

BEG1003 BASIC ELECTRICAL ENGINEERING (3-1-0)

OBJECTIVES

This is a foundation course to understand basic principles underlying the behaviour of "Electric circuits, Electric Power apparatus, generation, transmission, distribution and utilization of electric energy.

MODULE – I (12 hours)

I.DC Networks:

Kirchhoff's laws, node and mesh analysis,

Delta-star and star-delta transformations.

Superposition, Thevenin and Norton's theorem.

Transients, in R-L, R-C and R-L-C circuits with DC. Excitation. *(6 Lectures)*

II.Single Phase AC Circuits:

Single phase EMF generation, average and effective values of sinusoids, j operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits.

Introduction to resonance in series RLC circuit. *(6 Lectures)*

MODULE – II (9 Hours)

III. Three Phase AC Circuit:

Three phase EMF generation, delta and star connection,

Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits. *(5 Lectures)*

IV.Magnetic Circuits:

B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses. *(4 Lectures)*

MODULE – III (12 Lectures)

V. DC Machines:

D.C Generator: Different types, Principle of Operation of D.C. generator EMF equation, methods of excitation.

D.C. Motor, Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power.

Speed control of D.C. shunt motor. *(5 Lectures)*

VI.Transformers:

Construction and Principle of operation of single phase transformer,

EMF equation,

Single phase autotransformer. *(3 Lectures)*

VII Three phase Induction Motor:

Construction and principle of operation, types;

Slip-torque characteristics. *(3 Lectures)*

VIII, Introduction to single-phase induction Motor. *(1 Lecture)*

MODULE – IV(7 hours)

IX. Electrical Measuring Instruments:

DC PMMC instruments

Extension of range by shunts and multipliers.

Moving iron ammeters and voltmeters,

Dynamometer type Watt meters,

Induction type Energy Meter.

(4 Lectures)

X. Power supply systems:

Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy.

(2 Lectures)

XI. Introduction to Electric Heating & Welding

(1 Lecture)

TEXT BOOKS AND REFERENCES

1. Edward Hughes (revised by Ian McKenzie Smith). "Electrical & Electronics Technology" Pearson Education Limited. Indian Reprint 2002.

Chapters 3,4,7,10, 11,12,13,14,34,35,39,41,47

2. H. Cotton "Advanced Electrical Technology" CBS Publishers, New Delhi, 7th Edition. Reprint-1999.

3. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 1st Edition revised 2006.

4. S. Parker Smith: "Problems in Electrical Engineering" Asia Publications,

5. J. J. Cathey, "Schaum's Outline of Basic Electrical Engineering" McGraw-Hill Professional, 3rd Semester B.Tech

NETWORK THEORY (3-1-0)

MODULE - I (12 Hours)

Coupled Circuits: Self-inductance and Mutual inductance – Coefficient of coupling – dot convention – Ideal Transformer – Analysis of multi-winding coupled circuits – Analysis of single tuned and double tuned coupled circuits.

Transient study in RL, RC, and RLC networks by Laplace transform method with DC and AC excitation. Response to step, impulse and ramp inputs.

Two Port networks : Two port parameters – short circuit admittance parameter – open circuit impedance parameters – Transmission parameters – Image parameters and Hybrid parameters. Ideal two port devices – ideal transformer. Tee and Pie circuit representation, Cascade and Parallel Connections.

MODULE - II (10 Hours)

Network Functions & Responses :

Concept of complex frequency, driving point and transfer functions for one port and two port network, poles & zeros of network functions, Restriction on Pole and Zero locations of network function. Impulse response and complete response.

Time domain behaviour from pole-zero plot.

Three Phase Circuits

Analysis of unbalanced loads – Neutral shift – Symmetrical components – Analysis of unbalanced system – power in terms of symmetrical components

MODULE - III (10 Hours)

Network Synthesis: Realizability concept – Hurwitz property – positive realness – properties of positive real functions – Synthesis of R-L, R-C and L-C driving point functions – Foster and Cauer forms

MODULE - IV (8 Hours)

Graph theory: Introduction – Linear graph of a network – Tie-set and cut-set schedule – incidence matrix – Analysis of resistive network using cut-set and tie-set – Dual of a network.

Filters: Classification of filters – Characteristics of ideal filters **TEXT BOOKS**

1. Network Analysis : Mac.E Van Valkenburg

2. Network Analysis & Synthesis : Franklin Fa-Kun. Kuo, John Wiley & Sons Second Edition

REFERENCE BOOKS

1. A Course in Electrical Circuits and Analysis : M. L. Soni, J. C. Gupta

2. Network Synthesis : Mac. E. Van Valkenburg

3. Networks and Systems: D. Roy Choudhary

4. SCHAUM'S OUTLINE OF THEORY AND PROBLEMS OF ELECTRIC

CIRCUITS (SCHAUM'S OUTLINE SERIES) BY MAHMOOD NAHVI, JOSEPH

EDMINISTER, JOSEPH A. EDMINISTER, 4TH EDITION MGH

SIGNALS & SYSTEMS(3:0:0)

MODULE-I (10 Hours)

Introduction of Signals

Classification of Signals, General Signal Characteristics, Signal energy & Power

Continuous-Time Signals , Discrete-Time Signals

Basic System Properties, Systems with and without memory, Invertibility, causality, Stability, Time invariance, Linearity

Linear Time Invariant (LTI) Systems

Discrete Time LTI Systems, Convolution Representation of Linear Time-Invariant Discrete-Time Systems

Convolution of Discrete-Time Signals Convolution Representation of Linear Time-Invariant Continuous-Time Systems Convolution of Continuous-Time Signals, Properties of LTI Systems, Casual systems

MODULE-II(10 Hours)

Fourier Representations for Signals

Representation of Discrete Time Periodic signals, Continuous Time Periodic Signals, Discrete Time Non Periodic Signals, Continuous Time Non-Periodic Signals, Properties of Fourier Representations,

Frequency Response of LTI Systems, Fourier Transform representation for Periodic and discrete time Signals, Sampling, reconstruction, Discrete Time Processing of Continuous Time Signals, Fourier Series representation for finite duration Nonperiodic signals.

MODULE-III(8 Hours)

Modulation Types and Benefits, Full Amplitude Modulation, Pulse Amplitude Modulation, Multiplexing, Phase and Group delays

Representation of Signals using Continuous time Complex Exponentials: The Laplace Transform, The Unilateral Laplace Transform, its inversion, The Bilateral Laplace Transform, Transform Analysis of Systems

MODULE-IV(8 Hours)

Representation of Signals using Discrete time Complex Exponentials: The Z-Transform
Properties of Region of convergence, Inverse Z-Transform, Transform Analysis of LTI Systems,
The Unilateral Z-Transform

1.1.1 TEXT BOOKS

1. Signals and Systems by Simon Haykin and Barry Van Veen, 2nd Edition John Wiley & Sons.
2. Signals and Systems by Alan V. Oppenheim, Alan S. Willsky, with S. Hamid, S. Hamid Nawab (2nd Edition), Prentice Hall Inc.

Reference books:

1. Schaum's Outline of Signals and Systems, by Hwei Hsu, MGH
2. Fundamentals of Signals & systems using Web and MATLAB by EDWARD W. KAMEN AND BONNIE S. HECK, (2nd Edition), Prentice Hall Inc.

ELECTRICAL MACHINES – I(3:1:0)

Module I(11 Hours)

D.C Machines: Generation of D.C – Action of Commutator – constructional details of D.C machine – magnetic circuit of D.C machines – D.C Armature windings – Induced emf – emf equation – torque developed in a D.C machine – generator and motor action – back emf – Armature mmf – magnitude and direction – Air-gap flux distribution curve on load – effect of saturation – Demagnetising and cross – magnetising armature mmf – variation with brush position – compensating winding – Commutation – time of commutation – emf in coil undergoing commutation – reactance emf – effect of brush shift – inter-poles.

D.C Generator: Types of excitation – separately excited – self excited shunt, series and compound machines. OCC – Condition for self excitation – field critical resistance – critical speed –

Module II(11 Hours)

Load characteristics of DC generators – Load critical resistance – parallel operation of shunt, series and compound generators – equalizer connection – Losses – power flow diagram – efficiency - condition for maximum efficiency – applications – special machines – welding generator – Boosters.

D.C Motors: Performance characteristics of shunt, series and compound wound motors – starting – 3-point and 4-point starters – Calculation of resistance elements for shunt motor starters – methods of speed control of shunt, series and compound wound motors – effect of an open field circuit – power flow diagram – efficiency – testing D.C machine – Swineburne's test – Hopkinson's test – Field's test – Retardation test.

