRIVES** **LT P C**
3 0 0 3

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.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control – energy efficient drive – v/f control – constant air gap flux – field weakening mode – voltage / current fed inverter – closed loop control.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous motor.

UNIT V 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 – design of controllers; current controller and speed controller-converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Basic requirement of motor selection for different load profiles are studied.
- Stability aspects of drive systems are studied.
- Important features of DC and AC drives are studied.
- Controller design for DC drives is studied.

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.

PTEE7611 POWER SYSTEM SIMULATION LABORATORY LT P C
0 0 4 2

OBJECTIVES

- To study the modelling and parameter estimation of transmissions lines
- To study the various methods used for solving load flow analysis.
- To study the stability, dynamics and transient analysis of power systems.
- To understand the concept of economic dispatch.

LISTOFEXPERIMENTS:

1. Computation of Parameters and Modelling of Transmission Lines
2. DC Power Flow Analysis
3. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
4. Load Flow Analysis using Gauss-Seidel Method
5. Load Flow Analysis using Newton-Raphson Method.
6. Fault Analysis
7. Transient Stability Analysis :Single-Machine Infinite Bus System
8. Transient Stability Analysis of Multi machine Power Systems
9. Electromagnetic Transients in Power Systems
10. Load –Frequency Dynamics of Single-Area and Two-Area Power Systems
11. Economic Dispatch in Power Systems.
12. Contingency Analysis – Generation Shift factor & line Outage distribution factor.

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT FOR A BATCH OF 30 STUDENTS

1. Personal computers (Pentium-IV,80 GB, 512MBRAM)– 25nos
2. Printer laser- 1No.
3. Dotmatrix-1No.
4. Server (PentiumIV, 80 GB, 1GBRAM) (High Speed Processor)–1No.
5. Software: Any Power System Simulation Software- 5 licenses
6. Compliers: C, C++, VB,VC++ -25 users

OUTCOMES:

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

PTEE7711 **PROJECT WORK** **L T P C**
0 0 9 6

OBJECTIVES :

The student should be made to:

- learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
- prepare a good technical report.
- Gain Motivation to present the ideas behind the project with clarity.

A project must be selected either from research literature published list or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen the 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.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL : 135 PERIODS

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.

PTMA7001 **DISCRETE MATHEMATICS** **L T P C**
3 0 0 3

OBJECTIVES :

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.

UNIT I LOGIC AND PROOFS **9**

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 9

Mathematical induction – Strong induction and well ordering – The basics of counting - The pigeonhole principle – Permutations and combinations – Recurrence relations - Solving linear recurrence relations using generating functions – Inclusion - Exclusion - Principle and its applications.

UNIT III GRAPHS 9

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 9

Algebraic systems – Semi groups and monoids – Groups - Subgroups - Homomorphisms – Normal subgroup and coset - Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9

Partial ordering – Posets – Lattices as Posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL : 45 PERIODS

OUT COMES :

On completion of the module the student should be able to:

- Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
- Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.
- Use effectively algebraic techniques to analyse basic discrete structures and algorithms.
- Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
- Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

TEXT BOOKS :

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 7th Edition, Special Indian edition, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES :

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

PTMA7071	PROBABILITY AND STATISTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 9

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9

Sampling distributions - Tests for single mean, proportion, difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT IV DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design - 2^2 - Factorial design - Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 9

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 45 PERIODS

OUT COMES :

- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXT BOOKS :

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES :

1. Devore. J.L., " Probability and Statistics for Engineering and the Sciences ", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics

for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 3rd Edition, 2004.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.
5. Papoulis. A and Unnikrishnapillai. S., " Probability, Random Variables and Stochastic Processes ", McGraw Hill Education India , 4th Edition , New Delhi , 2010.

PTGE7071 DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- 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.

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES **L T P C**

(Common to all branches) **3 0 0 3**

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES **9**

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment –

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 9

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

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 conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism , understand their rights , legal ,ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. 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
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
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 Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTGE7073 **HUMAN RIGHTS** **LT P C**
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOMES :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTGE7074 **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES **9**

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality – New management tools – Six-sigma Process Capability–Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM **9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075	INTELLECTUAL PROPERTY RIGHTS	L T P C 3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),"The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTMG7001 MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING LT P C

3 0 0 3

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 DEMAND & SUPPLY ANALYSIS 9

Firm: Types & objectives - Managerial decisions - Fundamental economic concepts Demand - Types of demand - Determinants of demand - demand function - demand elasticity - demand forecasting - supply - Determinants of supply - supply function - supply elasticity

UNIT II PRODUCTION AND COST ANALYSIS 9

Production function - returns to scale - Managerial uses of production function. Cost concepts - cost function - Determinants of cost - Short run and long run cost curves

UNIT III PRICING 9

Pricing Objectives - Determinants of price - Pricing under different market structures – price discrimination - pricing methods in practice

UNIT IV FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT) 9

Basics of accounting - Journal, Ledger trial balance - Final accounts with Adjustment - Financial Ratio Analysis - Cash flow analysis - Fund flow analysis - Analysis and interpretation of

financial statements - Comparative financial statements

UNIT V CAPITAL BUDGETING **9**

Investments - Methods of capital budgeting and accounting for risk in capital budgeting

TOTAL:45 PERIODS

OUTCOMES:

- Basics of demand, supply and cost analysis are studied.
- Different methods of financial accounting and capital budgeting are studied.

TEXT BOOKS

1. Samuelson, Paul A and Nordhaus W.D., "Economics", Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
2. Salvatore Dominick, "Managerial Economics in a global economy", Thomson South Western, 4th edition, 2001.
3. S.N. Maheshwari, "Financial Accounting", Fourth Edn.,Vikas Publishers House, New Delhi.
4. Khan and Jain, "Management Accounting" Tata McGraw Hill Education, 2006

REFERENCES

1. Paresh Shah, "Basic Financial Accounting for Management" Oxford University Press, New Delhi, 2007.
2. James C. Van home and John M. Wachowics Jr. "Fundamentals of financial Management" Prentice Hall of India, New Delhi, 11th Edition, 2004.
3. VL. Mote, Samuel Paul, G.S. Gupta, "Managerial Economics Concepts & Cases, "Tata McGraw Hill Publishing Company Limited, 38th Reprint, 2005.

PTMG7751 PRINCIPLES OF MANAGEMENT **LT P C**
3 0 0 3

OBJECTIVES:

- To study the Evolution of Management
- To study the functions and principles of management
- To learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS **9**

Definition of Management – Science or Art – Manager vs. Entrepreneur- Types of Managers- Managerial Roles and Skills – Evolution of Management –Scientific, Human Relations, System and Contingency Approaches– Types of Business Organization- Sole Proprietorship, Partnership, Company- Public and Private Sector Enterprises- Organization Culture and Environment – Current Trends and Issues in Management.

UNIT II PLANNING **9**

Nature and Purpose of Planning – Planning Process – Types of Planning – Objectives – Setting Objectives – Policies – Planning Premises – Strategic Management – Planning Tools and Techniques – Decision Making Steps and Process.

