Uttarakhand Technical University
Program: **B.Tech, Electrical Engineering (EE)**
Year: 3 Session:2011-2012
Scheme and Evaluation Pattern

S No	Course No	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Semester: V										
Theory										
1	TEE501	Electromechanical Energy conversion-II	3	1	0	30	20	50	100	150
2	TEE502	System Engineering	3	1	0	30	20	50	100	150
3	TEE503	Applied & Electronic Instrumentation	3	1	0	30	20	50	100	150
4	TEE504	Fundamental of Power System	3	1	0	30	20	50	100	150
5	TEC502	Digital Signal Processing	3	1	0	30	20	50	100	150
6	TCS507	Concepts of Programming & OOPS	2	1	0	15	10	25	50	75
Practical/Design										
1	PEE551	EMEC-II Lab	0	0	2	0	0	25	25	50
2	PEE553	Applied Instrumentation Lab	0	0	2	0	0	25	25	50
3	PCS557	Concepts of Programming & OOPS Lab	0	0	2	0	0	10	15	25
4	DIS550	Discipline	0	0	0	0	0	0	0	50
Semester: VI										
Theory										
1	TEE601	Power System Analysis	3	1	0	30	20	50	100	150
2	TEE602	Control System	3	1	0	30	20	50	100	150
3	TEE603	Power Electronics	3	1	0	30	20	50	100	150
4	TEE604	Electrical Machine Design	3	1	0	30	20	50	100	150
5	TCS607	Data Structures Using C++	3	1	0	30	20	50	100	150
6	THU608	Principles of Management	2	1	0	15	10	25	50	75
Practical/Design										
1	PEE652	Control System Lab	0	0	2	0	0	25	25	50
2	PEE653	Power Electronics Lab	0	0	2	0	0	25	25	50
3	PCS657	Data Structures Using C++Lab	0	0	2	0	0	10	15	25
4	DIS650	Discipline	0	0	0	0	0	0	0	50

TEE501: ELECTROMECHANICAL ENERGY CONVERSION - II

Unit I:

Synchronous Machine I

Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torque co-efficient

Unit II:

Synchronous Machine II:

Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating characteristics.

Synchronous Motor: Starting methods, Effect of varying field current at different loads, V Curves, Hunting & damping, synchronous condensor

Unit III:

Three phase Induction Machine – I

Constructional features, Rotating magnetic field, Principle of operation Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator

Unit IV:

Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed Control (with and without emf injection in rotor circuit.)

Single phase Induction:

Motor Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, repulsion motor.

Unit V:

AC Commutator Motors:

Universal motor, Single phase a.c. series compensated motor, stepper motors

Reference Books:

1. D.P.Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw Hill
2. Gross, Charles E , Electric Machines Taylor & Francis/BSP
3. Srivastava,R.C. " Electric Machines' Cengage Learning
4. Wildi,T.'Electric Machines, Drives and Systems' Pearson Education
5. Sen.'Principles of Electric Machines & Power Electronics' wiley India

TEE502: SYSTEMS ENGINEERING

Unit I:
Introduction to System Engineering Concepts: Open loop and closed loop systems, model classification, performance criterion; Validation and testing of models, mathematical modeling and representation of physical systems and analogous systems, transfer functions for different type of systems, block diagrams; Signal flow graphs and Mason's gain formula reduction algebra.

Unit II:
Time Domain Analysis: Time domain performance criterion, transient response of first order, second order and higher order systems; Steady state errors: Static and dynamic error constants, system types, steady state errors for unity and non unity feedback systems, performance analysis for P, PI and PID controllers.

Unit III:
Discrete Data Systems: Introduction to discrete time systems, sample and hold circuits, pulse transfer function, representation by differential equations and its solution using z-transform and inverse-z transforms, analysis of LTI systems, unit circle concepts.

Unit IV:
State Variable Approach: Derivation of state model of linear time invariant (LTI) continuous and discrete time systems, transfer function from ordinary differential equations, canonical variable diagonalization, system analysis by transfer function and state space methods for continuous and discrete time systems convolution integral; State transition matrices and solution of state equations for continuous and discrete time systems. Controllability and observability and their testing

Unit V:
Stability Analysis of Non Linear system: Stability, linearization of state equation, stability analysis of non linear system, methods of analysis, contruction of Liapunov's function, Popov's stability criterion.

Reference Books:

1. Kuo B. C., "Automatic Control Systems", 8th Ed., Wiley India.
2. Singh & Janardhanan'Modern Control Engineering" Cengage Learning
3. Ogata K., "Modern Control Engineering", 4th Ed., Pearson Education.
4. Jagan,N.C." Control Systems' BSP, Hyderabad
5. Bhattacharya,S.K.'Control Systems Engineering' Pearson Education

TEE503: APPLIED & ELECTRONIC INSTRUMENTATION

Unit I:

Introduction: Basics of transducer, sensor and actuator; Active and passive transducers, generating and parametric transducers; Analog, digital and pulse outputs of sensors; Static characteristics of transducer and transducer system; Dynamic characteristics of nth, 0th, first and second order transducers.

Measurement of Displacement and Strain: Resistive, inductive and capacitive transducers for displacement; Wire, metal film and semiconductor strain gauges; Wheatstone-bridge circuit with one, two and four active elements, temperature compensation.

Unit II:

Measurement of Force and Pressure: Column, ring and cantilever-beam type load cells; Elastic elements for pressure sensing; Using displacement sensors and strain gauges with elastic elements.

Measurement of Temperature: Resistance temperature detector, NTC and PTC thermistors, Seebeck effect, thermocouple and thermopile.