Module III(11 Hours)

Transformers: Single phase transformer – Constructional details – Core – windings – Insulation – principle of operation – Inrush of switching currents – emf equation – magnetising current and core losses – no-load and load operation – Phasor diagram – equivalent circuit – losses and efficiency – condition for maximum efficiency – voltage regulation – approximate expression for

voltage regulation – harmonics in single phase transformers - Magnetising current wave form – OC and SC tests – Sumpner's test.

Module IV(10 Hours)

Three phase Transformer: Constructional features of three phase transformers – three phase connection of single phase transformers – oscillating neutral – tertiary winding –three winding transformer– Scott connection – open delta connection – three phase to six phase connection – equal and unequal turns ratio – load sharing – distribution transformers – all day efficiency. Autotransformers – saving of copper – applications - tap-changing transformers - cooling of transformers.

References

1. The performance and Design of Direct Current Machines: A. E. Clayton and N. N Hannock
2. The performance and design of AC Machines: M.G. Say, CBS Publishers
3. Theory of Alternating Current Machinery: Alexander S. Langsdorf, TMH
4. Theory and problems of Electrical Machines (TMH Outline Series), J.Nagrath & D.P.Kothari

ELECTRICAL MACHINES (3-1-0)

(All Branches except Electrical Engg)

Module I (10 Lectures)

D.C Mechanics :

D.C Generator – construction and principle of operation, E.M.F. equation ; types of generator; no load and load characteristics; Voltage build-up of shunt Generator; voltage regulation, Application.

D.C Motor –construction and principle of operation ; back E.M.F; torque and speed equations; characteristics and performance curves; speed control of series and shunt motors; motor starters; industrial application.

Losses and Efficiency of D.C machines.

Module II (10 Lectures)

Transformer:

Single phase – construction and principle of operation; E.M.F. equation; Phasor diagram; actual and approximate equivalent circuits; open and short circuit tests, voltage regulation; losses and efficiency.

Three Phase – Construction and principle of operation; connection of three single –phase units in wye, delta, open delta configurations; Autotransformer; conventional transformer connected as Autotransformer. Special Transformers – induction heating and high impedance and high frequency transformer.

Module III (10 Lectures)

Synchronous Machines :

Three- phase alternators – construction and principle of operation; E.M.F. equation; distribution and pitch factors; Synchronous reactance; performance of alternators on no-load and load; Phasor diagram; voltage regulation, power calculations of turbine and hydro-generators,; synchronization of a generator.

Three-Phase Synchronous Motor- construction and principle operation; V- curves; Phasor diagram; methods of starting; applications.

Module IV (10 Lectures)

Three-Phase induction Motor- construction of slip ring and squirrel cage type induction motors; Phasor diagram and equivalent circuit; torque-slip characteristics; maximum torque calculations; open and short-circuit tests; losses and efficiency; starting of induction motors; speed control; Induction generator.

Single-Phase Induction Motor- construction and principle of operation; capacitor- start and capacitor-run motors; Universal motor; Stepper motors.

Books :

- 1.Theory and problems of Electrical Machines (TMH Outline Series), J.Nagrath & D.P.Kothari
- 2.Fundamental of Electric Machines by B.R. Gupta and Vandana Singhal

3rd /4th semester B.Tech.

Basic Electrical Engineering LAB (0-0-3)
(Common to all branches of Engineering)

Preliminary:

- (i) Preparation of symbol chart for various systems & components as per ISS
 - (ii) To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat
 - (iii) Study of safety rules as per ISS
1. (a) Measurement of the armature & field resistance of D.C. Machine by volt-amp method.
(b) Starting and speed control of a D.C.shunt motor
 2. (a) Voltage – current characteristics of incandescent lamp
(b) Connection & measurement of power & power factor of Fluorescent lamp.
 3. Determination of open circuit characteristics(O.C,C) of D.C shunt generator when separately excited at different speeds.
 4. Measurement of inductance of a choke coil with & without air gap.
 5. Measurement of Power and Power factor of a 3-phase balanced and un-balanced load fed from a balanced source using 2-wattmeter method.
 6. Callibration of a single phase Energy Meter by directed loading

4th Semester Electrical Engg

ELECTRICAL MACHINES LAB - I (0-0-3)

1. O.C and S.C test on single phase transformer and prediction of performance parameters
2. Parallel operation of two single phase transformer and load sharing
3. Back –to-back test of Single phase transformer
4. Load characteristics of DC shunt/compound generator
5. Load characteristics of DC series Motor
- 6.Determination of efficiency of DC shunt machine by Swinburne test and brake test.

5th Semester (Electrical Engg) New-2008

CONTROL SYSTEM ENGINEERING-I (3-1-0)

Module - I (10 hours)

Introduction : Scope of control system Engineering, Various Classification of Control System, Closed Loop Control Versus Open Loop Control.

Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula.

Feed back Characteristics : Types of feedbacks, effect of degenerative feedback on control system, regenerative feedback.

Module – II (10 hours)

Time domain analysis: Standard test signals: Time response of 1st. order systems to unit step and unit ramp inputs. Time response of second order systems to unit step input. Time response specifications. Steady state errors and error constants of different types of control systems Generalised error series method. Application of MATLAB and its Tool Box for time response analysis.

Concepts of stability : Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feed back systems, Relative stability Analysis.

Module – III (10 hours)

Root locus techniques: Root locus concepts, rules for construction of root loci, determination of roots from root locus, root contours. systems with transportation lag, Root locus plots with MATLAB.

Frequency domain analysis: Introduction, Bode plots, determination of stability from Bode plots, polar plots, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems, Log magnitude versus phase plots, Use of MATLAB for plotting Bode & Nyquist diagram.

Module – IV (10 hours)

Closed loop frequency response: Constant M circles, constant N circles, use of Nichol's chart

Controllers: Introduction, Proportional, derivative and integral control actions, PD, PI and PID controllers and their applications to feedback control systems, Zeigler- Nichols method of tuning PID controllers for known dynamic model of the plant.

Components : A.C. Servo motor, DC servo motor, AC tacho meter, synchros, amplidyne, stepper motor, Liquid Level System, Hydraulics System, Pneumatic System meter, Application of Control. Theory in Non-Engineering Fields.

Reference Books :

- 1.. Modern Control Engineering by K. Ogata, 4th Edition, PHI
- 2 Control Systems Engineering by I.J. Nagrath, M. Gopal, 4th Edition, New Age International Publishers.

3. Feedback and Control Systems, by J.J. Distefano, III, A.R. Stubberud, I.J. Williams, 2nd Edition, TMH,
Schaum's Outlines
4. Feedback Control of Dynamic Systems, G.F. Franklin, J.D. Powell, A.. Emami, Naeini, 4th Edition, Pearson Education.
5. Automatic Control Systems, 8th Edition, B.C. Kuo and F. Golnaraghi, John Wiley & Sons.

ELECTRICAL MACHINE- II (3-1-0)

Module – I (10 hours)

Fundamental Principles of A.C. Machines: E.M.F. equation of an elementary alternator:- Single & three Phase, relation between speed & frequency, factors affecting the induced e.m.f., full pitch & fractional pitch windings, winding factors, armature reaction, the rotating field leakage reactance. Concept of time phasor & space phasor.

Synchronous Generator: Various types & construction, cylindrical rotor theory:- phasor diagram, open circuit & short circuit characteristics, armature reaction reactance, synchronous reactance, SCR, load characteristics, potier reactance, voltage regulation: .EMF method, MMF method, modified MMF method, power angle characteristics, ZPF method.

Module – II (10 hours)

Theory of salient pole machine: Blondel's two reaction theory, phasor diagram, direct axis and quadrature axis synchronous reactances, power angle characteristics, Slip Test.

Parallel operation: Synchronising method, effect of wrong synchronising, load sharing between alternators in parallel.

Sudden Short Circuit of a Synchronous Generator, Transient and Sub-transient reactances.

Synchronous Motor: General Physical consideration, torque and power relations in non-salient pole and salient pole motors, V-curves & inverted V-curves, Effect of change of excitation, synchronous conductor, starting of Synchronous Motor, performance characteristics, of synchronous motor. Hunting.

Synchronous Induction motor.

Module – III (12 hours)

Three Phase Induction Motors: Review of Types, Construction and principle of operation, 3 phase Induction Motor, general phasor diagram, equivalent circuit, power and torque relations, condenser for maximum torque, circle diagram, Performance characteristics, effect of rotor resistance on speed torque characteristics, stable & unstable region of operation, Operation with unbalanced supply voltage.