UNIT III ORGANISING **9**

Nature and Purpose – Formal and Informal Organization – Organization Chart– Organization Structure – Types – Line and Staff Authority – Departmentalization – Delegation of Authority – Centralization and Decentralization –Job Design – Human Resource Management –HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career Planning and Management.

UNIT IV DIRECTING 9

Foundations of Individual and Group Behavior– Motivation – Motivation Theories – Motivational Techniques – Job Satisfaction – Job Enrichment – Leadership – Types and Theories of Leadership – Communication – Process of Communication – Barrier in Communication – Effective Communication – Communication and IT.

UNIT V CONTROLLING 9

System and Process of Controlling – Budgetary and Non-Budgetary Control Techniques – Use of Computers and IT in Management Control – Productivity Problems and Management – Control and Performance – Direct and Preventive Control – Reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would have gained the ability to learn the different principles and techniques of management in planning, organizing, directing and controlling.

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall of India, Tenth Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, Sixth Edition, 2004.

REFERENCES:

1. Stephen A. Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, Seventh Edition, 2011.
2. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
3. Harold Koontz and Heinz Weihrich "Essentials of Management" Tata McGraw Hill, 1998.
4. Tripathy PC and Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

PTEE7001 ADAPTIVE CONTROL LT P C
3 0 0 3

OBJECTIVES

To illustrate the concept of system identification and adaptive control
To give an introductory knowledge about black-box approach based system identification
To give adequate knowledge on batch and recursive identification
To give basic knowledge on Computer Controlled Systems
To introduce the design concept for adaptive control schemes

UNIT I NON-PARAMETRIC METHODS 9

Non-parametric methods - Transient analysis - frequency analysis - Correlation analysis -Spectral analysis - Input signal design for identification

UNIT II PARAMETRIC METHODS 9

Least squares estimation – Analysis of the least squares estimate - Best linear unbiased estimate – Model parameterizations - Prediction error methods

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least square method - Model validation –Model structure determination - Introduction to closed loop system identification

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – Auto-tuning of PID controller using relay feedback approach – Types of adaptive control, Gain scheduling, Model reference adaptive control, Self–tuning controller – Design of gain scheduled adaptive controller – Applications of gain scheduling

UNIT V MRAC & STR 9

STR – Pole placement design – Indirect STR and direct STR – MRAC - MIT rule – Lyapunov theory – Relationship between MRAC and STR

TOTAL: 45 PERIODS

OUTCOMES:

- Various system identification techniques are studied.
- Features of adaptive control and other control techniques viz., STR, MRAC are studied.

TEXTBOOKS

1. T. Soderstrom and Petre Stoica, System Identification, Prentice Hall International (UK) Ltd. 1989
2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009

REFERENCES

1. L. Ljung, System Identification - Theory for the User, 2nd edition, PTR Prentice Hall, Upper Saddle River, N.J., 1999 2. Narendra and Annasamy, " Stable Adaptive Control Systems".

PTEE7002 ADVANCED CONTROL SYSTEMS LT P C
3 0 0 3

OBJECTIVES

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

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

UNIT I STATE VARIABLE DESIGN 9

Control law design – State feedback and pole placement - Estimator design – Regulator design - Combined control law and estimator – Introduction of the reference input – Integral control and disturbance estimation – Effect of delays

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearizing 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 – Analysis of non-linear systems – Limit cycle - Stability

UNIT IV STABILITY ANALYSIS 9

Introduction – Concept of stability – Equilibrium points- Lyapunov's stability theorems - Lyapunov's direct method for LTI systems – Lyapunov's method for non-linear systems - Krasovski's theorem on Lyapunov function

UNIT V OPTIMAL CONTROL 9

Problem formulation - Linear quadratic regulator - Finite and infinite time - Variational approach to optimal control problem - Solution of Ricatti equation - Differential and Algebraic

TOTAL: 45 PERIODS

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.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Publishers, Fourth Edition, 2012.
2. K P Mohandas, Modern Control Engineering, Sanguine Technical Publishers, 2008

REFERENCES

1. George J. Thaler, Automatic Control Systems, Jaico Publishers, 1993
2. Ashish Tewari, Modern Control Design with Matlab and Simulink, John Wiley, New Delhi, 2002
3. M. Gopal, Modern Control System Theory, New Age International Publishers, 2005.
4. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, Feedback Control of Dynamic Systems, Fourth edition, Pearson Education, 2002
5. William A. Wolovich, Automatic Control Systems, Oxford University Press, First Indian Edition 2010.

PTEE7003 ANALYSIS OF ELECTRICAL MACHINES LT P C
3 0 0 3

OBJECTIVES

- To study the fundamentals of electromechanical energy conversion process in electrical equipments.
- To study the theory of transformation of multi-phase circuits and systems and its application to multi-phase induction and synchronous machines.
- To develop the time domain mathematical model of DC and AC machines and analyse their

steady state and dynamic state performance

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION 9

General expression of stored magnetic energy, co-energy and force/ torque – example using single and doubly excited system – Calculation of air - gap mmf and per phase machine inductance using physical machine data.

UNIT II DC MACHINES 9

Voltage and torque equations – dynamic characteristics of permanent magnet and shunt DC machines – state equations - solution of dynamic characteristics by Laplace transformation.

UNIT III REFERENCE FRAME THEORY 9

Static and rotating reference frames – transformation of variables – reference frames – transformation between reference frames – transformation of a balanced set –balanced steady state phasor and voltage equations.

UNIT IV INDUCTION MACHINES 9

Voltage and torque equations – transformation for rotor circuits – voltage and toque equations in reference frame variables – analysis of steady state operation – free acceleration characteristics – dynamic performance for load and torque variations – dynamic performance of single phasing operation.

UNIT V SYNCHRONOUS MACHINES 9

Voltage and Torque Equation – voltage Equation in arbitrary reference frame and rotor reference frame – Park equations - steady state analysis – dynamic performances for torque variations- dynamic performance during three phase fault – transient stability limit – critical clearing time – computer simulation.

TOTAL: 45 PERIODS

OUTCOMES:

- Development of generalised force/torque equations of electro-mechanical systems from energy and co-energy equations are studied and analysed.
- Transformation theory is studied and applied to three-phase induction and synchronous machines.
- Dynamic state models of DC and AC machines are developed and their complete time domain performance is analysed.

TEXT BOOKS

1. Paul C.Krause, OlegWasyzczuk, Scott S, Sudhoff, “Analysis of Electric Machinery and Drive Systems”, IEEE Press, Second Edition**,** 2002.
2. R.Krishnan, “Electric Motor Drives, Modeling, Analysis and Control , Prentice Hall of India, 2002.
3. P.S. Bhimbra, Generalised theory of Electric machinery, Khanna Publishers, Fifth Edition, 2012, New Delhi.

REFERENCES

1. Samuel Seely, “Electromechanical Energy Conversion”, McGraw Hill Publishing Company**,** Reprint 2000
2. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umans, “ Electric Machinery”, Tata McGraw Hill, Sixth Edition, Reprint 2012.
3. P.C.Sen, “Principles of Electric Machines and Power Electronics”, John Wiley, 2007.