Unit III:

Measurement of Vibrations: Importance of vibration measurement, frequency range of vibrations; Absolute displacement, velocity and acceleration pick-ups; Mass-spring-damper system as absolute acceleration to relative displacement converter; Straingauge and piezoelectric type acceleration pickups.

Measurement of Speed and Torque: Electro-magnetic and photoelectric tachometers; Torque shaft, strain-gauge, electromagnetic and radio type torque meters.

Unit IV:

Noise and Interference in Instrumentation: Sources and effects of noise and interference; SNR and its improvement; Introduction to noise suppression methods; Grounding and shielding.

Telemetry: Meaning and basic scheme of telemetry; Sources of error, line or transmission error; DC voltage and current telemetry schemes; Radio telemetry; PWM and digital telemetry schemes.

Unit V:

Electronic Instrumentation

Analog electronic voltmeters, tuned and sampling voltmeters, AC and DC current probes. Analog electronic wattmeter and energy meter.

Digital displays, digital counter-timer and frequency meter, time standards, digital voltmeter and multimeter, accuracy and resolution considerations, comparison with analog electronic instruments.

Reference Books:

1. Johnson C. D., "Process Control Instrumentation Technology", 8th Ed.,Pearson Education
2. Cooper W.D. and Helfrick A. D,"Modern Electronic Instrumentation and Measurement Techniques", Pearson Education.
3. Oliver B. M. and Cage J. M., "Electronic Measurement and Instrumentation", McGraw-Hill International Book Company.
4. Dally.'Instrumentation for Engineering Measurement 2nd edition, Wiley India

TEE 504: FUNDAMENTAL OF POWER SYSTEMS

Unit I:

Power System Components:

Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.

Supply System

Different kinds of supply system and their comparison, choice of transmission voltage

Transmission Lines:

Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect.

Unit II:

Over Head Transmission Lines

Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading

Unit III:

Corona and Interference:

Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines,

Overhead line Insulators:

Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.

Unit IV:

Mechanical Design of transmission line:

Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers.

Unit V:

Insulated cables:

Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.

Reference Books

1. B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
2 M. V. Deshpande, "Electrical Power System Design" Tata Mc Graw Hill.
3.Weedy.'Electric Power Systems, Wiley India
4. Murthy P S R.'Electrical Power Systems' BSP, Hyderabad

TEC502: DIGITAL SIGNAL PROCESSING

UNIT 1

DISCRETE FOURIER TRANSFORM: Frequency Domain Sampling: The Discrete Fourier Transform Frequency Domain Sampling and Reconstruction of Discrete-Time Signals. The Discrete Fourier Transform (DFT). The DFT as a linear Transformation. Relationship of the DFT to Other Transforms.

Properties of the DFT: Periodicity, Linearity, and Symmetry Properties. Multiplication of two DFTs and Circular Convolution. Additional DFT Properties. Frequency analysis of signals using the DFT.

UNIT 2

EFFICIENT COMPUTATION OF DFT: Efficient Computation of the DFT: FFT Algorithms, Direct Computation of the DFT. Radix-2 FFT algorithms. Efficient computation of the DFT of two real sequences, computations, Efficient computation of the DFT of a 2N-Point real sequences, , Chirp Z-transform algorithm.

UNIT3

DESIGN OF DIGITAL IIR FILTERS: Impulse invariant and bilinear transformation techniques for Butterworth and chebyshev filters; Direct form (I & II), cascade and parallel.

UNIT4

DESIGN OF FIR FILTERS:- windowing, optimum approximation of FIR filters, multistage approach to sampling rate concession. Design of Hilbert transforms.

UNIT5

ADAPTIVE WIENER FILTER AND LMS ALGORITHM: Application of adaptive filtering to echo cancellation and equalization.

APPLICATION OF DSP AND CODING: Implementation of LIT using DFI, Goertzel algorithm, FFT algorithms. Audio and Video coding, MPEG coding standardization, FFT spectral analysis, DCT.

REFERENCE BOOKS:

1. DeFatta, D.J., Lucas, J.G. & Hodgkiss, W.S., "Digital Signal Processing", John Wiley & Sons
2. Proakis, J.G. & Manolakis, D.G., "Digital Signal Processing: Principles Algorithms and Applications", Pearson Education
3. Cuc, Roman.'Introduction to Digital Signal Processing' BSP,Hyderabad

TCS507: CONCEPTS OF PROGRAMMING AND OOPS

UNIT 1

UTILIZATION: Developer fundamentals such as editor, integrated programming environment, UNIX shell, modules, libraries.

PROGRAMMING FEATURES: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O.

APPLICATIONS: Sample problems in engineering, science, text processing, and numerical methods.

UNIT 2

PROBLEM SOLVING WITH ALGORITHMS- Programming styles – Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies – Software development Models, User interface Design – introduction – The process – Elements of UI design & reports.

UNIT 3

OBJECTED ORIENTED CONCEPTS – object oriented programming, UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism, Object Oriented Design methodology - Common Base class, Alice Tool – Application of OOC using Alice tool.

UNIT 4

RDBMS- DATA PROCESSING – the database technology – data models, ER modeling concept – notations – Extended ER features, Logical database design – normalization, SQL – DDL statements – DML statements – DCL statements, Writing Simple queries – SQL Tuning techniques – Embedded SQL – OLTP

1. Thinking in C++ 2nd Edition by Bruce Eckel
2. G. Dromey, How to Solve It by Computer, Pearson Education
3. Shukla.'OOPs Programming, Wiley India
4. Let Us C. Yashwant Kanetkar. Allied Publishers, 1998.
5. Seed Graham.'An Introduction to OOPs with C++, BSP,Hyderabad

PEE551: EMEC-II Lab

Note: The minimum 8 experiments are to be performed from the following, out of which there should be at least two software based experiments.