Starting: Starting of 3 phase induction motors, high starting torque motors, speed control, rheostatic method, pole changing method cascade control of speed, Double cage induction motor.

Module – IV (8 hours)

Cogging and Crawling of Induction motor, induction generator.

The single phase induction motor, theory of operation (Double revolving field theory, equivalent circuit, Determination of parameters) Methods of starting, split phase starting, Repulsion starting, shaded pole starting, performance characteristics. The single phase series motor. Theory of operation performance and application.

Reference books :

1. Theory and Performance of AC Machines - (M.G. Say), CBS Publishers.
2. Theory of Alternating Current Machinery, A.S.Langsdorf, TMH Edition.
3. The Performance & Design of A.C. Commutator motors including the single phase induction Motor by E.Openshaw Taylor, Wheeler Publishing, New Delhi.
4. Electrical Machinery & Transformer, I.L.Kosow, 2nd Edition, PHI

MICROPROCESSOR & MICRO CONTROLLER (3-1-0)

Module - I (12 hours)

Microprocessor Architecture: Introduction to Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution.

Instruction Set and Assembly Language Programming of 8085:- Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 Instruction Set, Use of Stack & Subroutines, Data transfer techniques, 8085 interrupts

Module – II (08 hours)

Interfacing & support chips:- Interfacing EPROM & RAM Memories, 2716, 2764, 6116 & 6264, Interfacing of ADC & DAC, Data Acquisition System.

Microprocessor Based System Development Aids, Programmable Peripheral Interface: 8255, Programmable DMA Controller: 8257, Programmable Interrupt Controller: 8259

Module – III (08 hours)

Advanced Microprocessor: Basic features of Advance Microprocessors, Intel 8086 (16 bit processors):- 8086 Architecture, Register organization, signal descriptions, Physical Memory Organization, Addressing Modes, Instruction Formats, Instructions Sets & Simple ALPs, 8086 Interrupts.

Module – IV (12 hours)

Microcontroller:- Introduction for Microcontrollers, Microcontrollers & Microprocessors, Embedded verses External Memory devices, CISC & RISC Processors, Harvard & Von Neumann Architectures, 8051 Microcontrollers. MCS-51 Architecture, Registers, Stack Pointer & Program Counter. 8051 Pin Description, Connections, Parallel I/O ports, Memory Organization, 8051 Addressing Modes & Instructions, 8051 Assembly Language Programming Tools.

TEXT BOOKS

1. Introduction to Microprocessor for Scientists & Engineers by Ghosh & Sridhar, PHI publication
2. Fundamentals of Microprocessor & Microcontroller by B.RAM, Dhanpat Rai Publications.
3. Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing) by A.K.Roy & K.M.Bhurchandi- TMH Publication
4. Microcontrollers [theory and applications] TMH publication by Ajay V. Deshmukh. (Chap – 1-5)

ELECTRICAL MEASUREMENTS & INSTRUMENTATION(3-0-0)

Module – I (12 hours)

Measuring Instruments : Classification, Absolute and secondary instruments, indicating instruments, control, balancing and damping, constructional details, characteristics, errors in measurement

Ammeters, voltmeters: (DC/AC) PMMC, MI, Electrodynamometer type

Wattmeters : Electrodynamometer type, induction type, single phase and three phase wattmeter, compensation.

Energymeters : AC. Induction type single phase and three phase energy meter, compensation,... creep, error, testing

Frequency Meters : Vibrating reed type, electrical resonance type

Module – II (10 Hours)

Instrument Transformers : Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors; testing and applications .

Galvanometers : General principle and performance equations of D' Arsonval Galvanometers, Vibration Galvanometer and Ballistic Galvanometer.

Potentiometers : D.C. Potentiometer-Crompton potentiometer, construction, standardization, application. AC. Potentiometer-Drysdale polar potentiometer; standardization, application.

Module –III (9 Hours)

DC/AC Bridges :General equations for bridge balance, measurement of self inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schering bridge, errors, Wagner's earthing device, Kelvin's double bridge.

Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Piezo-Electric transducers, Optical Transducer, Torque meters, inductive torque transducers, electric tachometers, photo-electric tachometers, Hall Effect Transducer

Module –IV (9 Hours)

Electronics Instruments

CRO: Block diagram, Sweep generation, vertical amplifiers, use of CRG in measurement of frequency, phase, Amplitude and rise time of a pulse.

Digital Multi-meter : Block diagram, principle of operation, Accuracy of measurement.

Electronic Voltmeter : Transistor Voltmeter, Block diagram, principle of operation, various types of electronic voltmeter

Digital Frequency meter: Block diagram, principle of operation

Reference Books:

- 1) A Course in Elec. & Electronics Measurements & Instrumentation: A K. Sawhney
- 2) Modern Electronic Instrumentation and Measurement Techniques: Helfrick & Cooper
- 3) Electronic Measurement & Instrumentation Systems: Larry Jones & A Foster Chin
- 4) Electrical Measurement and Measuring Instruments - Golding & Waddis

POWER STATION ENGINEERING (3-0-0)

Module -I (10 hours)

Introduction to different sources of energy and general discussion on their application to generation.

Hydel Power

Hydrology:- Catchments area of a reservoir and estimation of amount of water collected due to annual rainfall, flow curve and flow duration curve of a river and estimation of amount stored in a reservoir formed by a dam across the river, elementary idea about Earthen and Concrete dam, Turbines: - Operational principle of Kaplan, Francis and Pelton wheel, specific speed, work done and efficiency.

Hydro plant: - head gate, penstock, surge tank, scroll case, draft tube and tail race, classification of plants, turbines different heads, plant capacity as a base load and peak load station, power plant auxiliaries.

Module – II (10 hours)

Thermal Power.

Overall plant components in Block diagrams indicating the air circuit, coal and ash circuit, water and steam circuit, cooling water circuit; various types of steam turbines, ash and coal handling system, water tube boiler, fire tube boiler, super heater, economizer, air preheater, dust collection, draft fans and chimney; condensers, feed water heaters, evaporate and make-up water, bleeding of steam; cooling water system; Governors, plant layout and station auxiliaries.

Module – III (09 hours)

Nuclear Power: Introduction to fission & fusion, reactor construction, controlled chain reaction, operational control of reactors, Brief study of various types of reactors (Boiling water, pressurized water, sodium graphite, breeder) layout of nuclear power plant.

Electrical System: Different types of alternators, methods of cooling

Excitation system: - Shaft mounted D.C. Generator, elements of static and brush less excitation, field flashing.

AVR: - magnetic amplifier and thyristor converter type/DVR.

Main transformer, unit transformer and station reserve transformer, commissioning tests of alternators and transformers.

Module – IV (07 hours): Choice of size and number of generating units:- Review of the terms maximum demand, load factor, diversity factor, plant capacity and use factor, load & load duration curve and their effect on the generating capacity. Reserve units (hot, cold and spinning- reserve), Effect of power-factor on the generating capacity and economy. Different types of power tariffs. Brief idea about national grid and its operational problems.

Ref. Books:

1. Electrical power by J.B.Gupta

2. Power station engg.& economy by SKrotizki & Vopat(Tata M.H)

PRACTICALS

CONTROL SYSTEM LAB. (0-0-3)

CONTROL: (Any five)

1. Study of a two-phase AC servomotor and its transfer function parameters.
2. Find the frequency response of a Lag and Lead compensator.
3. To observe the time response of a second order process with P, P+I, P+I+D control and apply PID control to a DC servomotor.
4. To study the characteristic of a relay and analyze the relay control system (Phase Plane).
5. Study of a linear system simulator
6. Study of feedback characteristic using Amplidyne
7. To study digital control of a simulated system using an 8 bit microprocessor

INSTRUMENTATION LAB. (0-0-3)

INSTRUMENTATION: (Any five)

1. Measurements of unknown resistance, inductance, and capacitance using Bridges.
2. To plot the displacement –voltage characteristics of the given LVDT.
3. Study of a Data Acquisition System
4. Study of Synchro-transmitter & synchro-transformer
5. Speed measurement of DC Motor by none-contact type transducer
6. Calibration of DC Milli-Ammeter by a DC Potentiometer
7. Measurement of IR, earth Resistance and determination of cable fault.

MICROPROCESSOR & MICROCONTROLLER LAB. (0-0-3)

A) 8085 (2 hours)

1. Addition, Subtraction, Multiplication, Division of two 8 bit numbers resulting 8/16 bit numbers.
2. Smallest /Largest number among 'n' number in a given data array + Binary to Gray Code
/ Hexadecimal to decimal conversion.