PTEE7004 COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS L T P C
3 0 0 3

OBJECTIVES

To impart knowledge on

- Problem formulation for field computation Finite Element analysis
- Computer aided design of practical problems

UNIT I INTRODUCTION 9

Review on electromagnetic theory – Basic field equations, calculation of field distribution, inductance, capacitance, force and torque, Review on conventional electrical machine design methodology – computer aided design aspects - advantages.

UNIT II CAD PACKAGES 9

Numerical methods for solving field problems, recent developments, problem formulation – governing equations – modelling – boundary conditions and material characteristics.

UNIT III FINITE ELEMENT ANALYSIS 9

Mathematical formulation for 2-D planar and axial symmetry problems – discretization – shape functions – element and global matrices/vectors – solution – post processing.

UNIT IV FILED ANALYSIS USING FEA(PRACTICALS 9

Electrostatics, Magneto statics – linear and non-linear problems, permanent magnet, eddy current analysis, calculation of force/torque.

UNIT V DESIGN EXAMPLES (PRACTICALS) 9

Design of cylindrical magnetic devices, transformer, Rotating machines.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to design electrical apparatus using finite element package.

TEXT BOOKS

1. Sheppard.J.Salon " Finite Element Analysis of Electrical Machines", Springer International Edition, First Indian Reprint, 2007
2. Nicola Bianchi " Electrical Machine Analysis using Finite Elements", Taylor & Francis, 2005.

REFERENCES

1. K.J.Binns, P.J. Lawrenson, C.W. Trowbridge, " The analytical and numerical solution of electrical and magnetic fields", John Wiley & Sons, 1993.
2. Nathan Ida, Joao P A Bastos, "Electromagnetics and calculation of fields", Springer Verlag, Second Edition, 1997.
3. P P. Silvester, Ferrari, "Finite Elements for Electrical Engineers", Cambridge University Press, Third Edition, 1996.
4. M V K Chari, P P Silvester, " Finite Elements in Electrical and Magnetic Field problems", John Wiley, 1980.
5. S.S.Rao, "The Finite Element Method in Engineering", Elsevier,2011.
6. J.N.Reddy, "An Introduction to the Finite Element Method", McGrawHill International Editions, Third illustrated edition, 2006.

PTEE7005 DATA STRUCTURES AND ALGORITHMS LT P C
3 0 0 3

OBJECTIVES

- To provide an introduction to computer algorithms and data structures, with an emphasis on foundational material.
- To have a good understanding of the fundamental data structures used in computer science
- To have a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To analyze the space and time efficiency of most algorithms
- To design new algorithms or modify existing ones for new applications and reason about the efficiency of the result

UNIT I INTRODUCTION AND BASIC DATA STRUCTURES 9

Problem solving techniques and examples-Abstract Data Type (ADT)-The list ADT Arrays-Stacks and Queues: Implementation and Application

UNIT II ADVANCED DATA STRUCTURES 9

Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees

UNIT III SORTING AND HASHING 9

Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment-Heap Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort- Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash functions-Separate Chaining-Open Addressing-Rehashing-Extendible Hashing

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer-dynamic programming-Greedy Algorithm – Backtracking.

UNIT V GRAPHS ALGORITHMS 9

Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-All pairs shortest paths

TOTAL:45 PERIODS

OUTCOMES:

- Fundamentals of data structures and algorithms are studied.
- Features of various algorithms for different applications are studied.

TEXT BOOKS

1. M A Weiss," Data Structures and Algorithm Analysis in C++",3rd Edition, Pearson Education, 2007.
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest," Introduction to Algorithms", 2nd Edition, prentice Hall of India, 2002

REFERENCES

1. Malik,"Data Structures using C++",Cengage Learning , 2013
2. R G Dromey,"How to solve it by computers", Pearson Education Asia, 2005.
3. Robert L Kruse, Clovis L Tando and Bruce P Leung, "Data structures and Program Design in C", 2nd Edition, Prentice Hall of India,1991.
4. Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007.

PTEE7006 DIGITAL SIGNAL PROCESSING LT P C
3 0 0 3

OBJECTIVES:

- To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.
- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Introduction to Fourier Transform– Discrete time Fourier transform.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping -Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture of one DSP processor– Features – Addressing Formats – Functional modes - Introduction to Commercial Processors

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply Fourier transforms for processing of signals
- Ability to design and develop digital filters algorithms in digital signal processor platforms.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2009.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2006.

REFERENCES:

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.
2. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
3. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

PTEE7007 **EHV POWER TRANSMISSION** **LT P C**
3 0 0 3

OBJECTIVES

- To impart knowledge on EHV AC, HVDC and FACTS transmission trends with parameter calculations and study on the effect of EHV lines on living organisms

UNIT I TRANSMISSION LINE TRENDS 9

Standard transmission voltages, average values of line parameters – Power handling capacity and line losses - number of lines.

UNIT II LINE AND GROUND PARAMETERS 9

Resistance, Temperature rise and current carrying capacity of conductors. Properties of Bundle conductors – Calculation of L and C parameters – Modes of propagation – Effect of Earth.

UNIT III HIGH VOLTAGE DIRECT CURRENT (HVDC) 9

HVDC system – Principle of operation, control and design consideration, HVDC circuit breaking.

UNIT IV FACTS 9

Basic concepts – Reactive power control, uncompensated transmission line, series compensation, SVC, thyristor control, series capacitor, static synchronous compensator, unified power flow controller and applications.

UNIT V ELECTROSTATIC AND MAGNETIC FIELDS OF EHV LINES 9

Electric shock – threshold currents – Calculation of electrostatic fields and magnetic fields of AC and DC lines – Effect of fields on living organism – Electrical field measurement.

TOTAL : 45 PERIODS

OUTCOMES:

- Expose to the components of electrostatic and magnetic field effects of EHV lines.

TEXT BOOKS

1. S Kamakshaiah& V Kamaraju “HVDC Transmission”, Tata McgrawHilll Publishers, 2011.
2. Rakosh Das Begamudre “ Extra high voltage AC transmission Engineering”, New Age International Publishers, Third Edition, 2006.
3. Narain G Hingorani“ Understanding FACTS” Standard Publishers, 1994.
4. P.Kundur“ Power System stability and control”, Tata McgrawHilll Publishers, 1994.

REFERENCES

1. C.L. Wadhwa“ Electrical Power Systems”, New Age International Publishers, Fourth Edition, 2005.
2. K.R. Padiyar, “ HVDC Power Transmission System”. New Age International Publishers, First Edition, Reprint 2005.
3. M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A.Chakrabarti, “ A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998.
4. Mafen Abdel – Salam, Hussein Anis, Ahdab E-Moshedy, RoshdyPadwan “ High Voltage Engienering – Theory & Practice”, Marcel Dekker Inc., 2000.