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
(i) Torque -speed characteristics
(ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by Keeping V/f ratio constant

5. To study speed control of three phase induction motor by varying supply voltage.
6. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
7. To determine V-curves and inverted V-curves of a three phase synchronous motor.
8. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.
9. To study synchronization of an alternator with the infinite bus by using:
(i) dark lamp method (ii) two bright and one dark lamp method

Software based experiments (Develop Computer Program in 'C' language or use MATLAB or other commercial software)

10. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
11. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
12. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
13. Draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
14. To determine steady state performance of a three phase induction motor using equivalent circuit.

PEE553: APPLIED INSTRUMENTATION LAB

Note: Minimum ten experiments should be performed from the following

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
[28]
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers

10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer
13. Study of data acquisition system using "**labview**" software and test all signal points
14. Measurement of sine, triangular ,square wave signal of function generator and verify its frequency at 100 Hz tap point using "**labview**" software.
15. Measurement of voltage and current signal of programmable power supply using **Labview** GPIB interface.

Note :- Three more software based experiments may be added in place of experiments nos. 13 to 15.at the institute level.

PCS557: CONCEPTS OF PROGRAMMING & OOPS LAB.

Students should implement the following during Practical hours: (illustrative only)

1. Programs using C++ Language
2. Queries using MY-SQL
   (For 1 & 2, The Source: Campus connect portal)

3. Using Alice Tool :
   a. Write a method for an Alice object
   b. Condition Construct
   c. Repetition Construct
4. Group Project

Sl. No	Course	S/W on Students Machine	Remarks
1.	Programming Fundamentals	Visual Studio .NET (2003), Turbo C	Alternate: Visual Studio 6
2.	RDBMS	My-SQL	Alternate: Oracle 9i Client

The purpose of 1hour(s) tutorial per week is to help slow learning students bring upto speed all the students. The assignments for CHSSC, Programming Fundamentals, and Relational Data base Management System will be given by the instructor which is to be completed as a part of Tutorial.

TEE601: POWER SYSTEM ANALYSIS

Unit I:

Representation of power system components:

Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit system.

Symmetrical Components:

Symmetrical components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machines, internal voltage of loaded machines under transient conditions.

Unit II:

Analysis of single line to ground fault, line to line fault and double line to ground fault on an unloaded generator and power system network with and without fault impedance.
Formation of Z_{bus} using singular transformation and algorithm, computer method for short circuit calculations.

Unit III:
Load flows:
Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphon method, approximation to N-R method, line flow equation and fast decoupled method.

Unit IV:
Power system Stability:
Stability and stability limit, steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step by step method. Factors affecting steady sate and transient stability and methods of improvement.

Unit V:
Wave equation for uniform transmission lines, velocity propagation, surge impedance, reflection and transmission of traveling waves under different line loadings, Bewlay's Lattice diagram, protection of equipments and line against traveling waves.

Reference Books:

1. Kothari & Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill.
2. P S R Murthy." Power System Analaysis, BSP, Hyderabad
3. A.R. Bergen and V. Vittal, "Power System Analysis", Pearson Publication.
4. Stevenson." Elements of Power System Analysis. McGraw Hill Pub Co.,

TEE602: CONTROL SYSTEM

Unit I:
The Control System: Open loop & closed control; servomechanism, Physical examples.
Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit II:
Time Response analysis: Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices

Unit III:
Control System Components: Constructional and working concept of ac servomotor, synchros and stepper motor Stability and Algebraic Criteria concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations Root Locus Technique: The root locus concepts, construction of root loci

Unit IV:
Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles

Unit V:
Introduction to Design: The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain.

Reference Books:

1. Norman S. Nise, Control System Engineering 4th edition, Wiley Publishing Co.
2. Jagan, N C 'Control Systems, 2nd edn BSP, Hyderabad
3. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
4. . M.Gopal, "Control System; Principle and design", Tata McGraw Hill.

TEE603: POWER ELECTRONICS

Unit I:
Power semiconductor devices: Power semiconductor devices their symbols and static characteristic, characteristics and specifications of switches, type of power electronic circuits, Thyristor operation, V-I characteristic, two transistor model, methods of turn-on operation of GTO, MCT and TRIAC.

Unit II:
Power semiconductor devices (contd): protection of devices, series and parallel operation of thyristors, commutation techniques of thyristor.
DC-DC convertors: Principles of step-down chopper, step down chopper with R-L load, principle of step up chopper, and operation with R-L load, classification of choppers.

Unit III:
Phase controlled converters: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode, single phase fully controlled and half controlled bridge converters. Performance parameters, three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source inductance, single phase and three phase dual converters.

Unit IV:

AC Voltage controllers: Principle of on-off and phase controls, single phase ac voltage controller with resistive and inductive loads, three phase ac voltage controllers (various configuration and comparison).
Cyclo converters: Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation.

Unit V:
Inverters: Single phase series resonant inverter, single phase bridge inverters , three phase bridge inverters, introduction to 120^0 & 180^0 mode of operation, voltage control of inverters, harmonics reduction techniques, single phase and three phase current source inverters.

Reference Books:

1. 1.P.S. Bimbhra, "Power Electronics" Khanna Publication
2.Aggarwal. J P "Power Electronics" Pearson Education
3.Umanand." Power Electronics'Wiley India.