B) INTERFACING (5 hours)

COMPULSORY

1. Generate square waves of different frequencies on all lines of 8255 by the help of delay program.
2. Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds)

OPTIONAL (Any Two)

1. Study of Traffic Light controller
2. Generation of Square, triangular and saw tooth wave using Digital to Analog Converter
3. Study of 8253 and its operation (Mode 0, Mode 2, Mode 3)
4. Study of Mode 0, Mode 1, BSR Mode operation of 8255.
5. Study of 8279 (keyboard & Display interface)
6. Study of 8259 Programmable Interrupt controller.

C) 8051 MICROCONTROLLER (3 hours)

COMPULSORY

Initialize data to registers and memory using immediate, register, direct and indirect addressing mode

OPTIONAL (any one)

1. Addition, subtraction of 16 bit numbers.
2. Multiplication, Division of 16 bit numbers
3. Transfer a block of data to another memory location using indexing.
4. Operation of 8255 using 8051 microcontroller

D) 8086 (2 hours)

COMPULSORY

Addition, subtraction, Multiplication, Division of 16 bit nos + 2's complement of a 16 bit no.
OPTIONAL (Any One)

1. Finding a particular data element in a given data array.
2. Marking of specific bit of a number using look-up table.
3. Largest /Smallest number of a given data array.
4. To separate the Odd and Even numbers from a given data array.
5. Sorting an array of numbers in ascending/descending order

Total – 13 hours

NOTE Total 10 (Ten) experiments have to be completed.

Two from Gp-A, four from Gp-B, Two from Gp –C Two from Gp–D

ELECTRICAL MACHINES LAB - I (0-0-3)

1. O.C and S.C test on single phase transformer and prediction of performance parameters
2. Parallel operation of two single phase transformer and load sharing
3. Back –to-back test of Single phase transformer
4. Load characteristics of DC shunt/compound generator
5. Load characteristics of DC series Motor
6. Determination of efficiency of DC shunt machine by Swinburne test and brake test.

ELECTRICAL MACHINE LAB - II (0-0-3)

1. To determine the voltage regulation of an 3-Ph alternator by EMF method
2. To determine the V curve and inverted V curve of a 3-Ph synchronous motor
3. Speed control of a 3 phase induction motor by rheostatic, cascading and pole changing methods
4. Synchronisation of an 3-Ph alternator with infinite bus.
5. No load and Blocked rotor test of 3 Ph Induction motor.
6. Determination of power angle characteristics of an Alternator
7. Load test of 3-Ph Induction Motor

6th Semester (Electrical Engg)

TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER (3-1-0)

Module –I (12 hours)

General Introduction to power transmission by D.C. and A.C. overhead lines.

Lines Constants, Resistance, inductance and capacitance of single and three phase lines with symmetrical and unsymmetrical spacing transposition, charging current, skin effect and proximity effect

Performance of transmission Lines : Analysis of short, medium and long lines, equivalent circuit, representation of the lines and calculation of transmission parameters, use of static or synchronous condensers for improvement of regulation.

Module –II (9 hours)

Corona: Power loss due to corona, practical importance of corona, and inductive interference with neighboring communication lines, use of bundled conductors in E.H.V. transmission lines and its advantages

Overhead line Insulators: Voltage distribution in suspension type insulators, method of equalizing, voltage distribution, economic use of insulators.

Mechanical Design of Overhead Transmission Line, Sag and stress calculation, tension and sag at erection, effect of ice and wind, vibration dampers

Module –III (9 hours)

Under Ground Cables : Type and construction, grading of cables, capacitance in 3 core cables and dielectric loss

Distribution System; Effect of System voltage on transmission efficiency.. Economic choice of conductor size, Kelvin's Law, types of distributors and feeders (radial & ring), voltage drop and load calculation for concentrated and distributed loads.

Substation & Earthing : Types of substations, arrangement of bus-bars and control equipments, solid earthing, resistance earthing and Peterson coil

Module – IV (6 hours)

Per unit system one line diagram Power flow through transmission line, Power circle diagram. Universal power circle diagram series and shunt compensation.

FACTS:- Introduction to SVC, TCSC, SSSC, STATCOM and UPFC

Text Books :

- 1) Elements of Power System by W.D. Stevenson, Mc GrawHill.
- 2) Power System Analysis by Nagrath & Kothari, Tata Mc GrawHill
- 3) Electric Power Systems: C. L. Wadhwa, 4th Edition.

POWER ELECTRONICS (3-1-0) (For both Electrical & EI&TC Engg. students)

Module – I (12 hours)

Power Semiconductor Devices: Power diodes, Power Transistors and Thyristors, Static V-I Characteristics of SCR, TRIAC, GTO & IGBT, Turn-On & Turn-OFF Mechanism of SCR, its gate characteristics, Device Specification and rating, series and parallel operation, thyristor protection circuits, design of snubber circuit.

Triggering Circuits:

Types of triggering schemes: DC, AC & pulsed triggering, UJT triggering scheme, R-C triggering scheme, cosine – law triggering scheme.

Commutations: Principle of natural commutation & forced commutation, circuits for forced commutation (resonant, voltage & current commutation)

Module-II (10 hours)

Control Rectifiers (AC to DC Converter)

Single Phase- Circuit Configuration and principle of operation of half wave, full wave controlled rectifiers (full converters and semi converters) wave form of voltage and current at the output and across the thyristor for R-L & R-L-E load, effect of source inductance, importance free wheeling diode for inductive loads. Input power factor for R & R-L load, Ripple factor. Average output voltage and currents.

Three Phase Controlled Rectifiers :

Half wave and full wave full controlled bridge rectifiers. Three phase semi-converters, average output voltage and current for R & R-L load.

Module – III (10 hours)

Inverters (DC to AC Converters) : Single Phase – Series inverters : Circuit description and principle of operation for simple and improved circuit. Parallel inverter: Basic circuit description and principle of operation without and with feed back diodes.

Bridge Inverters: Principle of operation, Concept of voltage-source inverter & current-source inverter.

Three Phase: Concept of three phase bridge inverters, principle of operation (180° conduction mode & 120° conduction mode), wave form of output voltage and current for R & RL load.

Module – IV (10 hours)

DC Choppers:

Basic Principles of Chopper, Step-down and step-up chopper, Single quadrant Chopper, Two-quadrant Chopper, Four-Quadrant Chopper

Cyclo Converter (Single Phase) :

Basic Principle of Single phase Mid Point Cyclo-Converters and bridge types cyclo-converters.

Application:

Reference Books :

1. Power Electronics, Circuits, Devices & Applications, PHI, M.H. Rashid,
2. Power Electronics, P. S. Bhimbra
3. Power Electronics, Asghar
3. Power Electronics – P. C. Sen TMH.

CONTROL SYSTEM ENGINEERING-II (3-1-0)
(Electrical Engg)

Module – I (10 hours)

State Variable Analysis and Design: Introduction, Concepts of State, State Variables and State Model, State Models for Linear Continuous-Time Systems, State Variables and Linear Discrete-Time Systems, Diagonalization, Solution of State Equations, Concepts of Controllability and Observability, Pole Placement by State Feedback, Observer Systems.

Module – II (12 hours)

Introduction of Design: The Design Problem, Preliminary Considerations of Classical Design, Realization of Basic Compensators, Cascade Compensation in Time Domain, Cascade Compensation in Frequency Domain, Tuning of PID Controllers, Feedback Compensation, Robust Control System Design, Problems.

Digital Control Systems: Advantages and disadvantages of Digital Control, Representation of Sampled process, The z-transform, The z-transfer Function. The Inverse, z-transform and Response of Linear Discrete Systems, The z-transform Analysis of Sampled-data Control Systems, The z-and s-domain Relationship, Stability Analysis.

Module – III (10 hours)

Nonlinear Systems: Introduction, Common Physical Nonlinearities, The Phase-plane Method: Basic Concepts, Singular Points, Stability of Nonlinear System, Construction of Phase-trajectories, The Describing Function Method: Basic Concepts, Derivation of Describing Functions, Stability analysis by Describing Function Method, Jump Resonance, Signal Stabilization.

Liapunov's Stability Analysis: Introduction, Liapunov's Stability Criterion, The Direct Method of Liapunov and the Linear System, Methods of Constructing Liapunov Functions for Nonlinear Systems, Popov's Criterion.

Module – IV (8 hours)

Optimal Control Systems: Introduction, Parameter Optimization: Servomechanisms, Optimal Control Problems: State Variable Approach, The State Regulator Problem, The Infinite-time Regulator Problem, The Output regulator and the Tracking Problems, Parameter Optimization: Regulators, Introduction to Adaptive Control.