PTEE7008 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LT P C
3 0 0 3

OBJECTIVES

- To enable the student to have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.
- To introduce the general instrument system, error, calibration etc.
- To explain the techniques for measurement of voltage and current.
- To explain the techniques for measurement of other electrical parameters namely power, energy, frequency, phase etc.
- To discuss the comparison methods of measurement.
- To give exposure to non-electrical measurements and data acquisition system.

UNIT I UNITS AND STANDARDS IN MEASUREMENT 9

Principle of measurement – absolute, comparative, direct reading and null balance methods. SI units - rules for display of results of a measurement – Systematic errors – accuracy- and random errors - precision index – peak (unipolar and bipolar) and standard deviations - statistical evaluation of measurement data - Gaussian distribution - Standards and calibration

UNIT II ANALOG AND INDICATING INSTRUMENTS 9

PMMC ammeter – range conversion – PMMC voltmeter – Figure of merit - moving iron ammeter – range conversion – MI voltmeter – Electrodynamometer type ammeter – Electrodynamometer type wattmeter – UPF, LPF types – Induction type energy meter - Single and three phase power and energy measurement.

UNIT III DIGITAL INDICATING INSTRUMENTS 9

Timer –counter – Dual slope DVM – Digital multi meter (DMM) – Digital energy meter (DEM)– DAC - ADCs - Data acquisition systems – PC based measurements.

UNIT IV NULL BALANCE METHODS OF MEASUREMENT 9

Potentiometer: - DC and AC – Wheatstone, Kelvin and Mega ohm bridges - A.C. bridges: Maxwell, Anderson, Hay, Wien and Schering.

UNIT V MISCELLANEOUS INSTRUMENTS 9

Q- meter – Instrument transformers – CRT and CRO – DSO - Multiple earth and earth loops – Grounding techniques - Electrostatic and electromagnetic interference - Measurement of pressure - temperature: thermocouple and RTD; Measurement of displacement: LVDT – Measurement of force: strain gauge – A.C. and D.C. tachometer – Digital transducers.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to implement and verify different measurement schemes for measuring of electrical and non-electrical parameters.

TEXT BOOKS:

1. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, Edition 2011.
2. A. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall, 2007.
3. R.B. Northrop, ‘Introduction to Instrumentation and Measurements’, Taylor & Francis, New Delhi, 2008

REFERENCES:
1. M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009
2. J.J. Carr, 'Elements of Electronic Instrumentation and Measurement', Pearson Education India, New Delhi, 2011
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
4. E. O. Doebelin and D. N. Manik, " Measurement Systems – Application and Design", 6th Edition, Tata McGraw-Hill, New Delhi, 2011.

PTEE7009 EMBEDDED AUTOMATION SYSTEMS LT P C
3 0 0 3

OBJECTIVES
- To introduce different types of sensors used extensively in vehicle automation
- To understand the basic scheme for interfacing sensing and actuating component
- To focus on scope for embedded based secured environment for industrial and home automation

UNIT I INTRODUCTION TO SENSORS AND ACTUATORS 9

Sensor electronics and techniques – Overview of sensor measurements – Sensor linearization and characterization – Sensor classification - – sensors and actuators for automotive systems - .Air flow rate sensor – angular position sensor – engine speed sensor – torque, light, distance and level –Hall Effect position sensor – optical crank shaft sensor – throttle angle sensor – sensor for feedback control – automotive engine control actuators–sensor data acquisition.

UNIT II AUTOMOTIVE SYSTEM AND CONTROL 9

Basics of Electronic engine control system – Electronic Fuel Control System – Electronic ignition system- Digital Engine Control systems – Speed, EGR , Traction control- Functions and control – Vehicle motion control- Engine performance metric—BSFC, Power, Efficiency, Engine mapping, Air fuel ratio – Electronic Fuel Control—Electronic Ignition—Comparison with Hybrid vehicle Power train control .

UNIT III AUTOMOTIVE INSTRUMENTATION 9

Microcomputer based instrumentation system – advantages – signal conversion – multiplexing – sampling – Measurement of fuel, coolant temperature, oil pressure, speed –Principles of stepper motors, Relays , solenoids , Hydraulic and pneumatic devices-microcontrollers interface for Sensor and actuator circuit, Display devices – onboard diagnostics

UNIT IV BUILDING AUTOMATION 9

CAN Bus Network for vehicle Automation – Integrated vehicle electronic system – Telematics – Electronic control system diagnostics –Concept of energy management system, occupancy sensors, fans & lighting controller-Basics of virtual instrumentation-Digital field testers – test and calibration standards –traceability-EMI/EMC

UNIT V ADVANCES IN AUTOMOTIVE ELECTRONIC SYSTEMS 9

Introduction to electric and hybrid vehicles – Fuel cells powered vehicles – Safety and Collision Avoidance – Navigation support for vehicles – Automatic unmanned driving control for vehicles.

TOTAL: 45 PERIODS

OUTCOMES:
- Able to design an efficient embedded automation system for vehicles.

TEXT BOOKS

1. William B. Ribbens, Understanding Automotive Electronics, 6th edition, YES DEE Publishing Private Limited, 2011.
2. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.

REFERENCES

1. Al Santini, ' Automotive Technology', Cengage Learning edition 2004.
2. Ali Emadi, 'Vehicular Electric Power Systems', Marcel Dekkeredition 2004
3. MehrdadEhsani, 'Modern Electric, Hybrid Electric and Fuel cell vehicles', CRC Press Second edition 2011.
4. BarneyCapehart,'WebBasedEnterpriseEnergyandBuildingAutomationSystems',C.E.M, Editor.
5. E Q Doebelin, Measurement Systems, Application and Design, 4th edition, McGraw-Hill, 2011.
6. Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer; First edition, 2000.

PTEE7010 EMBEDDED SYSTEM DESIGN LT P C
3 0 0 3

OBJECTIVES

To provide a clear understanding on the basic concepts of embedded system design and its applications to various fields:

- Building Blocks of Embedded System
- Introduction to Embedded software Tools
- Bus Communication protocol, Input/output interfacing.
- Various scheduling concepts for process &basics of Real time operating system.
- Discussions through Phases of development of embedded products.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems – The build process for embedded systems- Structural units for an Embedded microcontroller , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock-- IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, Boundary Scan

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols -RS232 standard – RS485 – USB Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C)

UNIT III INTERRUPTS SERVICE MECHANISM AND DEVICE DRIVERS 9

Programmed-I/O busy-wait approach without interrupt service mechanism-ISR concept-interrupt sources – multiple interrupts – context and periods for context switching, interrupt latency and deadline – Introduction to Device Drivers

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Pre-emptive and non-pre-emptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of commercial Real time Operating systems: Vx Works, чC/OS-II, RT

Linux

UNIT V EMBEDDED SYSTEM APPLICATION WITH DEVELOPMENT 9

Case Study: Washing Machine- Automotive Application-Embedded Product Development Life Cycle, Objective, Need, and different Phases & Modelling of the EDLC

TOTAL:45 PERIODS

OUTCOMES:

- Able to understand the hardware and software functional required to design automation for an embedded process.

