ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. Electrical and Electronics Engineering

(Part Time)

HAND BOOK
2016

DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER I	
Course Code	**Course**
EEEC 101	Engineering Mathematics – I
PEEEC 102	Circuit Theory- I
PEEEC 103	Electronics –I
PEEEC 104	Material Science
PEEEC 105	Electrical Machines-I

SEMESTER II	
Course Code	**Course**
PEEEC 201	Engineering Mathematics – II
PEEEC 202	Circuit Theory II
PEEEC 203	Electronics - II
PEEEC 204	Electrical Measurements
PEEEC 205	Electrical machines II

SEMESTER III	
Course Code	**Course**
PEEEC 301	Data structures and c++ programming
PEEEC 302	Electronic Instruments and Measurements
PEEEC 303	Field theory
PEEEC 304	Digital electronics
PEEEP 305	Electrical machines lab
PEEEP 306	Measurements And Instruments Lab

SEMESTER IV	
Course Code	**Course**
PEEEC 401	Electrical Machine Design
PEEEC 402	Control Systems
PEEEC 403	Power Electronics
PEEEC 404	Transmission And Distribution
PEEEP 405	Electronis Lab
PEEEP 406	Control Systems Lab

SEMESTER V	
Course Code	**Course**
PEEEC 501	Power Plant Engineering
PEEEC 502	Industrial Control and Automation
PEEEC 503	Solid State Drives
PEEEC 504	Embedded Systems
PEEEC 505	Power System Analysis

SEMESTER VI	
Course Code	**Course**
PEEEC 601	Communication Engineering
PEEEC 602	Protection Switchgear and Utilisation
PEEEC 603	Computer Aided Power System Analysis
PEEEE 604	High Voltage Transmission System
PEEEP 605	Embeded Systems Lab
PEEEP 606	Power Electronics and Drives Lab

SEMESTER VII	
Course Code	**Course**
PEEEC 701	Quantitive Management Techniques
PEEEE 702	Soft Computing Techniques
PEEEE 703	Bio Medical Electronics and Instrumentation
PEEEE 704	Static Relays
PEEEV 705	Project Work and Viva-Voce

SYLLABUS
FIRST SEMESTER

EEEC 101	ENGINEERING MATHEMATICS – I	L	T	P	C
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AIM

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

OBJECTIVE:

At the end of the course the students would.

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

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solution of standard types of first order partial differential equations – Lagrange's linear equation – linear partial differential equations of second order with constant coefficients.

UNIT II FOURIER SERIES

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

UNIT III BOUNDARY VALUE PROPLEMS

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

UNIT IV FOURIER TRANSFORM

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

UAUNIT V Z-TRANSFORM AND DIFFERENCE EQTIONS

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 102 CIRCUIT THEORY- I

AIM

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

OBJECTIVE

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

UNIT I INTRODUCTION

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

UNIT II NETWORK REDUCTION TECHNIQUES

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

UNIT III AC CIRCUITS

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

UNIT IV MAGNETIC CIRCUITS

Ampere's law; magnetic circuit concept and laws; magnetisation curve of ferromagnetic materials; calculation of magnetic circuit quantities; series and parallel circuits; circuits with short airgaps; fringing with long air gaps; energy of magnetic field; magnetic pull; hysteresis and eddy current losses with a.c. excitation; mutual inductance and coefficient of coupling.

UNIT V TIME DOMAIN ANALYSIS

Unit functions, step, impulse, ramp and parabolic; solution of network problems using Laplace transform; transient and steady state response of RLC networks with different types of forcing functions. Complex frequency; poles and zeros of network functions (introductory concept only).

TEXT BOOK

1. **Soni, Gupta** "A Course in Electrical Circuit Analysis" Dhanpat Rai and Sons2003.

REFERENCE BOOKS

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

PEEEC 103 ELECTRONICS -I

AIM

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

OBJECTIVES

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

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

UNIT I PN JUNCTION DEVICES

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

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

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

UNIT II BIPOLAR JUNCTION TRANSISTOR

Characteristics - Junction transistor - Current components - Transistor as an amplifier - Input /output characteristics of CB,CE,CC configurations - Cutoff, saturation, active regions - Common emitter current gain - Maximum voltage rating - Photo transistor . Transistor biasing and thermal stabilization - Operating point - Bias stability - Stabilization factors - Different bias stabilization circuits - Bias compensation techniques - Diode compensation - Thermistor and sensitor compensation – Thermal runaway and operating point consideration - Thermal stability and use of heat sinks.