TEE604: ELECTRICAL MACHINE DESIGN

Unit I: General Considerations
Basic Concept of design, limitation in design, standardization, modern trends, in design of electrical manufacturing techniques, classification of insulating materials, Modes of heat dissipation & temperature rise-time curves. Methods of cooling ventilation (induced & forced, radial & axial), direct cooling & quantity of cooling medium. Calculation of total mmf and magnetizing current. Specific permeance and leakage reactance.

Unit II: Transformer Design
Output equation, design of core, yoke and windings, overall dimensions, computation of no load current, voltage regulation and design of cooling systems.

Unit III: Elements of rotating machine design:
Output equations of rotating machines, specific electrical & magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size. Core and armature design of dc and 3-phase ac machines.

Unit IV: Elements of rotating machine design (cont.):
Rotor design of three phase induction motors. Design of field system of DC machine and synchronous machines. Estimation of performance from design data.

Unit V: Computer aided design:
Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure. Flow charts for design of transformer, dc machines, three phase induction and synchronous machines.

Reference Books:

1. S.K. Sen, "Principle of electrical machines design" Oxford and IBH publications.
2. Ghosh, Samarjeet.' Electrical Machines' Pearson Education
3. Murthy, Vishnu.'Computer aided design for Electric Machines' BSP Hyderabad

TCS607: DATA STRUCTURES USING C++

UNIT 1

COMPLEXITY ANALYSIS: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

LINEAR LISTS: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

UNIT 2

STACKS AND QUEUES: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

UNIT 3

HASHING: Search efficiency in lists and skip lists, hashing as a search structure, hash table, collision avoidance, linear open addressing, chains, uses of hash tables in text compression, LZW algorithm.

UNIT 4

TREES: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heapsort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in mergesort as an external sorting algorithm, bin packing.

UNIT 5

GRAPHS: Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation – adjacency matrix and linked adjacency chains, graph traversal – breadth first and depth first, spanning trees.

Reference Books:

1.M. T. Goodrich and R. Tamassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, John Wiley & Sons, 2001.

2. Storer J A." An introduction to Data structures and Algorithms' Springer India/BSP
3. Wirth, N., "Algorithms and Data Structures", Pearson Education
4.A. Aho, J. E. Hopcroft and J. D. Ullman, *The Design and Analysis of Computer Algorithms*, Pearson Education

THU608: PRINCIPLES OF MANAGEMENT

UNIT 1

INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

UNIT 2
MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision making and MIS.

UNIT 3
PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation and merit rating.

UNIT 4

MOTIVATION AND PRODUCTIVITY: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies.

REFERNCE BOOKS

1. Peter Drucker, The Practice of Management.
2. Koontz: Essentials of Management, TMH, New Delhi.
3. Stoner: Management, Pearson Education
4. Daft: Principles of Management, Cengage Learning.
5 .A V Rau.' Management Science' BSP, Hyderabad
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PEE652: CONTROL SYSTEM LAB

Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output V/S input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study PID Controller for simulation proves like transportation lag.

Software based experiments (Use MATLAB, LABVIEW software etc.)

11. To determine time domain response of a second order system for step input and obtain performance parameters.
12. To convert transfer function of a system into state space form and vice-versa.
13. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' for stability.
14. To plot a Bode diagram of an open loop transfer function.
15. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

PEE653: POWER ELECTRONICS LAB

Note: The minimum of 10 experiments is to be performed out of which at least three should be software based.

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cyclo-converter
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
9. To study operation of IGBT/MOSFET chopper circuit
10. To study MOSFET/IGBT based single-phase series-resonant inverter.
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments(PSPICE/MATLAB)

12. To obtain simulation of SCR and GTO thyristor.
13. To obtain simulation of Power Transistor and IGBT.
14. To obtain simulation of single phase fully controlled bridge rectifier and draw load voltage and load current waveform for inductive load.
15. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
16. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in out put voltage and load current.

PCS657: DATA STRUCTURE USING C++ LAB.

Problems in **"C++"** using **Data Structures** involving arrays, stacks, queues, strings, linked lists, trees, graphs.

1) Using STACK to check matching left and right characters such as parantheses, curly braces and square brackets in a given string.
2) Single server queuing system and gathering statistics.
3) Operations on Stacks.
4) Sparse Matrices
5) Linear linked list implementation
6) Operations on Doubly Linked List and Circular List with a test application
7) Operations on Ordered Binary Trees.
8) Graph Traversal Techniques
9) Implementation of Quicksort, Mergesort and Heapsort
10) Operations on Binary Trees
11) Shortest Path Problem

S No	Course No	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Semester: VII										
Theory										
1	TEE701	Switch Gear and Protection	3	1	0	30	20	50	100	150
2	TEE702	ANN & Fuzzy Logic	3	1	0	30	20	50	100	150
3	TEE703	FACTS Devices	3	1	0	30	20	50	100	150
4		Elective-1	3	1	0	30	20	50	100	150
5		Open Elective	3	1	0	30	20	50	100	150
Practical/Design										
1	PEE751	Power System Lab	0	0	2	0	0	25	25	50
2	PEE753	FACTs Lab using MATLAB	0	0	2	0	0	25	25	50
3	PEE754	Industrial Training Seminar	0	0	2	0	0	25	25	50
4	PEE755	Project	0	0	2	0	0	50	50	100

Semester: VIII

Theory										
1	TEE801	Electric Drives	3	1	0	30	20	50	100	150
2	TEE802	Power Station Practice	3	1	0	30	20	50	100	150
3		Elective-2	3	1	0	30	20	50	100	150
4		Elective-3	3	1	0	30	20	50	100	150
Practical/Design										
1	PEE851	Electric Drive Lab	0	0	2	0	0	25	25	50
2	PEE853	Project	0	0	2	0	0	100	200	300
3	DIS850	Discipline	0	0	2	0	0	0	50	50