TEXT BOOKS

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010

REFERENCES

1. Shibu.K.V, "Introduction to Embedded Systems", Tata McGraw Hill,2009
2. LyaB. Das," Embedded Systems",Pearson Education,2010.
3. Elica White, 'Making Embedded Systems', O'Reilly Series,SPD,2011
4. Dave, "Embedded Systems: Concepts Design and Programming,1st edition, Pearson Education,2015.
5. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
6. Jonathan W. Valvano, 'Embedded Microcomputer Systems Real time Interfacing', Cengage learning , 3rd edition ,2012
7. Han-Way Huang, "Embedded system Design using C8051", Cengage Learning,2009

PTEE7011 ENERGY MANAGEMENT AND AUDITING L T P C
3 0 0 3

COURSE OBJECTIVES

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation

Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL:45 PERIODS

TEXT BOOKS

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,. Logman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.

PTEE7012 FLEXIBLE AC TRANSMISSION SYSTEMS LT P C
3 0 0 3

OBJECTIVES

- To expose the students to the start-of-art of the power system
- To analyze the performance of power systems with FACTS controllers.
- To model FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation. Basic concepts of Static Var Compensator (SVC)–Thyristor Controlled 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 fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

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.

UNITIV 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.

UNITV CO-ORDINATION OF FACTS CONTROLLERS 9

Controllerinteractions–SVC–SVCinteraction–Co-ordinationofmultiplecontrollersusing linear control techniques –Control co-ordination using genetic algorithms.

TOTAL:45 PERIODS

OUTCOMES:

- Able to understand, analyse and develop analytical model of FACTS controller for power system application.

TEXTBOOKS

1. R.MohanMathur,RajivK.Varma,"Thyristor–BasedFactsControllersforElectrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. Narain G.Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.

REFERENCES

1. K.R.Padiyar,"FACTSControllersinPowerTransmissionandDistribution",NewAgeInternational (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

PTEE7013 FUNDAMENTALS OF COMPUTER ARCHITECTURE LT P C
3 0 0 3

OBJECTIVES

To understand the basic concepts and organization of Computers

- To understand the basic concepts and organization of Computers.
- To study implementation of combinational circuits, the design of various synchronous and asynchronous circuitry supportive to CPU operation.
- To introduce various memory devices, Significances of Memory management.
- Introduce the CPU architecture, micro programming and peripheral interfacing.
- Concepts and importance of parallelism through various processor technologies

UNIT I BASIC STRUCTURE OF COMPUTING PROCESSORS 9

Functional units –Number system, error detection, corrections & codes conversions, Binary Arithmetic, Boolean algebra: Basic operational concepts. Design of adder, subtractor,

comparators, code converters, encoders, decoders, multiplexers and demultiplexers.

UNIT II DIGITAL CIRCUIT DESIGN 9

Flip flops - SR, D, JK and T, shift registers, counters, state assignments analysis and design of synchronous sequential circuits, state diagram; state reduction-Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

UNIT III CONTROL AND CENTRAL PROCESSING UNIT 9

Micro programmed control –design of control unit- Central processing unit – general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, execution of instruction set in computer–concepts in design of addition and subtraction, multiplication algorithms for arithmetic operations-Memory organization – ROM, PROM, EPROM, cache memory, need for memory management .

UNIT IV INPUT OUTPUT ORGANIZATION 9

Input output organization: peripheral devices, input output interface, asynchronous data transfer, Bus arbitration – Instruction and instruction sequencing –modes of transfer, interrupt service, input output interface, communication ports-need for Serial BUS-RS232,Ethernet Bus, Parallel port communication- ISA, PCI

UNIT V PIPELINE AND PARALLELISM IN COMPUTER PROCESSORS 9

Parallel Processing-- Pipelining-Arithmetic Pipeline—Instruction Pipeline—Introduction to Vector processors and Array processors.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand the architecture and various components of computer hardware system. Introduction to functions of various types of digital circuits are analysed and studied as building blocks of a computation processor.

TEXT BOOKS

1. Morris Mano, ‘Computer system architecture’, 3rd edition, Pearson education 2007
2. Thomas L. Floyd, ‘Digital Fundamentals’, Tenth Edition, Pearson education 2010
3. William Stallings, ‘Computer Organization and architecture’, 7th edition Pearson Education 2011

REFERENCES

1. Behrooz Parhami, ‘Computer Architecture’, Oxford University Press, 2005.
2. Vincent P. Heuring and Harry F. Jordan, ‘Computer systems design and architecture’ Pearson Education Asia Publications, 2004.
3. Charles H.Roth,Jr., ’Fundamentals of Logic Design’, Cengage Learning Fifth Edition, 2012

PTEE7014 FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING LT P C
3 0 0 3

OBJECTIVES

To introduce the concept of Object Oriented Programming and C++.

- Familiar with the concepts of Object Oriented Programming.
- Able to appreciate the features of C++ programming Language.
- Having a thorough understanding about Classes and Objects.
- Able to develop programs in C++

UNIT I INTRODUCTION TO OBJECT-ORIENTED PROGRAMMINGAND C++ 10

Procedure-Oriented Programming System – Object-Oriented Programming System – Comparison of C++with C–Object-Oriented Terms and Concepts–Object-Oriented Languages – Differences between Procedural and Object-Oriented Programming – Merits and Demerits of Object-Oriented Methodology. Structure of a C++ Program–Data Types– Operators in C++ - Control Structures – Functions in C++

UNIT II CLASSESAND OBJECTS 8

Introduction to Classes and objects – Member Functions and Member Data – Objects and Functions–Objects and Arrays–Name Spaces–Nested Classes–Dynamic Memory Allocation and Deallocation – Constructors and Destructors

UNIT III INHERITANCEAND POLYMORPHISM 9

Introduction – Base Class and Derived Class Pointers – Function Overriding – Base Class Initialization–Protected Access Specifier–Deriving by Different Accessing specifiers– Different Kinds of Inheritance – Order of Invocation of Constructors and Destructors – Virtual Functions – Mechanism of Virtual Functions – Pure Virtual Functions–Virtual Destructors and Constructors

UNIT IV OPERATOR OVERLOADING, TEMPLATES 9

Operator Overloading–Overloading of various Operators– Type Conversion–New Style Casts and the typed Operator–Function Templates–Class Templates– The Standard Template Library (STL)

UNIT V EXCEPTION HANDLINGAND CASE STUDIES 9

Introduction–C-Style Handling of Error-generating Code–C++-Style Solution-the try/ throw/ catch Construct–Limitations of Exception Handling. Case Studies: String Manipulations– Building classes for matrix operations

TOTAL:45 PERIODS

OUTCOMES:

- Ability to develop the object oriented programs for simple projects

TEXT BOOKS

1. SouravSahay,"ObjectOrientedProgrammingwithC++",OxfordUniversityPress,2006.
2. Deittel and Deittel, "C++ - How to Program", 2nd Edition, Prentice Hall of India.
3. Balagurusamy E. ,"Object Oriented Programming with C++",3rd Edition, Tata McGraw Hill, 2007

REFERENCES

1. K U Subhash, " Object Oriented Programming with C++", Pearson, 2010.
2. Bhushan Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.