UNIT III BJT ANALYSIS

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

UNIT IV MULTISTAGE AMPLIFIERS

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

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

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

UNIT V JUNCTION FIELD EFFECT TRANSISTOR

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

TEXT BOOK

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

REFERENCE BOOKS

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

PEEEC 104 MATERIAL SCIENCE

AIM

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

OBJECTIVES

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

UNIT I: CONDUCTING MATERIALS

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

UNIT II: SEMICONDUCTING MATERIALS

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

UNIT III: MAGNETIC AND DIELECTRIC MATERIALS

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

UNIT IV: OPTICAL MATERIALS

Optical properties of metals, insulators and semiconductors - phosphorescence and fluorescence - excitons, traps and colour centres and their importance-different phosphors used in CRO screens-liquid crystal as display material-thermography and its applications-photoconductivity and photo conducting materials.

UNIT V: NEW ENGINEERING MATERIALS

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

TEXT BOOKS

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

REFERENCE BOOKS

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

AIM

PEEEC 105 ELECTRICAL MACHINES-I

AIM

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

OBJECTIVES

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

UNIT I : D.C. MACHINES

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

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

UNIT II CONTROL OF DC MOTORS

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

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

UNIT III TRANSFORMERS

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

UNIT IV TESTING OF TRANSFORMERS

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

UNIT V THREE PHASE INDUCTION MOTORS

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

TEXT BOOKS

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

REFERENCE BOOKS

1. **Clayton. A.E and Hancock "**Performance and Design of Direct Current Machines" Oxford and IBH publishing Co; 1988.
2. **Hughes. E** "Electrical Technology" ELBS & Longman edition;1975.
3. **Theraja B.L. & Theraja A.K**."A Text Book of Electrical Technology-Vol II"S.Chand & Company Ltd;2000
4. **Bimbhra P.S.** "Electrical Machinery"Khanna Publishers; 1998.
5. **Murugesh Kumar K"**D.C.Machines & Transformers" Vikas Publishing House1999
6. **Bhattacharya S.K. "**Electrical Machines" Tata McGraw Hill Publishing company Limited,New Delhi;1998.

PEEEC 201- ENGINEERING MATHEMATICS – II

AIM

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

OBJECTIVES

At the end of the course , the students would

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

UNIT - I PROBABLITY THEORY

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

UNIT – II RANDOM PROCESS

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

UNIT - III TESTS OF SIGINIFICANCE

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

UNIT – IV INTERPOLATION AND CURVE FITTING

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

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

UNIT -V SOLUTION OF ALGEBRAIC AND TRANSCENDENTIAL EQUATIONS

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

TEXT BOOKS

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

REFERENCES

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

PEEEC 202 CIRCUIT THEORY II

AIM

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

OBJECTIVES

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

UNIT I THREE PHASE CIRCUITS

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

UNIT II TWO PORT NETWORK

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

UNIT III RELIABILITY AND IMMITTANCE FUNCTIONS

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

UNIT IV TRANSFER FUNCTION SYNTHESIS

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

UNIT V FILTERS

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

TEXT BOOK

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

REFERENCE BOOKS

1. **Soni, Gupta** "A Course in Electrical Circuit Analysis" Dhanpat Rai and Sons 2003.
2. **M.E.Van Valkenberg** "Introduction to Modern Network Synthesis" Wiley Eastern; 1986.
3. **Umesh Sinha** "Network Analysis and Synthesis"Satya Prakashan Publishers1985.
4. **V.K Aatre** "Network Theory and Filter Design" Wiley Eastern; 1985.
5. **M.E.Van Valkenberg** "Network Analysis and Synthesis" John Wiley;1976.

PEEEC 203 - ELECTRONICS - II

AIM

This subject enables to gain a indepth knowledge about the power amplifiers, oscillators, integrated circuits and filters.