Reference Books

- 1.. Modern Control Engineering by K. Ogata, 4th Edition, PHI
- 2 Control Systems Engineering by I.J. Nagrath, M. Gopal, 4th Edition, New Age International Publishers.
3. Feedback and Control Systems, J.J.Distefano, III, A.R.Stubberud, I.J.Williams, 2nd Edition, TMH, Schaum's Outlines
4. Discrete Time Control System, K.Ogata, 2nd Edition, Pearson Education Asia.

ELECTROMAGNETIC THEORY (3-0-0)

Module – I (10 hours)

Representation of vectors in Cartesian, Cylindrical and Spherical coordinate system, Vector products, Coordinate transformation.

The Law of force between elementary electric Charges, Electric Field Intensity and Potential due to various charge configuration, Electric Flux density, Gauss law and its application, Application of Gauss Law to differential Volume element, Divergence Theorem.

Potential Gradient, Dipole, and Energy Density in Electrostatic Field.

Module – II (08 hours)

Current and Conductors, Continuity of Current, Conductor Properties and Boundary Conditions. The Method of Images, Nature of dielectric Materials, Boundary Conditions for Perfect Dielectric Materials Capacitance.

Poisson's & Laplace equation, Uniqueness Theorem, Analytical Solution in one dimension.- Use of MATLAB

Module – III (10 hours)

Steady Magnetic Field : Biot Savart Law, Ampere's Circuital Law, Stoke's Theorem, Scalar and Vector Magnetic Potential, Force on a moving Charge, Force on a differential Current Element, Force & Torque Magnetisation & Permeability, Magnetic Boundary Conditions, Inductance & Mutual Inductance.

Time Varying Fields :- Faraday's Law, Displacement Current, Maxwell's Equation.

Module – IV (12 hours)

Univerm Plane Wave : Wave propagation in Free Space, Dielectric, Good Conductor, Poynting's Theorem and wave power, Wave polarization, Reflection and Transmission of Uniform Plane Waves at Normal & Oblique incidence, Standing Wave Ratio, Basic Wave Guide Operation and Basic Antenna Principles.

Reference Books

1. Engineering Electromagnetics W. H. Hayt, Jr & J. A. Buck, 7th Edition, TMH, New Delhi
2. Fundamentals of Electromagnetics with Matlab- K. E. Lonngren and S.V. Savor, PHI (EEE) 2006.
3. Electromagnetic Waves & Radiating System, E.C.Jordan, K.G. Balmain 2nd Edition, EEE, PHI.
4. Elements of Electromagnetics M. N. O., 3rd Edition, Sadiku Oxford University Press.

CONTROL SYSTEM ENGINEERING (3-0-0)

(Electronics & Telecommunication Engineering Students)

Module – I (10 hours)

Introduction: Basic concept of control systems, Open loop & closed loop systems, difference between Open loop & closed loop systems, classifications.

Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula.

Feed back theory: Types of feed backs, effect of degenerative feedback on control system, regenerative feedback.

Module – II (10 Hours)

Time domain Analysis: standard test signals: step, ramp, parabolic and impulse signals. Time response of 1st Order system to unit step & unit ramp inputs. Time response of 2nd Order system to unit step input.

Time response specifications. Steady state errors & error constants of different types of control systems. Generalised error series method.

Concept of stability: Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion Application of Routh stability criteria to linear feedback systems, relative stability. Root locus technique: Root locus concepts for construction of root loci, determination of roots from root locus, Root contours.

Module –III (10 Hours)

Frequency domain analysis: Introduction, Bode plot, determination of stability from Bode plot, polar plot, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback system. Closed loop frequency response: constant M-circle, constant N circle.

Controllers: Introduction, proportional, derivative & integral control actions, PD, PI & PID Controllers & their applications to feedback control systems, Zeigler – Nichols method of tuning PID controller for known dynamic model of the plant.

Module –IV(10 Hours)

State Variable Analysis: Introduction, concept of state variables, state vectors, i/p & o/p vector, general state model representation of linear time invariant, SISO & MIMO systems and their block diagram representations, state model representation of physical systems.

Digital control system: Introduction to digital control system, Shannon's sampling theorem, signal reconstruction, transfer function of ZOH, Z transform of various functions, inverse Z transform, property of Z transform, solutions of difference equations. The pulse transfer functions for linear feedback systems. Introduction to MATLAB.

Reference Books:

1. Control System Engineering by L.J.Nagrath, M.Gopal, 4th Edition, New Age International Publishers.
2. Modern Control Engineering by K.Ogata, PHI, 4th Edition.
3. Feedback and Control Systems, by J.J.Distefano, III, A.R.Stubberud, I.J.Williams, 2nd Edition, TMH, Schaum's Outlines.

COMPUTER SYSTEM ARCHITECTURE (3-0-0)

Module – 1 (06 hrs)

Introduction: Brief history of computers, organization and architecture, basic organization of computers, system bus & interconnection, PCI, computer functions, I-cycle, interrupt and class of interrupts, Von-Neumann Machine: structure of IAS, computer components, fetch and execute cycles, example of program execution instruction cycle state diagram, instruction pipelining.

Module – 2 (14 hrs)

CPU Organization: Fundamental concepts, fetching and storing a word in memory, register transfer, performing an arithmetic and logic operation, execution of a complete instruction, general register organization: control word, examples of micro-operations, stack organization, RPN, evaluation of arithmetic expression using RPN, instruction format; three address, two address, one address and zero address instructions, addressing modes; types of addressing modes, numerical examples, data transfer and manipulation; data transfer, data manipulation, arithmetic, logical & bit manipulation instruction, program control; conditional branch instruction, subroutine, program interrupt, types of interrupt, RISC & CISC characteristics, control unit operation; hardware and micro-programmed control.

Module – 3 (08 hrs)

Input/Output *Organization*: Peripheral devices, input-output interface, I/O bus and interface module, asynchronous data transfer, strobe control, handshaking, asynchronous serial transfer, asynchronous communication interface, modes of transfer; programmed I/O, interrupt driven I/O, direct memory access (DMA), DMA controller, I/O channel & processor, priority interrupt: daisy chaining priority, parallel priority interrupt.

Module – 4 (12 hrs)

Memory *Organization*: Memory hierarchy, characteristic of memory system, semiconductor main memory types, organization, memory cell operation, cache memory; cache principles, elements of cache design, cache size, mapping function, replacement algorithm, LRU, FIFO, LFU, write policy, number of caches; single versus two level caches, Pentium cache organization, associative memory; hardware organization, match logic, read operation, write operation auxiliary memory; magnetic disks magnetic tapes, virtual memory; paging, address mapping using pages, segmentation, demand paging, memory management hardware.

Text Book

William Stallings, “Computer Organization and Architecture”, Fourth Edition, PHI

Reference Book

1. M.Morris Mano, “Computer System Architecture”, Third Edition, PHI

PRACTICALS

DESIGN OF ELECTRICAL APPARATUS LAB. (0-0-3)

1. Computer aided design of a Single-Phase Transformer using MATLAB
2. Optimized design of a 3-phase synchronous generator using MATLAB and hence find out its reactance, voltage regulation and efficiency on load.
3. Induction motor design using MATLAB

Text Books: Electrical Machine Design by A.K.Sawhney & Electrical Machines, Analysis and Design applying MATLAB by J. J. Cathey, Tata Mc-GrawHill

ELECTRICAL MACHINE LAB - III (0-0-3)\

(6th Semester Electrical)

1. Determination of Parameters of 3 phase three winding transformer and trace the waveform of
 - (i) Magnetising Current
 - (ii) Induced e.m.f.
2. Determination of Parameters of single phase induction motor
3. Study of 3 phase transformer connections
4. Parallel operation of two 3 phase alternator
5. Separation of hysteresis and eddy current losses of single phase transformer.
6. Voltage regulation of 3 phase alternator by ZPF method.
7. Separation of losses of alternator.