3. IraPohl, “Object Oriented Programming using C++”,Pearson Education,2nd Edition, 2003
4. John P. Hayes , ‘ Computer Architecture and Organization’, Tata McGraw-Hill, 1988.
5. Andrew S Tannenbaum ‘Structured Computer Organization‘,5thedition Pearson Education 2007

PTEE7015 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION LT P C
3 0 0 3

OBJECTIVES

To understand the concept, planning of DC power transmission and comparison with AC power transmission.

- To analyse HVDC converters.
- To study about the HVDC system control.
- To analyse harmonics and design of filters.
- To model and analysis the DC system under study state.

UNITI INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems

UNITII ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysisofa 12 pulse converters– Analysis of VSC topologies and firing schemes

UNITIII CONVERTERANDHVDCSYSTEMCONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNITIV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters

UNITV POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL:45 PERIODS

OUTCOMES:

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

TEXTBOOKS

1. Padiyar,K.R.,"HVDCpowertransmission system",New Age International(P)Ltd.NewDelhi,Second Edition,2010.
2. Edward Wilson Kimbark," Direct Current Transmission", Vol.I,Wiley inter science, New York, London, Sydney,1971.

REFERENCES

1. Kundur P.," Power System Stability and Control", McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG," High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Arrillaga,J.,"HighVoltageDirectCurrentTransmission",PeterPregrinus,London,1983.

PTEE7016 INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN LT P C

3 0 0 3

OBJECTIVES

- To know the Industrial power quality standards
- To know mitigation techniques for harmonics and flicker problem

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited Capacity Generators-Computer-Aided Analysis.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modelling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Over voltages-Switching Surge Analysis-Back-to-Back Switching.

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

TOTAL : 45 PERIODS

OUTCOMES:

- Different standards of power quality are studied.
- Features of different PF correction studies, harmonic analysis and flicker analysis and grid analysis are studied.

TEXT BOOKS

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.
2. Sen, S.K. "Principles of Electrical machine Designs with Computer Programmes." Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987

REFERENCES

1. A.Shanmugasundara, G. Gangadharan, R. Palani " Electrical machine Design Date Book'" New Age International Pvt. Ltd., Reprint 2007.
2. Balbir Singh "Electrical Machine Design" Brite Publications, Pune, 1981.

PTEE7017 MEDICAL INSTRUMENTATION LT P C
3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues – Basic mechanics of spinal column and limbs - Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements .

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography– Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart–Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopaedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Second Edition, Boca Raton, CRC Press LLC, 2000

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 1997.
3. Joseph J.Carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 1997.
4. Khandpur R S, Handbook of Medical Instrumentation, Tata Mc Graw Hill.
5. Duane Knudson, Fundamentals of Biomechanics, Springer, 2003.
6. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.

PTEE7018 MICRO ELECTRO MECHANICAL SYSTEMS LT P C
3 0 0 3

OBJECTIVES

- To introduce MEMS technology
- To study the different MEMS materials and their properties
- To study the different fabrication process used in MEMS technology.
- To introduce the fundamental working principles of different micro sensors and actuators.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of Micro systems – Energy Domains and Transducers- Sensors and Actuators – Silicon based MEMS processes – MEMS Materials –Review of Electrical and Mechanical concepts in MEMS – Introduction to Micro system Fabrication processes

UNIT II MICROMACHINING 9

Bulk Micromachining - Surface micromachining and LIGA processes

UNIT III SENSORS AND ACTUATORS - I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Micro motors –Inter digitated Finger capacitor – Comb drive devices – Thermal Sensing and Actuation – Thermal expansion– Thermal couples – Thermal resistors – Applications – Magnetic Actuators – Micro magnetic components – Case studies of MEMS in magnetic actuators.

UNIT IV SENSORS AND ACTUATORS - II 9

Piezo resistive sensors – Piezo resistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT V APPLICATIONS 9

Application to Acceleration, Pressure, Flow, Chemical, Inertial sensors - Optical MEMS – Bio MEMS – RF MEMS – Energy Harvesting – NEMS devices

TOTAL : 45 PERIODS

OUTCOMES:

- Able to design and analyse the performance of MEMS devices.
- Able to identify the right MEMS device against the applications.

TEXT BOOKS.

1. Stephen D Senturia, “Micro system Design”, Springer International Edition, 2006.
2. Tai Ran Hsu, “MEMS and Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2006.
3. N.P. Mahalik, “ MEMS”, Tata McGraw-Hill, New Delhi, 2007

REFERENCES

1. Marc Madou, “Fundamentals of Micro fabrication”, CRC press, 2002.
2. Gregory T. Kovacs “Micro machined Transducers Source Book”, McGraw-Hill High Education, 1998.
3. M.H.Bao, “Micromechanical Transducers: Pressure sensors, Accelerometers and Gyroscopes”, Elsevier, Newyork, 2000.
4. Chang Liu, “Foundations of MEMS”, Pearson Education Inc., 2006

PTEE7019 NANO TECHNOLOGY LT P C
3 0 0 3

OBJECTIVES

- To introduce the concept and knowledge of Nano science and Nanotechnology.
- To know about preparation methods and nanofabrication techniques.
- To create awareness of clean room environment & societal implications of Nanotechnology
- To know about the different characterization techniques used for Nano systems

UNIT I INTRODUCTION 10

Nano scale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of bulk nano structured materials- Nano particles- quantum dots, nano wires-ultra-thin films – multilayered materials, Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties

UNIT II PREPARATION ENVIRONMENTS 5

Clean rooms: specifications and design, air and water purity, requirements for particular Processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological Contamination, Safety issues, flammable and toxic hazards, biohazards, implication of Nano science and Nanotechnology on society.

UNIT III PREPARARTION ROUTES AND LITHOGRAPHY FOR NANOSCALEDEVICES **10**

Preparation of nanoscale materials: precipitation, mechanical milling, colloidal routes, self assembly; vapour phase deposition, CVD, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy, lithography: optical/UV, electron beam and x-ray lithography, systems and processes, wet etching, dry etching

UNIT IV CHARECTERIZATION TECHNIQUES **10**

X-ray and Neutron diffraction technique, Scanning Electron Microscopy plus environmental techniques, Transmission Electron Microscopy including high-resolution imaging, analytical electron microscopy, EDX and EELS, Surface Analysis techniques, XPS, SIMS, Auger

UNIT V EVOLVING INTERFACES OF NANO **10**

Applications of nanotechnology: NEMS – Nanosensor – nanomedicines - nanotechnology Applications to electrical engineering –Nanoelectronics: quantum transport devices, molecular electronics devices, quantum computing ,memory, CNT and its applications, Nano motor, Nano robot, energy efficient battery technology, Nano dielectrics, lighting system, solar cell

TOTAL:45 PERIODS

OUTCOMES:

- To understand unique properties of Nano material structure and apply them for Electrical and Electronics Engineering.