OBJECTIVES

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

UNIT I FEEDBACK AMPLIFIERS

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

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

UNIT II INTEGRATED CIRCUIT FABRICATION

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

UNIT III DIFFERENTIAL AMPLIFIERS

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

Power amplifiers - Classification - Class A,B,C & AB -Single ended, push pull configurations - Power dissipation - Output power, efficiency, distortion - Complementary symmetry. Power amplifier - Class C power amplifier - Thermal considerations - IC power amplifier - Introduction to VMOS.

UNIT IV OPERATIONAL AMPLIFIER

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

UNIT V GENERAL APPLICATIONS OF OPERATIONAL AMPLIFIERS

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

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

TEXT BOOK

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

REFERENCE BOOKS

1. **Allen Mottershead** "Electronic Devices and Circuits" PHI; 1994.
2. **Jacob Millman and Halkias. C.C** "Electronic Devices and Circuits" Mc Graw Hill; 1987.
3. **Rinehart and Wenston**"Microelectronic Circuits" A.S. Sedra and K.C.Smith1987.
4. **Gayakwad A.** Op.amp and Linear Integrated Circuits(second edition); PHI; 2000.
5. **Roy Choudhury and Shail Jain** Linear Intergrated Circuits; Wiley Eastern; 1991.

PEEEC 204 - ELECTRICAL MEASUREMENTS

UNIT I UNITS AND STANDARDS

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

UNIT II MEASUREMENT OF POWER

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

UNIT III BRIDGES AND POTENTIOMETER

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

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

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

UNIT IV MAGNETIC MEASUREMENT

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

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

UNIT V HIGH VOLTAGE MEASUREMENT

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

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

TEXT BOOK

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

REFERENCE BOOK

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

PEEEC 205 ELECTRICAL MACHINES II

AIM

The subject enables the students to gain the in depth knowledge about the various AC machines.

OBJECTIVES

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

UNIT I : THREE PHASE INDUCTION MOTORS

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

UNIT II : SINGLE PHASE INDUCTION MOTORS

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

UNIT III : SYNCHRONOUS GENERATORS

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

UNIT IV : SYNCHRONOUS MOTORS

Principle of operation, synchronous motor on infinite busbars, phasor diagram, V curves and inverted V curves, hunting and its suppression, natural frequency of oscillation, starting methods, synchronous induction motor and

its applications - Synchronous phase modifier and its applications - Permanent magnet synchronous motors – Principle of operation and characteristics.

UNIT V : SPECIAL MACHINES : (QUALITATIVE TREATMENT ONLY)

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

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 301 DATA STRUCTURES AND C++ PROGRAMMING

AIM

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

OBJECTIVES

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

UNIT I DATA STRUCTURES

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

UNIT II TECHNIQUES

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

UNIT III OBJECT ORIENTED PROGRAMMING

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

UNIT IV OBJECTS AND CLASSES

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

UNIT V OPERATIONS

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

TEXT BOOKS

1. **John R.Hubbard**, "Programming with C++", Tata McGraw Hill, New Delhi, 1988.

2. **Jean - Paul Tremblay and Paul G.Sorenson**, "An Introduction to Data Structures with Applications", Tata McGraw Hill, 1988.

REFERENCE BOOKS

1. **Bjarne Stroustrup**, "The C++ Programming Language", Addison - Wesley Publication , New York, 2006.

2. **Cay Horstmann,** "Computing Concepts with C++ Essentials" ,John Wiley, 2006.

PEEEC 302 - ELECTRONIC INSTRUMENTS AND MEASUREMENTS

UNIT I ELECTRONIC METERS AND SIGNAL SOURCES

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

UNIT II FREQUENCY AND PERIOD MEASUREMENTS

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

UNIT III DIGITAL TRANSDUCERS AND DISPLAY DEVICES

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

UNIT IV DISPLAY INSTRUMENTS AND AMPLIFIER MEASUREMENTS: CRO

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

UNIT V RECORDERS

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

TEXT BOOKS

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

REFERENCE BOOKS

1. **Sawhney. A.K** "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Sons 1995.
2. **Jones L.D and Foster Chin A.** "Electronic Instrumentation and Measurements", Prentice Hall , 1984.
3. **Donald P.Eckman** "Industrial Instrumentation", Wiley Eastern Ltd, 1986..
4. **Oliver B.M and Cage J.M** "Electronic Measurements and Instrumentation" McGraw Hill, 1977
5. **Barney G.C.** "Intelligent Instrumentation", Prentice Hall of India,1998.