LIST OF ELECTIVE – I

TEE 011: Utilization of Electrical Energy and Traction

TEE 012: Digital Control System
TEE 013: SCADA & Energy Management System
TEE 014: Special Electrical Machines

LIST OF ELECTIVE – II

TEE 021: Modern Control System
TEE 022: Bio-Medical Instrumentation
TEE 023: Power Plant Engineering
TEE 024: High Voltage Engineering

LIST OF ELECTIVE – III

TEE 031: Power Quality Improvement Techniques
TEE 032: Power Converter Application
TEE 033: EHV AC & DC TRANSMISSION
TEC 034: Telemetry and Data Transmission

TEE701: SWITCHGEAR AND PROTECTION

Unit I:
Introduction to power system:

Introduction to protective system and its elements, function of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays:

Electromagnetic, attraction and induction type relays, thermal relay, gas actuated relay.

Unit II:

Relay Applications and characteristics:

Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relays.

Static relays:

Comparison with electromagnetic relays, classification and their description, over current relays, directional relays, distance relays, differential relays.

Unit III:

Protection of transmission line:

Time graded protection, differential and distance protection of feeders, choice between impedance, reactance and MHO relays, Elementary idea about carrier current protection of lines, protection of bus, auto reclosing, pilot wire protection.

Unit IV:

Circuit Braking:

Arc phenomenon, properties of arc, arc extinction theories, recovery voltage and restriking voltage, current chopping, resistance switching, capacitance current interruption, circuit breaker ratings.

Testing of circuit breakers:

Classification, testing station & equipments, testing procedure, direct and indirect testing.

Unit V:

Apparatus protection:

Types of faults on alternator, stator and rotor protection, negative sequence protection, loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, isolated neutral system, grounded neutral system and selection of neutral grounding.

Circuit breakers:

Need of circuit breakers, types of circuit breakers, operating modes, principles of construction, details of Air Blast, Bulk Oil, Minimum Oil, SF6, Vacuum Circuit Breakers, DC circuit breakers.

TEE702: ANN AND FUZZY LOGIC

Unit-I

Neural Networks-1(Introduction & Architecture): Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory

Unit-II

Neural Networks-II (Back propogation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propogation algorithm, factors affecting back propagation training, applications.

Unit-III

Fuzzy Logic-I (Introduction) : Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory versus probability theory, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV

Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzifications, Fuzzy Controller,

Unit-V

Application of Neural Network and Fuzzy logic: Application of neural network, case study, Inverted pendulum, Image processing. Introduction to neuro & fuzzy logic controller.

TEE703: FACTS DEVICES

Unit I:
FACTS: Concept, power flow and stability, basic theory of line compensation
Power Electronic Controllers: Review of PWM voltage source inverters used in FACTS, classifications of FACTS controllers.

Unit II:
Static Shunt Compensators: SVC and STATCOM - TCR, TSC, system stability.
Static Series Compensators: GCSC, TSSC, TCSC and SSSC, control techniques.

Unit III:
Static Voltage and Phase Angle Regulators: Power flow control, TCVR and TCPAR.
Unified Power Flow Controller (UPFC): Concept of power flow control, operation and control of UPFC, Interline Power Flow Controller.

Unit IV:
Stability Analysis: Modeling of FACTS devices, optimization of FACTS, transient and dynamic stability enhancement

Unit V:
Applications of FACTS controller: Principle of control of FACTS in HVDC links, co- ordination of FACTS devices with HVDC links, case study.
Advanced FACTS devices.

Books:

1. Song Y. H. and Johns A. T., "Flexible AC Transmission Systems (FACTS)", IEE Press.
2. Hingorani N. G. and Gyugyi L., "Understanding FACTS", IEEE Press, Standard Publishers Distributors.
3. Ghosh A. and Ledwich G., "Power Quality Enhancement Using Custom Power Devices," Kluwer Academic Publishers.
4. Mathur R. M. and Varma R. K., "Thyristor – Based FACTS Controllers for Electrical Transmission Systems," John Wiley and Sons.
5. Padiyar K. R., "FACTS Controller in Power Transmission and Distribution", New Age International Private Limited.
6. Miller T. J. E., "Reactive Power Control in Electric Systems," Wiley-Interscience.

TEE011: UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

Unit I: Electric Heating
Advantage & methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating,

Unit II: Electric Welding
Electric arc welding, electric resistance welding, Electric Welding control, Electrolyte Process: Principal of Electro deposition, laws of Electrolysis, application Electrolysis.

Unit No III: Illumination
Various definition, laws of Illumination, requirement of good lighting, Design of indoor lighting & outdoor lighting system.
Refrigeration and Air Conditioning
Refrigeration system, domestic Refrigerator, water cooler, Types of Air conditioning, Window air Conditioner

Unit IV: Electric Traction – I
Types of electric traction, system of track electrification, Traction mechanics-types of services, speed time curve and its simplification, average and schedule speeds, Tractive effort specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

Unit V: Electric Traction – II
Salient features of traction drives, Series-parallel control of dc traction drives (bridge traction) and energy saving, Power Electronic control of dc & ac traction drives, Diesel electric traction.

.

TEE012: DIGITAL CONTROL SYSTEMS

Unit I: Signal Processing in Digital Control
Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method.

Unit II: Design of Digital Control Algorithms
Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

Unit III: State Space Analysis and Design
State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.

Unit IV: Stability of Discrete System
Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method.

Unit: V Optimal digital control
Discrete Euler Lagrange equation, max. min. principle, otpimality & Dynamic programming, Different types of problem and their solutions.