TEXT BOOKS

1. Chattopadhyay K.K and A.N Banerjee, Introduction to Nanoscience and nanotechnology, PHI, 2009
2. T. Pradeep, Nano the essentials, Tata-McGraw Hill Education, 2007

REFERENCES

1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999.
2. Charles P.Poole & Frank ,J.Owens,Introduction to nanotechnology ,WileyIndia.
3. Jan Korwink and Andreas Greiner, Semiconductors for Micro and Nanotechnology: An Introduction for Engineers, Weinheim Cambridge: wiley-VCH,2001.
4. Rainer wager(ed), Nano Electronics and Information Technology,2nd Edition, Wiley-VCH
5. N. John Dinardo, Nanoscale Characterization of Surfaces and Interfaces, Second edition, Weinheim Cambridge: wiley-VCH,2000
6. B S Murthy,P Shankar, Baldev Raj, BB Rath& James Murday.'Text book of Nanoscience and Nano Technology',,Universities Press, 2011.

PTEE7020 OPERATIONAL RESEARCH LT P C
3 0 0 3

OBJECTIVES

- To learn the basics of optimization techniques and their applications to Electrical Engineering

UNIT I LINEAR PROGRAMMING 9

Introduction - formulation of linear programming model - Graphical solution – solving LPP using simplex algorithm – Revised Simplex Method

UNIT II ADVANCES IN LPP 9

Duality theory - Dual simplex method - Sensitivity analysis –- Transportation problems – Assignment problems- Traveling sales man problem -Data Envelopment Analysis

UNIT III NON LINEAR PROGRAMMING 9

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions – Reduced gradient algorithms – Quadratic programming method – Penalty and Barrier method.

UNIT IV INTERIOR POINT METHODS 9

Karmarkar's algorithm – Projection Scaling method –Dual affine algorithm – Primal affine algorithm Barrier algorithm.

UNIT V DYNAMIC PROGRAMMING 9

Formulation of Multistage decision problem – Characteristics – Concept of sub-optimization and the principle of optimality – Formulation of Dynamic programming – Backward and Forward recursion – Computational procedure – Conversion of final value problem into Initial value problem.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply the optimization technique for electrical engineering applications.

TEXT BOOKS

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000
2. R.Panneer selvam, "Operations Research", PHI, 2006

REFERENCES

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Hamdy A Taha, "Operations Research – An Introduction", Prentice Hall India, 2003.
3. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005.

PTEE7021 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS **L T P C**
3 0 0 3

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**

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**

Standalone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid 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 : 45 PERIODS

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.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press 2005.

REFERENCES:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, 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,2011.

PTEE7022 POWER QUALITY LT P C
3 0 0 3

OBJECTIVES

- To study the causes & Mitigation techniques of various PQ events
- To study various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – 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 SWELLS 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sags, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swells.

UNIT III 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, IEEE and IEC standards

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators Analysis and Design of Passive Shunt Compensators Simulation, and Performance of Passive Power Filters Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyser - Flicker meters - Disturbance analyser - Applications of expert systems for power quality monitoring. Principle& Working DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL: 45 PERIODS

OUTCOMES

- Students learn about the various sources, causes, effects and understand the monitoring techniques and preventive measures of different Power quality issues in electrical systems.

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.Wayne Beaty, "Electrical Power Systems Quality", McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment", (New York: Wiley),2000.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”,(New York: IEEE Press),2000.
3.Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” (New York: Wiley), Reprint 2015.

PTEE7023 RESTRUCTURED POWER SYSTEMS LT P C
3 0 0 3

COURSEOBJECTIVES

- To introduce there structuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNITI INTRODUCTIONTO RESTRUCTURINGOFPOWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems–Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production– Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis–a–vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSIONCONGESTIONMANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management–Classification of congestion management methods–Calculation of ATC-Non market methods–Market methods–Nodal pricing–Inter zonal and Intra zonal congestion management–Price area congestion management–Capacity alleviation method.

UNIT III LOCATIONALMARGINALPRICESANDFINANCIAL TRANSMISSION RIGHT 9

Mathematical preliminaries:-Locational marginal pricing Lossless DCOPF model for LMP calculation Loss compensated DCOPF model for LMP calculation ACOPF model for LMP calculation–Financial Transmission rights–Risk hedging functionality Simultaneous feasibility test and revenue adequacy–FTR issuance process: FTR auction, FTR allocation–TreatmentofrevenueshortfallSecondarytradingofFTRs–Flow gate rights–FTR and market power-FTR and merchant transmission investment.

UNIT IV ANCILLARYSERVICEMANAGEMENTANDPRICINGOFTRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services Classification of Ancillary services–Load generation balancing related services Voltagecontrolandreactivepowersupportdevices–Blackstartcapabilityservice-How to obtain ancillary service –Co-optimization of energy and reserve services- International comparison Transmission pricing –Principles– Classification– Rolled in transmission pricing methods–Marginaltransmissionpricingparadigm–Compositepricingparadigm–Merits and demerits of different paradigm.

UNIT V REFORMSININDIAN POWER SECTOR 9

Introduction–Frame work of Indian power sector–Reform initiatives-Availability based tariff Electricity act 2003–Open access issues–Power exchange–Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES

- Learners will have knowledge on restructuring of power industry, basics of congestion management and also have enriched with the significance ancillary services and pricing of transmission network and various power sectors.

TEXT BOOKS

1. Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading andvolatility" Pub.,2001
2. Kankar Bhattacharya, Jaap E.Daadler,MathH.J.Boolen," Operation of restructured power systems",Kluwer AcademicPub.,2001.

REFERENCES

1. SallyHunt,"Making competition work inelectricity",,JohnWilleyandSonsInc.2002
2. StevenStoft, "Power system economics: designing markets for electricity", John Wiley&Sons,2002.

PTEE7024 SMART GRID L T P C
3 0 0 3

COURSE OBJECTIVES

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES (Transmission) 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control.

UNIT III SMART GRID TECHNOLOGIES (Distribution) 9

DMS, Volt/VAr control,Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT IV SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband

over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES

- Students will develop more understanding on the concepts of Smart Grid and its present developments.
- Students will study about different Smart Grid technologies.
- Students will acquire knowledge about different smart meters and advanced metering infrastructure.
- Students will have knowledge on power quality management in Smart Grids
- Students will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS

1. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions",CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.

REFERENCES*:*

1. Vehbi C. Güngör*,* DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella*,* Carlo Cecati*,* and Gerhard P. Hancke*,* Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids.

PTEE7025 SOFT COMPUTING TECHNIQUES L T P C

3 0 0 3

OBJECTIVES

- To study the basics of artificial neural network.
- To study the concepts of modelling and control of neural and fuzzy control schemes.
- To study the features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back propagation algorithm (BPA) – Recurrent neural network (RNN) – Adaptive resonance theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– Introduction to GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to support vector machine – Particle swarm optimization – Case study – Familiarization with ANFIS toolbox

TOTAL: 45 PERIODS

OUTCOMES:

- Basic concepts of ANN , different features of fuzzy logic and their modelling, control aspects; different hybrid control schemes are studied through practice.