PEEEC 303 FIELD THEORY

AIM

The subject enables the students to gain a in depth knowledge about the electromagnetic.

OBJECTIVES

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

I) Vector analysis of electromagnetic fields

ii) Electro static principles

iii) Various concepts of electro magnetic and magnetic circuits

iv) Time varying magnetic fields

v) Maxwell's equation and concepts of waves.

UNIT I : VECTOR ANALYSIS

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

UNIT II : ELECTROSTATICS

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

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

UNIT III : ELECTROMAGNETICS

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

UNIT IV : TIME DEPENDENT ELECTROMAGNETIC FIELDS

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

UNIT V : PLANE ELECTROMAGNETIC WAVES

Maxwell's equations in point and integral form - Maxwell's wave equation - Plane electromagnetic wave in free space - Sinusoidal electromagnetic wave - Poynting vector and Poynting's theorem - Relation between electric field intensity and magnetic field intensity - Applications of the concept of Pointing vector - Examples of wave propagation - Surge impedance of a line in terms of energy balance.

TEXT BOOK

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

REFERENCE BOOKS

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

PEEEC 304 DIGITAL ELECTRONICS

AIM

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

OBJECTIVES

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

(i) Number systems, codes & Boolean algebra.

(ii) Logic families (RTL,DTL,HTL,TTL,ECL,MOS & CMOS) & Logic packages (SSI,MSI,LSI,VLSI & VVLSI)

(iii) Combinational logic circuits.

(iv) Sequential logic circuits.

(v) Digital IC's.

UNIT I : BOOLEAN ALGEBRA

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

UNIT II : LOGIC FAMILIES

Logic families - Specifications of a logic circuit - Operation and characteristics of RTL,DTL,HTL,TTL,ECL,MOS,CMOS and I^2L families - Comparison of logic families - Open collector, totem pole, Schottky and tristate TTL gates - Wire-ANDing, strobed gate, expanders, and expandable gates - Logic packages SSI,MSI,LSI,VLSI and VVLSI

UNIT III : COMBINATIONAL LOGIC

Combinational logic - Introduction - Min Terms and Max Terms - Truth tables and maps - Solving digital problems using maps - Sum of products and product of sums map reduction - Hybrid functions - Incompletely specified functions - Multiple output minimization - Tabular minimization - Implementation of boolean expressions using AND, OR, INVERT Logic gates & Universal gates.

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

UNIT IV : SEQUENTIAL LOGIC

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

UNIT V : DIGITAL INTEGRATED CIRCUITS

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEP 305 ELECTRICAL MACHINES LAB

AIM

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

OBJECTIVES

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

PEEEP 306 MEASUREMENTS AND INSTRUMENTS LAB

AIM

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

OBJECTIVES

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

PEEEC 401 ELECTRICAL MACHINE DESIGN

AIM

The subject enables the students to gain a indepth knowledge about the design of electrical machines.

OBJECTIVES

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

(i) Detailed design of electrical machines

(ii) Limitations and restrictions imposed by the cost, economy, requirements and performance characteristics.

UNIT I INTRODUCTION

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

UNIT II DC MACHINE DESIGN

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

UNIT III TRANSFORMER DESIGN

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

UNIT IV INDUCTION MOTOR DESIGN

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

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

UNIT V SYNCRONOUS MACHINE DESIGN

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 402 CONTROL SYSTEMS

AIM

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

OBJECTIVES

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

i) Modeling of translational and rotational system, block diagram reduction techniques and signal flow graph for obtaining transfer function.

ii) Transient analysis of various standard inputs for first order and second order system.

iii) Frequency response analysis and frequency domine specification by bode plot and pola plot.

iv) Stability analysis by Routn hurwitz criterion and Nyguist stability criterion.

v) Analysis of sampled data control system using Z transform.

vi) State space analysis (writing state equation for physical, phase, canonical variables.)

vii) Concept of controllability and observability.