POWER ELECTRONICS LAB. (0-0-3)

(Any 10 experiments)

1. V-I Characteristic of SCR
2. Different methods of triggering of SCR
 - (a) Phase controlled method
 - (b) UJT triggering method
 - (c) Cosine controlled triggering method
3. Study of triac and full wave voltage control method of it.
4. 1 phase half wave and full wave full controlled converter with R, R-L and D.C motor load with / without freewheel diode
5. 3-phase half and full wave full controlled converter with R, R-L and D.C motor load with/ without freewheeling diodes
6. Study of characteristics curves of a 3 phase diode bridge.
7. Study of DC chopper with PWM controller
8. Study of SCR communication
 - (a) Forced communication
 - (b) Load communication
9. Study of single phase series inverter

10. Three phases IGBT based four quadrant chopper drive for D.C motor
11. Three phases IGBT based four quadrant chopper drive for induction motor
12. Study of 1 phase Cycloconverter

ELECTRICAL MACHINES LABORATORY

5TH SEMESTER MECHANICAL ENGINEERING

1. O.C and S.C test on single phase transformer and predetermination of performance parameters.
2. Determination of efficiency of D.C shunt machine by Swinburne test and brake test.
3. Speed control of 3 phase induction motor
4. Determination of voltage regulation of an alternator by EMF method.
5. Synchronisation of an alternator with infinite bus-bar.
6. Load characteristics of D.C shunt generator.

7th Semester (Electrical Engg) New-2008

BEE-402 POWER SYSTEM OPERATION & CONTROL (3-1-0)

Module - I (12 hours)

Concept of real and reactive powers, Complex power, Transmission capacity, The static load flow equations(SLFE), Definition of the load flow problem, Network model formulation, A load flow sample study, Computational aspect of the load flow problem. Gauss seidel and Newton Raphson method for power flow fast decoupled load flow, On load tap changing transformer and block regulating transformer, effects of regulating transformers, Z bus Algorithm.

Module – II (08 hours)

Power System Stability: Steady State Stability, Transient stability, Swing equation, Equal area criterion for stability, critical clearing angle, point by point Methods of improvement of transient stability. Voltage stability, concept, causes determination loading margin, countermeasures.

Module – III (12 hours)

Economic Operation of Power System: Distribution of load between units within a plant, Transmission losses as function of plant generation, Calculation of loss coefficients, Distribution of loads between plants with special reference to steam and hydel plants, Automatic load dispatching.

Fault Analysis: Symmetrical and unsymmetrical fault analysis for power system Z bus method in fault analysis.

Module – IV (8 hours)

Load frequency control, PF versus QV control, , Modelling of speed governing system, Division of power system into control areas, Single area control and two area control

TEXT Books :

1. John J Grainger W.D.Stevenson "Power System Analysis"
2. P.Kundur, "Power System Stability and Control" Tata McGraw Hill Publication
3. C.L.Wadhwa, "Electric Power System" New Age Publishers.

_ BEE 401-ELECTRICAL DRIVES (3-1-0)

Module- I (8 Hours)

Requirements, AC and DC drives, modern trends in drives technology, Characteristics of DC.Induction and Synchronous motor drives,(starting, running, speed control, braking),size and rating of motors(short time, intermittent, continuous),Mechanical considerations(enclosure, bearing transmission of drive, through chain, pulley and gears noise)

Module – II (12 Hours)

Control for drive systems, Control of D.C.Induction, and Synchronous motor drives. Control Techniques for electric drives, Block diagram representation, transfer functions transient response, frequency response and stability, compensating techniques.

Module – III (8 Hours)

Electric Traction: System of electric traction

Mechanics of Train Movement:

Speed- time, distance- time and simplified speed-time curves, Attractive effort for acceleration and propulsion, effective weight, train resistance, adhesive weight, specific energy output and consumption.

Traction Motors:

Review of characteristics of different types of DC and AC motors used in traction and their suitability

Module-IV (8 Hours)

Rating and heating of electric drives, power loss, Heating and cooling of motors, Classes and duty and selection of motors, Drives for specific application like steel, paper, Textile Mills control of electric drives microprocessor hardware and software for drive system.

TEXT BOOKS:

- 1.V.Subrahmanyam, TMH “Electric Drives”
- 2.M.H.Rashid (P.H.I.Edition)”Power Electronics”
- 3.G.K.Dubey, Norasa Pub. House ND “Electric Drive”

BEE 403 –SWITCH GEAR AND PROTECTIVE DEVICES (3-1-0)

Module-I (8 Hours)

Protective Devices:

Philosophy of protection, Nature, Causes and consequences of faults, Zone of protection, Requirements of a protective scheme, Basic terminology components of protection scheme. Relay classification, Principle of different types of electromagnetic relay. General equation of phase and magnitude comparators, Electromagnetic relays, over current relays Directional relays, Distance relay- impedance, Reactance and Mho type, Differential relays.

Module-II (10 Hours)

Feeder: Protection: Over current and earth fault protection, Distance protection, Pilot wire protection, Carrier current protection.

Generator Protection: Biased differential protection, restricted earth fault protection, Field suppression, Negative sequence protection, Earth fault detection in rotor circuit

Power transformer Protection: Biased differential protections, restricted earth fault protection, Buchholz relay Protection of combined transformer and alternator.

Bus Zone Protection: frame leakage and circulating current scheme-use of translay relay.

Module III (10 Hours)

Circuit Breakers

Formation of arc during circuit breaking. Characteristics of electric arc. Theories of arc Interruption. Recovery and restriking voltage, interruption of capacitive and inductive currents. Current chopping. Principle of A.C.and D.C.circuit breaking requirements of good circuit breaker circuit breaker rating.

Different types of circuit breakers. Air break and Air blast circuit breaker.Plain break and controlled break all circuit breakers. Minimum oil circuit breakers.Vacuum circuit breaker, Sulphurhexs fluoride circuit baker.D.C. Circuit breaker.

H.R.C. Fuse: Construction and characteristics

Module IV (10 Hours)

Static Relays : Development and classification of static relays, Different types of phase and amplitude capacitors, Basic static relays used in protective scheme, Elementary idea about digital protection. Testing and maintenance of protective gear, Protection against surge-surge absorber, Surger diverter.

Arrangement of Busbar, Circuit breaker and isolator. Current limiting reactors in power system and their arrangement calculation of fault MVA for symmetrical short circuits. Circuit breaker capacity.

Text BOOK

1. Sunil S.Rao, "Switch Gear and Protection" Khanna Publication
2. Ravindranath and M.Chander "Power System Protection and Switch Gear" Pub.Wiley
3. Eastern Ltd. New Delhi
4. W.D.Stevenson "Elements of Power System Analysis" Mc Graw Hill
5. Van C Warrington, "Protective Relays Vol.I

**BEE 405- RENEWABLE SOURCES OF ENERGY
(3-0-0)**

Module-1 [12 Hrs]

Energy Scenario:

Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts.

Solar Energy:

Solar thermal Systems: Types of collectors, Collection systems, efficiency calculations, applications.

Photo voltaic (PV) technology:

Present status, - solar cells , cell technologies, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , sizing and economics. Peak power operation. Standalone and grid interactive systems.

Module-2 [10 Hrs]

Wind Energy:

Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating. Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation. Small Hydro Systems

Module-3 [8 Hrs]

Energy storage and hybrid system configurations:

Energy storage, Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators. Battery management. Flywheel-energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra Capacitors. Bio-Mass and Bio-Fuels.

Module-4 [10 Hrs]

Grid Integration:

Stand alone systems, Concept of Micro-Grid and its components, Hybrid systems – hybrid with diesel, with fuel cell, solar-wind, wind –hydro systems, mode controller, load

sharing, system sizing. Hybrid system economics. Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. Effect on power quality - harmonic distortion, voltage transients and sags, voltage flickers. Dynamic reactive power support. Systems stiffness.

Books:

1. Renewable energy technologies - R. Ramesh, Narosa Publication.
2. Energy Technology – S. Rao, Parulkar
3. Non-conventional Energy Systems – Mittal, Wheelers Publication.
4. Non-Conventional Sources of Energy- G.D.Rai, Khanna Publishers

BEE-410 ADVANCED ELECTRIC MACHINE (3-0-0)

Module-1(12 hr)

Synchronous Machines: The basic of general theory and generalized equation of A.C machines, stator flux linkage park's transformation(dq0), Derivation of two-axis equations, stator and rotor equations in per unit representation, power and torque equation, equivalent circuit for d-axis and q-axis, steady state analysis and phasor diagram, transient and sub-transient reactance, synchronous machine dynamics and phasor diagram, magnetic saturation, The constant flux linkage theorem, reactive capability chart.

Module-2(10 hr)

Induction machines: General equations of an induction motor, the d-q transformation, park's equations, basic machine equation in d-q reference frame, electrical torque and power calculation in terms of d-q variables, equivalent circuit, representation in stability studies, induction machine transient, transient equivalent circuit, induction machine dynamics.

Module-3(8 hr)

Transformers: Transformer switching-in or inrush current phenomenon, mathematical analysis, flux and current waveforms, surge phenomenon, surge voltage distribution, static shielding, protection against surges.