TEXTBOOKS

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

PTEE7026 SPECIAL ELECTRICAL MACHINES LT P C
3 0 0 3

OBJECTIVES:

- To explore the theory and applications of special electrical machines.
- To review the fundamental concepts of permanent magnets and the operation of permanent magnet brushless DC motors.
- To introduce the concepts of permanent magnet brushless synchronous motors and synchronous reluctance motors.
- To develop the control methods and operating principles of switched reluctance motors.
- To introduce the concepts of stepper motors and its applications.
- To understand the basic concepts of other special machines.

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control

UNIT II PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – EMF and torque equations - Phasor diagram - Power controllers– performance characteristics – Digital controllers – Constructional features, operating principle and

characteristics of synchronous reluctance motor.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features –Principle of operation- Torque prediction –performance Characteristics- Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT IV STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque equation – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Need for special electrical machines are studied. Different features of special machines and converter circuits for special machines are obtained

TEXT BOOKS:

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Claredon press, London, 1989.
2. R.Krishnan, Switched Reluctance motor drives, CRC press, 2001.
3. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
4. K. Venkataratnam **,**Special Electrical Machines, Universities Press, 2014.

REFERENCES:

1. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.
2. R.Krishnan, Electric motor drives, Prentice hall of India, 2002.
3. D.P.Kothari and I.J.Nagrath, Electric machines, Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.
4. Irving L.Kosow, Electric Machinery and Transformers, Pearson Education, Second Edition, 2007.

PTEE7027 VLSI DESIGN AND ARCHITECTURE LT P C
3 0 0 3

OBJECTIVES

To understand the basic concepts of VLSI and CMOS design.

- Introduce the basics of VLSI design and its importance.
- Analyse the switching Characteristics of MOS transistor.
- Study the construction of NMOS, CMOS and Bi-CMOS based logic circuits.
- To learn about the programming of Programmable device using Hardware description Language.

UNIT I BASIC MOS TRANSISTOR 9

Introduction to logic design –switching devices- MOS transistor current equation – second order effects – MOS Transistor Model- Fabrication Technologies (NMOS, PMOS, CMOS, BiCMOS).

UNIT II NMOS & CMOS GATES 9

NMOS & CMOS inverter – Determination of pull up / pull down ratios – CMOS based logic design- stick diagram – lambda based rules – super buffers – BiCMOS .

UNIT III SUB SYSTEM DESIGN & LAYOUT 9

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

UNIT IV DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAYLOGIC 9

Programmable Logic Devices- PLA, PAL, GAL, CPLD, FPGA–- Implementation of Finite State Machine with PLDs

UNIT V VHDL PROGRAMMING 9

RTL Design – Structural level Design -combinational logic – Types – Operators – Packages– Sequential circuit – Sub programs – Test benches. (Examples: adder, counters, flip flops, FSM, Multiplexers / Demultiplexers).

TOTAL:45 PERIODS

OUTCOMES

- Expose to HDL language and ability to design PLD devices and simple application.

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Debprasad Das, VLSI Design, Oxford University Press, 2010.
3. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.

REFERENCES

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002.
2. Charles H.Roth, 'Fundamentals of Logic Design', Jaico Publishing House, 1992.
3. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.
4. Douglas Perry, 'VHDL Programming By Example', Tata McGraw Hill, 3rdEdition.2007.
5. Parag K.Lala, 'Digitl System Design using PLD', BS Publications, 2003

PTCS7071 OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the concepts of operating systems.
- To learn about the various issues in operating systems.
- To familiarize with the important mechanisms in operating systems.
- To appreciate the emerging trends in operating systems.

UNIT I OPERATING SYSTEMS OVERVIEW 9

Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open-source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on

processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples.

UNIT II PROCESS MANAGEMENT 9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple-processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section problem – Peterson's solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Memory Management – Swapping – Contiguous memory allocation – Paging –Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing**.**

UNIT IV I/O SYSTEMS 9

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection.

UNIT V CASE STUDY 9

The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

- Articulate the main concepts, key ideas, strengths and limitations of operating systems
- Explain the core issues of operating systems
- Know the usage and strengths of various algorithms of operating systems

TEXT BOOK:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 2010.

REFERENCES:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
3. D M Dhamdhere, "Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
4. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice Hall, 2011.

PTEI7651 INDUSTRIAL DATA COMMUNICATION LT P C
3 0 0 3

COURSE OBJECTIVES

- To give an overview of the Industrial data communications systems.
- To provide a fundamental understanding of common principles, various standards, protocols.
- To provide insight into some of the new principles those are evolving for future networks.

UNIT I DATA NETWORK FUNDAMENTALS 9

EIA 232 interface standard – EIA 485 interface standard – ISO/OSI Reference model – Media access protocol: Command/response, Token passing and CSMA/CD – TCP/IP – Bridges – Routers – Gateways – Standard ETHERNET Configuration

UNIT II MODBUS AND HART 9

MODBUS: protocol structure, Function codes. Evolution of signal standard: HART communication protocol – Communication modes – HART Networks – HART commands – HART applications – Troubleshooting

UNIT III PROFIBUS AND FF 9

Fieldbus: Introduction – General Fieldbus architecture – Basic requirements of Fieldbus standard – Fieldbus topology – Interoperability and Interchangeability. Profibus: Introduction – Profibus protocol stack – Profibus communication model – Communication objects – Foundation field bus versus Profibus.

UNIT IV AS – INTERFACE (AS-i), DEVICENET AND INDUSTRIAL ETHERNET 9

AS interface: Introduction – Physical layer – Data link layer – Operating characteristics. Device net: Introduction – Physical layer – Data link layer and Application layer.
Industrial Ethernet: Introduction – 10Mbps Ethernet – 100Mbps Ethernet.

UNIT V WIRELESS COMMUNICATION 9

Wireless sensor networks: Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless HART – Existing Wireless Options: IEEE 802.15.4 - ISA 100 – Zigbee – Bluetooth **–** their relevance to industrial applications

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Gain knowledge on various industrial data communication networks, protocols and their selection.
2. Able to select and use most appropriate networking technologies and standards for a given application.
3. Ability to design and ensuring that best practice is followed in installing and commissioning the data communications links to ensure they run fault-free.
4. Ability to understand requirements of industrial application and provide wired or wireless solution.

TEXT BOOKS:

1 Mackay, S., Wright,E., Reynders,D., and Park,J., “Practical Industrial Data Networks: Design, Installation and Troubleshooting”, Newnes Publication, Elsevier, 2004.

2 Buchanan,W., “Computer Busses: Design and Application”, CRC Press, 2000.

REFERENCES:

1 Bowden,R., “HART Application Guide”, HART Communication Foundation, 1999.

2 Bela G.Liptak, “Instrument Engineers’ Handbook, Volume 3 : Process Software and Digital Networks”, 4th Edition, CRC Press, 2011.

3 Berge,J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

4 Lawrence (Larry) M. Thompson and Tim Shaw, “Industrial Data Communications”, 5th Edition, ISA Press, 2015.

5. NPTEL Lecture notes on, ”Computer Networks” by Department of Electrical Engg., IIT Kharagpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
2		✓										
3				✓								
4					✓							
5												