Reference Books:

1. J.R.Leigh, "Applied Digital Control", Prentice Hall, International
2. C.H. Houpis and G.B.Lamont, "Digital Control Systems: Theory, hardware, Software", Mc Graw Hill.
1. B.C.Kuo, "Digital Control System", Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

TEE013: SCADA & ENERGY MANAGEMENT

Unit I: SCADA

Purpose and necessity, general structure, data acquisition, transmission & monitoring, general power system hierarchical structure., Overview of the methods of data acquisition systems, commonly acquired data, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites.

Unit II: Supervisory and Control Functions

Data acquisitions, status indications, majored values, energy values, monitoring, alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc., Regulatory functions: Set points and feed back loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.

Unit III: MAN- Machine Communication

Operator consoles and VDUs, displays, operator dialogues, alarm and event, loggers, mimics diagrams, report and printing facilities.

Unit IV: Data basis

SCADA, EMS and network data basis, SCADA system structure - local system, communication system and central, system. Configuration- NON-redundant- single processor, redundant dual Processor, multi control centers, system configuration. Performance considerations: real time operation system requirements, modularization of software programming languages.

Unit V: Energy Management Center

Functions performed at a centralized management center, production control and Load management economic dispatch, distributed centers and power pool management.

Reference Books:

1. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
2. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th Edition.

1. Torsten Cergrell, “Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis", Prentice Hall of India

TEE014: SPECIAL ELECTRICAL MACHINES

UNIT-I

Poly-phase AC Machines:

Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power)

UNIT-II

Single phase Induction Motors:

Construction, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor start, capacitor-run and shaded pole motors.

Two Phase AC Servomotors:

Construction, torque-speed characteristics, performance and applications.

UNIT-III

Stepper Motors:

Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.

Switched Reluctance Motors:

Construction; principle of operation; torque production, modes of operation, drive circuits.

UNIT-IV

Permanent Magnet Machines:

Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators.

UNIT-V

Single Phase Commutator Motors:

Construction, principle of operation, characteristics of universal and repulsion motors ; Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Reference Books:

2. P.C. Sen “ Principles of Electrical Machines and Power Electronics” John willey & Sons, 2001

3. G.K.Dubey “Fundamentals of Electric Drives” Narosa Publishing House, 2001
4. Cyril G. Veinott “Fractional and Sub-fractional horse power electric motors” McGraw Hill International, 1987

PEE751: POWER SYSTEM LAB

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

1. To determine direct axis reactance (x_d) and quadrature axis reactance (x_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (x_d) and sub transient quadrature axis reactance (x_q) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

Simulation Based Experiments (using MATLAB or any other software)

11. To determine transmission line performance.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To obtain formation of Y-bus and perform load flow analysis
14. To perform symmetrical fault analysis in a power system
15. To perform unsymmetrical fault analysis in a power system

PEE753: FACTS LAB USING MATLAB

Note: - A student must perform at least minimum 10 experiments out of the following list

1. Simulation for performance of uncompensated transmission line
2. Simulations for performance of mid -point shunt compensated transmission line
3. Simulation for performance of series compensated transmission line
4. Simulation of a transmission line with a FC-TCR at receiving end with firing control
5. Simulation of transmission line with a SVC at receiving end with firing control
6. Simulation of transmission line with a TCSC with firing control scheme
7. Simulation of PWM voltage source inverter.
8. Simulation of transmission line with a UPFC controller
9. Simulation of transmission line with a Interline Power flow controller
10. System stability analysis for 3 bus system using both TCR and TSC
11. Comparison in performance of TSSC and SSSC used for series compensation of transmission of line
12. Comparison between TCR and TCS used for shunt compensation of transmission of line
13. Simulation of TCPAR used for phase angle and voltage control in case of a transmission line

TEE801: ELECTRIC DRIVES

Unit I: Fundamentals of Electric Drive:
Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torque conventions and multi-quadrant operations, Constant torque and constant power operation, Types of load, Load torque: components, nature and classification

Unit II: Dynamics of Electric Drive:
Dynamics of motor-load combination; Steady state stability of Electric Drive; Transient stability of electric Drive
Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization

Unit III: Electric Braking:
Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors. Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

Unit IV: Power Electronic Control of DC Drives
Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only); dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Chopper control of separately excited dc motor and dc series motor.

Unit V: Power Electronic Control of AC Drives
Three Phase induction Motor Drive, Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo- converter based) static rotor resistance and slip power recovery control schemes.
Special Drives
Switched Reluctance motor, Brushless dc motor.

Reference Books:

1. M.Chilkin, “Electric Drives”, Mir Publishers, Moscow.
2. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
3. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd
4. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill

TEE802: POWER STATION PRACTICE

Unit I: Economics of generation

Load curve, load duration curve, Types of loads, load factor, capacity factor, diversity factor etc. Base & peak load stations, captive power plants, operating & spinning reserves. Load forecasting, site selection of different types of plants.

Unit II: Tariff and Power factor improvement

Electric utility services, General tariff forms and different types of tariffs, max demand indicators and recorders. Causes and effects of low power factor, Necessity of power factor improvements and use of power factor improvements devices.

Unit III: Coordinated operation of power plants

Advantages of coordinated operation of different types of power plants, hydro –therml scheduling, short term and long term steam plant coordination with run off river, dam storage, pumped storage and gas turbine plants.

Unit IV: Diesel gas turbine and MHD generators.

Field of application of diesel and gas turbine plants. Principle of working and main components, cooling of MHD generators, open and closed combined cycle operation, Types of MHD generators, advantages and problems, future trends.