Module-4(10 hr)

DC machine dynamics: Dynamic analysis of sep. excited and shunt generator and motor, effect of saturation, dynamic analysis with time domain techniques, performance of brushless DC motors.

Special machines: linear synchronous and induction motors, Schrage motors, construction and operation of metadyne and amplitryne, Single phase series motor.

Text Books:

1. B.ADKINS and R. H. HARLEY "The generalised theory of electrical machines"

Reference Book:

2. P. KUNDUR "Power System Stability and Control", Tata-McGraw Hill Publication.

3. M.G SAY. "A.C MACHINES "

4. E.O TAYLOR "A.C COMMUTATOR MOTOR"

BEE-404 HIGH VOLTAGE ENGINEERING (3-0-0)

Module-I

(10 Hours)

CONDUCTION AND BREAKDOWN IN GASES:

Gases as insulating media, Ionisation processes. Townsents current grow- the equation. Current growth in the presence of secondary processes. Townsend's criterion for breakdown. Experimental determination of coefficients. Breakdown in electronegative gases, time lags for breakdown, streamer theory of breakdown in gases, paschent's law, Breakdown in non-uniform field and corona discharges, past – breakdown phenomena and applications, practical considerations in using gases for insulation purposes.

Module-II

(10 Hours)

CONDUCTION AND BREAKDOWN IN LIQUID DIELECTRICS:

Pure liquids and commercial liquids, conduction and breakdown in pure liquids.

BREAKDOWN IN SOLID DIELECTRICS:

Introduction,. Intrinsic brakdown. Electromechanical breakdown, Thermal breakdown.. Breakdown of solid dielectrics in practice.

Module-III

(10 Hours)

GENERATION OF HIGH VOLTAGE AND CURRENTS:

Generation of high D.C, voltages, Generation of high alternating voltages, Generation of Impulse voltages. Tripping and control of impulse generators. Generation of Impulse currents.

MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS:

Measurement of high D.C.voltages. Measurement of high D.C. and impulse voltages. Introduction.. Measurement of high D.C. A.C. and impulse currents, cathode ray oscillographs for impulse voltages and currents measurements.

Module-IV

(10 Hours)

NON DESTRUCTIVE TESTING OF MATERIALS AND ELECTRICAL APPARATUS:

Introduction. Measurement of DE.C. resistivity. Measurement of dielectric constant and loss factor. Partial discharge measurements.

HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS:

Testing of insulators and bushings. Testing of isolators and circuit breakers. Testing of cables. Testing of transformers. Testing of surge diverter's Radio interference measurements.

TEXT BOOK:

1. “High Voltage Engg.” by M. S. Naidu, V. Kamaraju. Tata Mc Graw Hill Publishing, Company Ltd. New Delhi.
2. “High Voltage Fundamentals” by duffel. E. and Zaengel W. Pergamon press.

BEE-412 SOFT COMPUTING (3-0-0)

Module - I (06 hours)

Basic tools of soft Computing-Fuzzy logic, Neural Networks and Evolutionary Computing, Approximations of Multivariate functions, Non-linear Error surface and optimization.

Module – II (10 hours)

Fuzzy Logic Systems: Basics of fuzzy logic theory, Crisp and fuzzy sets. Basic set operations. Fuzzy relations, Composition of Fuzzy relations, Fuzzy inference, Zadeh’s compositional rule of inference. Defuzzification. Fuzzy logic control: Mamdani and Takagi and Sugeno architectures. Applications to pattern recognition and control.

Module – III (16 hours)

Neural networks: Single layer networks, Perception. Activation functions. Adalinc: its training and capabilities, weights learning, Multilayer perceptrons: error back propagation, generalized delta rule. Radial basis function networks and least square training algorithm, Kohonen self-organizing map and learning vector quantization networks. Recurrent neural networks, Simulated annealing neural networks. Adaptive neuro-fuzzy information; systems (ANFIS), Applications to control and pattern recognition.

Module – IV (08 hours)

Evolutionary Computing: Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic programming concepts Applications.

Text Books:

1. V.Keeman, “Learning and Soft computing”, Pearson Education, India.
2. J.S.R.Jang. C.T.SUN and E.Mizutani, “Neuro-fuzzy and soft-computing” PHI Pvt.Ltd., New Delhi.
3. Fredric M. Ham and Ivica Kostanic, “Principle of Neuro Computing for Science and Engineering”, Tata McGraw Hill.
4. S.Haykins, “Neural networks: a comprehensive foundation” Pearson Education, India.

BEE-413 INTRODUCTION TO BIO INFORMATICS (3-0-0)

Module – I

(10 Hrs)

Introduction to Genomic data and Data Organization: Sequence Data Banks – introduction to sequence data banks – protein sequence data bank. NBER-PIR. SWISSPORT. Signal peptide data bank, Nucleic acid sequence data bank – Gem Bank, EMBL nucleotide sequence data bank. AIDS virus sequence data bank. PRNA data bank, structural data banks – protein Data Bank(PDB). The Cambridge Structural Database(CSD) : Genome data bank – Metabolic pathway data; Microbial and Cellular Data Bank.

Module – II

(10 Hrs)

Introduction to MSDN (Microbial Strain Data Network) : Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; other important Data banks in the area of biotechn9ology/life sciences/biodiversity.

Sequence analysis: Analysis Tools for Sequence Data Bank: Pair wise alignment NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data; Sequence patterns motifs and profiles.

Module – III

(10 Hrs)

Secondary Structure Predictions; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Tertiary Structure predictions; prediction algorithms, Chao-Fasman algorithm. Hidden-Markov model, Neural Networking.

Module – IV

(10 Hrs)

Application in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognitions (threading), protein structure Predictions: Compaative modeling (Homology), Advanced topics: Protein folding Protein ligand interactions, Modular Modeling & Dynamics, Drug Designing.

Text Books:

1. Lesk, OUP “*Introduction to Bio Informatics*” .
2. Atwood, Pearson “*Education Introduction to Bio-informatics*”.
3. Cynthia Gibas and Per Jambeck 2001 SPD ”*Developing Bio-informatics Computer Skills*”.
4. Murty CSV, Himalaya, ” *Bioinformatics*”

BEE 414 INTRODUCTION TO NANOTECHNOLOGY(3-0-0)

Module-I Introduction and Definition of Nanotechnology (10 hours)

Introduction, Definition of Nanotechnology: Broad perspective of Nanotechnology, Narrow perspective of Nanotechnology, Cultural perspective of Nanotechnology. Knowing the Size, Understanding Nanotechnology, Nanotechnology and Today's World, Importance of Nanoscale Science and Technology, Agitated Humans and Nanotechnology.

Module-II History of Nanotechnology (10 hours)

Introduction, History of Nanotechnology-by Chris Phoenix, Contribution of Different Scientist in Nanotechnology: Richard Feynman, K. Eric Drexler, Gerd Binnig and Heinrich Rohrer, Don Eigler and Erhard Schweizer, Professor Richard Smalley, Professor Mauro Ferrari, Joseph Proust, History at a Glance, Different Timelines of Nanotechnology.

Module-III Future of Nanotechnology (10 hours)

Introduction, The Beginning of technological Revolution, Silicon Based Technology, Benefits and Challenges of Molecular Manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities. Visions and Objective of Nanotechnology, Nanotechnology in Different Fields: Automobile, Electronics, Nanobiotechnology, Materials, Medicine, Dental care, Nanocomputers, Power storage, Nanotechnology products.

Module-IV Applications of Nanotechnology (10 hours)

Introduction, Nanotechnology in Industries, Nanotechnology in Computing: Quantum computing, Molecular Computation, Nanotechnology in Electronics: Computational Nanotechnology, Computational Optoelectronics, Mechanical Nanocomputers, Supercomputing systems.

Nanotechnology in Health and Life Sciences: Nanotechnology in medicine, Drug delivery, Drug encapsulation, Tissue repair and implantation, Bioresorbable materials, Other application of nanotechnology in health and medicine.

Nanotechnology in Smart Materials: Sensors, Smart instruments- atom computers

Nanotechnology in High Voltage Insulation: Nanocomposites.

Nanotechnology in Defence, Nanotechnology in Optics: Optical industry, Metrology.

REFERENCE BOOKS:

1. "Nanotechnology", Foster, Pearson Education.

2. "Nanotechnology: A gentle Introduction to yhe next Big Idea" , Ratner, Pearson Education.
3. Handbook of Nanotechnology, The- Nanometer Structures: Theory, Modeling and Simulation", Lakhtakia, PHI Learning Pvt Ltd.
4. "Introduction to nanoscience and Technology", Chattopadhyay, PHI Learning Pvt Ltd.