UNIT I SYSTEM MODELLING

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

UNIT II TIME DOMAIN ANALYSIS

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

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

UNIT III FREQUENCY DOMAIN ANALYSIS

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

UNIT IV STATE SPACE ANALYSIS

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

UNIT V OPTIMAL AND ADAPTIVE CONTROL

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

TEXT BOOK

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

REFERENCE BOOKS

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

PEEEC 403 POWER ELECTRONICS

AIM

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

OBJECTIVES

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

UNIT I POWER SEMICONDUCTOR DEVICES

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

UNIT II AC TO DC CONVERTERS

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

UNIT III AC TO AC CONVERTERS

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

UNIT IV DC TO DC CONVERTER

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

UNIT V DC TO AC CONVERTERS

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 404 TRANSMISSION AND DISTRIBUTION

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION

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

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

UNIT II DISTRIBUTION SYSTEMS

Feeders, distributors and service mains : D.C. distributors - Singly fed and doubly fed two wire and three wire systems, with concentrated and uniformly distributed loads. A.C. distributor - Single phase and three phase

- Division of load between lines in parallel.

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

UNIT III PERFORMANCE OF TRANSMISSION LINES

Characteristics and performance of transmission lines : Representation of lines - Short lines - Medium length lines - Solution by nominal T and π methods - Calculation of sending and receiving end voltages and current - Regulation and efficiency of a

transmission line - Long transmission line - Hyperbolic form of equations for long lines - ABCD constants - Ferranti effect - Tuned power lines - Equivalent circuit of a long line.

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

UNIT IV MECHANICAL CHARACTERISTICS

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

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

UNIT V INSULATORS

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

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

TEXT BOOK

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

REFERENCE BOOKS

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

PEEEP 405 ELECTRONIS LAB

AIM

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

OBJECTIVES

To motivate the students in the field of developing electronics Component.

PEEEP 406 CONTROL SYSTEMS LAB

AIM

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

OBJECTIVES

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

PEEEC 501 POWER PLANT ENGINEERING

AIM

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

OBJECTIVES

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

(i) Conventional & non - conventional Sources of energy for power generation

(ii) Principle and operation of hydro, thermal and Nuclear power plants. Also to impart a knowledge in deciding of location, type and capacity of power plants at the economic point of view.

UNIT I INTRODUCTION

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

UNIT II HYDRO - ELECTRIC PLANT

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

UNIT III STEAM POWER PLANT

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

UNIT IV NUCLEAR POWER PLANT

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

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

UNIT V POWER PLANT ECONOMICS

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 502 - INDUSTRIAL CONTROL AND AUTOMATION

UNIT I PROCESS MODELLING

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

UNIT II CONTROLLERS

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

UNIT III DIGITAL CONTROL STRATEGIES

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

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS

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

UNIT V DISTRIBUTED CONTROL SYSTEMS

Evolution of DCS - Factors to be considered in selecting a DCS – Typical architecture - local control unit (LCU) and architecture - LCU languages - LCU - process inte7rfacing issues - communication system requirements - architectural issues - protocol issues - communication media - message security - communication system standards - field bus, HART. Operation interface - requirements - display -alarms and alarm management - engineering interface– requirements - Comparison of DCS with direct digital control and supervisory control

TEXT BOOKS

1. **George Stephanopoulos,** "Chemical Process Control, An introduction to the theory and Practice", Prentice Hall International Inc.,2001

2. **Gopal.M**, "Digital control and state variable methods" TMH -2002

3. **Michal P Lucas**., "Distributed Control Systems" Van Noster and Reinhold Co.,.1986

REFERENCE BOOKS

1. Donald R Coughanowr, " Process System and Conttrol, Second Edition" , McGraw Hill 2006.

2.. **F.D Petruzella.,** "Programmable Logic Controllers" McGraw Hill 2006.

3. **Thomas Hughes**, "Programmable Controller" Instrument Society of America, 1992.

PEEEC 503 SOLID STATE DRIVES

AIM

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

OBJECTIVES

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

UNIT I: INTRODUCTION

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

UNIT II PHASE CONTROLLED DC DRIVES

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

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

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

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

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

UNIT V: SYNCHRONOUS MOTOR AND SPECIAL MACHINE DRIVES

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 504 - EMBEDDED SYSTEMS

UNIT I INTRODUCTION

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

UNIT II 8051 ARCHITECTURE

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

UNIT III PIC MICROCONTROLLER

PIC 16C74A Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly – I/O port, Data Conversion, RAM & ROM Allocation, Timers – Interrupts, I/O Ports- I^2C bus-A/D converter-UART– Flash and EEPROM memories.