Unit V: Power Station auxiliaries

Governors for hydro and thermal generators, excitation system. Auto voltage regulators (AVR).Busbar arrangements, Battery charger, Nuclear fuel processing and waste handling.

Books recommended

1. B.R. Gupta ‘Generation of electric energy’ (Eurasia publishing house; Delhi)
2. M.V. Desbrfiranote ‘Elements of power station design’ (wheeler Publishing houses)

TEE021: MODERN CONTROL SYSTEM

Unit I: Introduction to control systems
Introduction to control systems, properties of signals and systems. Convolution integral, Ordinary differential equation, Transfer function, Pole zero concepts, effect of pole location on performance specification.

Unit II: State Space analysis
State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Solution of state equation, concepts of controllability, observability, Controllability and Observability tests.

Unit III: Discrete time control systems
Sampling theorem, Sampled-data systems, the sample and hold element, pulse transfer function, The Z-transform, stability analysis.

Unit IV: Stability
Liapunov's method, generation of Liapunov's function, Popov's criteria, design of state observers and controllers, adaptive control systems, model reference.

Unit V: Optimal Control
Introduction , formation of optimal control problems, calculus of variation, minimization of functions, constrained optimization, dynamic programming, performance index , optimality principles, Hamilton – Jacobian equation, linear quadratic problem, Ricatti II equation and its solution, solution of two point boundary value problem

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
2. M. Gopal, "Modern Control System", Wiley Eastern.
1. B.D.O. Anderson and IB. Moore, " Optimal Control System: Linear Quadratic Methods", Prenctice Hall International.
2. U. Itkis, "Control System of Variable Structure", John Wiley and Sons.
3. H. Kwakemaok and R. Sivan, "Linear Optimal Control System", Wiley Interscience.

TEE022: BIO –MEDICAL INSTRUMENTATION

Unit I: Basic Physiological system of body
Problem encountering measuring leaving system, bioelectric potential, biomaterial, Basic transducers principle, Active and passive transducers, transducer for biomedical applications, Generation, propagation and distribution of bioelectric potential (ECG, EEG and EMG)

Unit II: Bio Potential Electrode
Basic type (micro skin surface and needle electrodes), Biochemical transducer (PH, blood gas and specification electrodes), Cardiovascular System & Measurement, Heat and cardiovascular system and circulation block diagram blood pressure and, measurement, characteristics of blood flow and heart sound, Electrocardiography, ECG an lead, configuration, ECG recording and their types

Unit III: Nervous System
The anatomy of nervous system, neuronal communication, EPSP, IPSP, Organization of brain, Measurement from the nervous system, Systematic skin and body temperature measurement, Temperature measurement, Brief idea about ultrasonic measurements

Unit IV: Patient Care Monitoring
Element of intensive care, Organizational the hospital fore patient-care monitoring, Pace makers-type, systems, mode and generators, Defibrillator-types.Biotelemetry and application of telemeter inpatient care

Unit V: Automation of Chemical Test
Instrumentation for diagnostic X rays, Interfacing computer with medical instrumentation and other equipments, Bio medical computer application. Shock hazards from electrical equipments, methods of accident prevention.

Reference Books:

1. Cromwell- Biomedical Instrumentation and Measurements- PHI
2. Webster, J.G. –Bio- Instrumentation, Wiley (2004)
4. Carr & Brown –Introduction to Biomedical Equipment Technology – Pearson
5. Pandey & Kumar-Biomedical Electronics and Instrumentation. - Kataria

TEE023: POWER PLANT ENGINEERING

UNIT 1

INTRODUCTION : Piping and instrumentation diagram of a thermal power plant, basic process on a boiler, Fuel measurement- review of pressure and temperature measurement steam and water flow measurement – instrument applications in power stations: review of indicating and recording instrument applications in power stations: review of indicating and recording instruments, water level gauge for boiler drums, closed circuit television instrument, gas analysis meters, smoke instruments, dust monitor-measurement of impurities in feed water and steam generator coolant controls and instruments, instrument maintenance aspects.

UNIT 2

BOILER CONTROL-I: Boiler control objectives-combustion of fuels (gaseous liquid, and solid), excess air, combustion chemistry and products of combustion, requirement for excess combustion, air-circulation of efficiency of boiler: input/output method-stream temperature control systems super heaters and de-superheaters.

UNIT 3

BOILER CONTROL-II: Feed water supply and boiler water circulation system-drum level control systems-boiler draft systems-measurement and control of furnace draft measurement and control of combustion-draft and air flow control related functions.

UNIT 4

FLUE GAS ANALYSIS TRIMMING OF COMBUSTION CONTROL SYSTEMS :

Combustion control for liquid and gaseous fuel boilers coal or solid fuel strokes combustion control for stoker-fired boilers- pulverised coal-fired boilers. Turbine monitoring and control: speed, vibration, shell temperature monitoring.

UNIT 5

NUCLEAR POWER PLANT INSTRUMENTATION: Piping and instrumentation diagram of different types of nuclear power plants-radiation detection instruments process sensors for nuclear power plants-spectrum analyzers-nuclear reactor control systems and allied instrumentation.

REFERENCE BOOKS:

1. B.G.Liptak, Instrumentation in process industries, Vol. I and II, Chilton books co, 1973.
2. Sam G. Dukelow. The control of boilers, Instrument Society of America press.
1. A.Sherryet. Al. (Editors), Modern power station practice, Vol.6 (Instrumentation controls and testing), Pergamon Press, 1971.

TEE024: HIGH VOLTAGE ENGINEERING

Unit I:

Break Down In Gases

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, breakdown in non- uniform field, breakdown in vacuum.