BEE 407 ENERGY MANAGEMENT (3-0-0)

Module-I

(10 hours)

General principles of energy management and energy management planning; application of Pareto's model for energy management; obtaining management support; establishing energy data base; conducting energy audit; identifying, evaluating and implementing feasible energy conservation opportunities; energy audit report; monitoring, evaluating and following up energy saving measures.

Module-II

(10 hours)

Energy efficiency analysis; thermodynamics and energy; coefficient of performance; energy effectiveness; management of heating, ventilating and air-conditioning (HVAC) – principles, opportunities, case studies; management of process energy- principles, opportunities, case studies; management of electrical load and lighting - management opportunities with electric drives, lighting, heating and electrolytic systems; electrical load analysis; peak demand control; computer-aided energy management; cogeneration; forms of cogeneration; feasibility study for cogeneration.

Module-III

(10 hours)

Energy efficiency of turbines, compressors and pumps (brief treatment only); specific energy consumption; parameters affecting specific energy consumption; flexi targeting technique.

Lighting- Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study.

Module-IV

(10 hours)

Financial evaluation of energy projects; cash flow model; time value of money; evaluation of proposals - payback method, average rate of return method, internal rate of return method, present value method, profitability index, life cycle costing approach, investment decision and uncertainty; consideration of income taxes, depreciation and inflation in investment analysis.

Reference Books:

1. "Energy Management: Challenges for the Next Millennium", Pradeep Chaturvedi, Vedams eBooks (P) Ltd.

2. “Energy management” ,Paul O’Callaghan,McGraw Hill Book Co.
3. “Energy management principles”, Craig B Smith,. Pergamon Press.
4. “Albert Thumann”, .Handbook of Energy Audits., Fairmont Pr; 5th edition (1998).

BEE-411-HVDC (3-0-0)

Module 1: *Introduction*, Comparison of AC and DC transmission, Application of HVDC Transmission, Description of HVDC transmission systems, Planning of HVDC transmission, Power carrying capability of AC and DC lines, Modern trends in HVDC transmission, Research and development.

[6]

HVDC Converters: Basic conversion principle, Selection of converter configuration, Rectifier operation, Converter bridge characteristics, Inverter operation, twelve pulse converter, Converter harmonics.

[6]

Module 2: *Converter and HVDC control:* Principle of DC link Control, Converter control characteristics, System control Hierarchy, Firing angle control, Current and extinction angle control, Reversal of dc power flow, Modification to the basic characteristics, Tap changer control, different control levels, power flow control, Telecommunication requirements.

[10]

Module 3: *Multiterminal HVDC:* Application, Types of MTDC systems, Control and protection of MTDC systems, Study of MTDC systems.

[4]

Converter Faults and Protection: Introduction, Converter faults, Protection against over currents, Over voltages in Converter station, Surge arresters, Protection against over voltages.

[6]

Module 4: *Harmonics and Filter:* Introduction, Generation of Harmonics, Design of AC filters, Design criteria, design factors, network impedance, circuit modeling, Tuned filter, self-tuned filters, High pass filters, Thpe C damped filters, DC filters, Alternative methods of harmonic elimination, Magnetic flux compensation, Harmonic injection, Ripple injection, Carrier frequency and RI Noise.

[8]

Books Recommended

1. Padiyar K. R. “HVDC power transmission System”, Willey Eastern Ltd,New Delhi, 1990 .
2. Arrillaga J. “ High Voltage direct current transmission”, Peter Peregrinus, London. 1983
3. Kimbark E. W. “Direct Current transmission”, vol. 1, John Wiley, New York. 1971.

BEE-406 POWER QUALITY

Module 1 (10 hours)

Overview of Power Quality and Power Quality Standard ,Interest in Power Quality, Power Quality, Voltage Quality ,Overview of Power Quality Phenomena ,Power Quality and EMC Standards ,Long Interruptions and Reliability Evaluation,Introduction , Observation of System Performance , Standards and Regulations ,Overview of Reliability Evaluation ,Basic Reliability Evaluation Technique ,Costs of Interruptions

Module II (8 hours)

Short Interruptions, Introduction ,Terminology ,Origin of Short Interruptions, Monitoring of Short Interruptions ,Influence of Equipment , Single Phase Tripping , Stochastic Prediction of Short Interruptions

Module III (12 hours)

Voltage Sags – Characterization ,Introduction ,Voltage Sag Magnitude Voltage Sag Duration,Three Phase Unbalance ,Phase –Angle Jumps ,Magnitude and Phase-Angle Jumps for three phase Unbalanced Sags ,Other Characteristics of,Load Influence on Voltage Sags

Sags due to Starting of Induction Motors

Module IV (10 hours)

Mitigation of Interruptions and Voltage Sags ,Overview of Mitigation Methods ,Power System Design Redundancy Through Switching ,Power System Design – Redundancy through Parallel Operation,The System – Equipment Interface

Reference Book:-

- (1) Understanding Power Quality Problem-by M.H.S Bollen
- (2) Standard Publisher Distributor –Delhi-110006 IEEE Press

BEE-408 BIO-MEDICAL INSTRUMENTATION (3-0-0)

Module – I (8 Hrs).

Basic physiological system of the body: Problems encountered in measuring living systems, bioelectric potentials, biomaterials,

Basic Transducer Principles: Active and passive transducers, Transducers for biomedical applications, Generation, propagation and distribution of bioelectric potentials (ECG, EEG and EMG)

Bio potential electrodes: Basic types (micro, skin surface and needle electrodes), biochemical transducers(PH, blood, gas and specific ions electrodes)

Module-II (12 Hrs)

The cardiovascular system and measurements: Heart and cardiovascular system and circulation block diagram, blood pressure and measurement ,characteristics of blood flow and heart sounds, Electrocardiography ,ECG lead configurations, ECG recording and their types

The Nervous System: The anatomy of nervous system, Neuronal communication EPSP & IPSP Organization of the brain, Measurements from the nervous system

Module III (12 Hrs)

Systemic Body & Skin Temperature Measurement: Temperature measurements, Brief idea about ultrasonic measurements

Patient care monitoring: Elements of intensive care: Organization of the Hospital for patient care monitoring, Pace-makers types, systems, modes and generators, Defibrillators types,Bio telemetry and applications of telemetry in patient care.

Module –IV (8 Hs)

Automation of chemical tests, Instrumentation for diagnostic X Rays, Interfacing computer with medical instrumentation and other equipments, biomedical computer applications, Shock hazards from electrical equipments, methods of accident prevention.

TEXT BOOK

1. Cromwell, F.J.Weibell & F.A.Pfieffer, “Biomedical Instrumentation & Measurements”
Prentice Hall International.

Reference Books:

1. R.S.Khanpur, ”Handbook of Biomedical Instrumentation” Tata Mc Graw Hill
2. H.E.Thomas, ”Handbook of Biomedical Instrumentation and Measurement”
Restone Publishing Company
3. J.G.Webester, “Medical Instrumentation” Houghton Mifflin

BEE-491POWER SYSTEM LABORATORY (0-0-3)

1. Determination of sequence impedance of an alternator
 - (a) Positive sequence (b) Negative sequence (c) Zero sequence
2. Study of Ferro resonance Phenomenon effect of a single phase transformer with no load
 - Light load
3. Determination of sub transient, transient and steady state reactance of 3-Ph alternator
4. Study of the characteristics of Over Current Relay
5. Study of the characteristics of biased differential relay
6. (i) Calibration of various gaps using HVAC
 - (ii) Study of Dry flashover characteristics of Overhead line insulators
 - (iii) To determine the Breakdown strength of Transformer oil as per Indian Standard
7. Study of HVDC set up, Lightning impulse set up and use of surge Oscilloscope
8. Determination of A, B, C. and D Parameters of artificial Transmission line and to predict its performance.

BEE-492-ADVANCED COMPUTATION LAB.(0-0-3)

The list of Simulation Programs

1. The formation of Z_{Bus} and Y_{Bus} for the 14 –Bus IEEE Test system
2. PID Controller for DC Motor speed control using Simulink
3. 6-Pulse bridge controlled rectifier using Simulink and to test the out and current wave forms for both R-L Loads
4. Simulation of Speed Governing system using Simulink

5. Fast fourier analysis using PSCAD
6. Simulation of Transmission line using PSCAD
7. Write a program to obtain performance characteristics of 3-phase Induction motor
8. Response of SMIB system using ETAP