UNIT IV ARM ARCHITECTURE AND PROGRAMMING

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

UNIT V OPERATING SYSTEM OVERVIEW

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

PEEEC 505 POWER SYSTEM ANALYSIS

AIM

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

OBJECTIVES

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

(i) Symmetrical components, sequence networks, phase shift in various transformer connections.

(ii) Graph theory, and optimal ordering techniques

(iii) Various methods in load flow analysis and short circuit studies.

UNIT I INTRODUCTION

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

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

UNIT II BUS IMPEDANCE AND ADMITTANCE MATRIX

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

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

UNIT III POWER FLOW ANALYSIS

Sparsity - Different methods of storing sparse matrices - Triangular factorization of a sparse matrix and solution using the factors - Optimal ordering - Three typical schemes for optimal ordering - Implementation of the second method of Tinney and Walker. Power flow analysis - Bus classification - Development of power flow model - Power flow problem - Solution using Gauss Seidel method and Newton Raphson method - Application of sparsity based programming in Newton Raphson method - Comparison of both methods - Fast decoupled load flow.

UNIT IV FAULT ANALYSIS

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

UNIT V : SHORT CIRCUIT STUDIES

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

TEXT BOOKS

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

REFERENCE BOOKS

1. **Wadhwa. C.L.** "Electric Power Systems" Wiley Eastern; 2007.
2. **Stagg and El-Abiad** "Computer Methods in Power System Analysis" Mc Graw- Hill International; 1968.
3. **Stevenson W.D. "**Element of Power System Analysis" Mc Graw-Hill; 1975.
4. **Ashfaq Husain** "Electrical Power Systems" CBS Publishers & Distributors; 1992.
5. **Gupta. B.R.** "Power System Analysis and Design , Third edition ", A. H. Wheeler and Co Ltd.. New Delhi 1998

PEEEC 601 COMMUNICATION ENGINEERING

AIM

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

OBJECTIVES

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

UNIT I MODULATION

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

UNIT II ANGLE MODULATION

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

UNIT III PULSE MODULATION

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

UNIT IV PCM SYSTEMS

Quantization - Compounding - Pulse code modulation - Sampling and digitizing - Aliasing - Sample and hold circuit - Practical implementation of sampling and digitizing - Equalization - Multiplexing - FDM and TDM - Data communications - Transmission

lines and digital signals - Frequency component of pulse wave forms - Practical line interface circuits, capabilities Serial synchronous, asynchronous communication protocol - Hardware USARTS - INTEL 8251A - Software USART.

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

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

TEXT BOOKS

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

REFERENCE BOOK

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

PEEEC 602 PROTECTION SWITCHGEAR AND UTILISATION

AIM

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

OBJECTIVES

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

UNIT I: PROTECTIVE RELAYS

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

UNIT II: CIRCUIT BREAKERS

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

UNIT III: PROTECTION

Feeder protection - distance protection - alternator protection - short circuit protection of stator windings by percentage differential relays - protection against turn to turn faults in stator winding - field ground fault protection - protection of stator windings by overvoltage relays - protection against stator open circuits- loss of synchronism - loss of excitation - rotor overheating - protection of transformers – Digital Protection Schemes.

UNIT IV: ILLUMINATION

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

UNIT V: ELECTRIC HEATING AND WELDING

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEC 603 COMPUTER AIDED POWER SYSTEM ANALYSIS

AIM

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

OBJECTIVES

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

i) Economic load dispatch of power systems.

ii) Load frequency control.

iii) Steady state and transient stability of power systems.

iv) Power system reliability

V) State estimation and security analysis.

UNIT I ECONOMIC LOAD DISPATCH

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

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

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

UNIT II POWER SYSTEM STABILITY

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

UNIT III MULTI MACHINE STABILITY

Formation of multimachine transient stablility problem - Swing equation - solution techniques, flow charts and algorithms for direct method and alternate cycle method using modified Euler, Fourth order Runge Kutta and trapezoidal rule numerical procedures. Concept of coherency and coherent groups.

UNIT IV POWER SYSTEM RELIABILITY

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

UNIT V STATE ESTIMATION AND SECURITY ANALYSIS

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEE 604 HIGH VOLTAGE TRANSMISSION SYSTEM

AIM

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

OBJECTIVES

At the end of the course students would have an exposure about: The need to have high voltage transmission systems, Calculation of various line parameters, Predetermination of the line performance using mathematical techniques. Features of DC transmission systems. Problems faced with high voltage transmission through EHV cables and protection of EHV systems.

UNIT I INTRODUCTION

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

UNIT II CORONA

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

UNIT III EHVAC TRANSMISSION

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

UNIT IV DC TRANSMISSION

Review of rectification and inversion process -Constant current and constant extinction angle modes of operations - Analysis of DC transmission systems -Harmonics on AC and DC sides and filters for their suppression - Multiterminal DC transmission systems -Parallel operation of AC and DC transmission - Modern developments in HVDC transmission/Introduction to FACTS.

UNIT V OVERVOLTAGE IN EHV SYSTEMS

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEP 605 EMBEDED SYSTEMS LAB

AIM

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

OBJECTIVES

To develop the knowledge in the field of to study various equipments used in electrical engineering.

PEEEP 606 POWER ELECTRONICS AND DRIVES LAB

AIM

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

OBJECTIVES

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

PEEEC 701 QUANTITIVE MANAGEMENT TECHNIQUES

AIM

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

OBJECTIVE

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

UNIT I: INTRODUCTION

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

- Various approaches – Limitation of CVP analysis.

UNIT II: PROBABILITY ANALYSIS

Decision making: Analysis for decision making - Cautions about use of decision making under uncertain future conditions - Review of probability techniques and applications - Calculation of conditional and expected profits

- Expected value with perfect information -Use of marginal analysis - Utility as a decision criterion. Probability distributions -Normal distribution and cost, volume, profit analysis - Unit monetary values with probability distribution - Decision tree analysis.

UNIT III: INVENTORY AND PRODUCTION MODELS

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

UNIT IV: LINEAR PROGRAMMING

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

UNIT V: CPM - PERT ANALYSIS

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

TEXT BOOK

1**. Levin and Kirkpatrik "**Quantitative Approaches to Management", Mcgraw Hill Int.St.Ed., 2002.

REFERENCE BOOKS

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

PEEEE 702 SOFT COMPUTING TECHNIQUES

AIM

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

OBJECTIVES

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

i) Basic reaction of Fuzzy set theory, neural networks.

ii) Applications of back propagation neural nets, and hop field neural nets etc.

iii) Knowledge about Neuro controllers and Fuzzy logic controllers and its their applications.

UNIT I: ARTIFICIAL NEURAL NETWORKS

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

UNIT II: NEURAL NETWORK ARCHITECTURE AND ALGORITHMS

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

UNIT III: FUZZY LOGIC

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

UNIT IV: FUZZY LOGIC CONTROLLER

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

UNIT V: GENETIC ALGORITHM

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEE 703 BIO MEDICAL ELECTRONICS AND INSTRUMENTATION

AIM

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

OBJECTIVES

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

(i) Electro physiology

(ii) Instrumentation

(iii) Bio - electrical potential and cardiovascular measurements

(iv) Respiratory and pulmonary measurements

(v) Recent trends in Bio medical instrumentation

UNIT I: ELECTROPHYSIOLOGY

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

UNIT II: INSTRUMENTATION

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

UNIT III: BIOELECTRIC POTENTIAL AND CARDIOVASCULAR MEASUREMENTS

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

UNIT IV: RESPIRATORY AND PULMONARY MEASUREMENTS AND REHABILITATION

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

UNIT V: RECENT TRENDS

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEE 704 STATIC RELAYS

AIM

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

OBJECTIVES

To impart knowledge on the following topics

i) Basics of Static relays

ii) Comparators

(iii) Over current, differential, pilot wire relays and applications.

UNIT I COMPARATORS

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

UNIT II RELAYS

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

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

Static frequency relays – Under frequency and over frequency relays.

UNIT III DIFFERENTIAL RELAYS

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

UNIT IV PROTECTION SCHEMES

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

UNIT V POWER SYSTEM APPARATUS PROTECTION

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

TEXT BOOKS

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

REFERENCE BOOKS

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

PEEEV 705 PROJECT WORK AND VIVA-VOCE

AIM

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

OBJECTIVES

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