Break Down In Liquid Dielectrics

Classification of liquid dielectric, characteristics of liquid dielectric, breakdown in pure liquid and commercial liquid.

Break Down In Solid Dielectric

Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

Unit II: Generation of High Voltage and Currents

Generation of High direct Current Voltage, Generation of high voltage alternating voltages, generation of impulse voltages generation of impulse currents, tripping and control of impulse generators.

Unit III: Measurement of High Voltage and Currents

Measurement of High direct Current Voltages, Measurement of High alternating & Impulse voltages, Measurement of High direct, alternating & Impulse Currents, Cathode ray Oscillographs for impulse voltage and current measurements.

Unit IV: Over Voltage Phenomenon & insulation Coordination:

Lighting Phenomenon as natural cause for over voltage, over voltage due to switching surges and abnormal conditions, Principal of insulation coordination.

Unit V: Non -Destructive Testing

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements.

High voltage testing

Testing of insulator & bushing, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Reference books:

1. E Kuffel and W.S.Zacngal , High voltage Engineering:, Pergamum Press
4. C.L. Wadhwa,"High Voltage Engineering", Wiley Eastern Ltd.
5. M.Khalifa," High Voltage Engineering theory and practice, "Marcel Dekker.
6. Subir Ray." An Introduction to High Voltage Engineering" Prentice Hall of India.

TEE031: POWER QUALITY IMPROVEMENT TECHNIQUE

Unit I: Power Quality Terms and Definitions
Introduction, transients, sag and swell, short duration/long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation.
Power Quality Problems:
Poor load power factor, loads containing harmonics, notching in load voltage, DC offset in loads, unbalanced loads, disturbance in supply voltage.
Unit II: Fundamentals of Harmonics: Representation of harmonics, waveform, harmonic power, measures of harmonic distortion; current and voltage limits of harmonic distortion: IEEE, IEC, EN, NORSOK
Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace, TV and battery charger.

Unit III: Effect of Harmonics: Parallel and series resonance, effect of harmonics on static power plant-transmission lines, transformers, capacitor banks, rotating machines, harmonic interference with ripple control systems, power system protection, consumer equipments and communication systems, power measurement.
.
Unit IV: Elimination/Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections (Delta, polygon)
Passive Filters: Types of passive filters, single tuned and high pass filters, filer design criteria, double tuned filters, damped filters and their design.

Unit V: Active Power filters: Compensation principle, classification of active filters by objective, systems configuration, power circuit and control strategy.
Shunt Active Filter: Single phase active filter, principle of operation, expression for compensating current, concept of constant capacitor voltage control; Three phase active filter: Operation, analysis and modeling; Instantaneous racavitve power theory
Three phase series active filters: Principle of operation, analysis and modeling.
Other Techniques: Unified power quality conditioner, voltage source and current configurations, principle of operation for sag, swell and flicker control.

. **Reference books:**

1. Roger C.Dugan, Mark F. Mc Granhgan, Surya Santoso," Electrical Power System Quality"Mc Graw hill, 2nd Edition.
2. Arindam Ghosh and Gerard Ledwich,"Power Quality Enhancement using custom power devices ", Kulwer academic publishers.
l.
1. C. Sankarm,"Power Quality" CRC Press USA.
3. Wilson E. Kazibwe,"Electrical power quality controls techniques" Van Nostrand Reinhold.

TEE032: POWER CONVERTER APPLICATIONS

Unit I: HVDC Transmission
Schematic diagram; modes of operation, twelve pulse line commutated converters, effect of source inductance; control of HVDC converters, converter faults and protection, harmonic filters

Unit II: FACT Controllers
Principal of power transmission, principal of shunt compensation- and series compensation-TCR, TCS, SVC, STATCOM, Series compensator- TSSC, FCSC, TCSC, SSVC, phase angle compensator, unified power flow controller (UPFC), comparison of compensator
.

Unit III: Power Supplies
Desirable specification of power supply, draw back of linear power supply. Switch mode power supply (SMPS)-schematic diagram, fly back converters, forward converter, push pull converters, half bridge and full bridge converter; uninterruptible power supply,(UPS)-configuration of line and online UPS, switch mode and resonant power supplies, air craft power supply.

Unit IV: Industrial Applications
High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electric welding control.

Unit V:
Interconnection of Renewable Energy Sources to the Utility Grid, Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage system, DC circuit breaker, single phase and three phase ac switches, Excitation control of synchronous generator.

Reference Books:

1. Ned Mohan, T.M. Undeland and William P. Robins, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons.
2. M.H. Rashid, “Power Electronics: Circuits, Devices and Applications” Prentice Hall of India.
3. K.R. Padiyar, “HVDC Power Transmission: Technology and System Reactions” New Age International

TEE033: EHV A.C. & D.C. TRANSMISSION

Unit I: Introduction
Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC & DC transmission.

Unit II: EHV AC Transmission
Corona loss formulas, corona current, audible noise- generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system.

Unit III: Extra High Voltage Testing
Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines, Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

Unit IV: EHV DC Transmission-I
Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters, principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

Unit V: EHV DC Transmission- II
Converter faults, protection against over currents and over voltage, Smoothing reactors, generation of harmonics, ac and dc filters, multi –terminal dc systems (MTDC): Types, control, protection and application

Reference books:

3. J Arrillaga,"High Voltage Direct current Transmission "IFFE Power Engineering Series 6, Peter Peregrionus Ltd. London.
4. M.S Naidu & V.K Kamaraju "High Voltage Engineering "Tata Mc Graw Hill.
5. M.H Rashid,"Power Electronics: Circuit, Devices and Applications "Prentice hall of India.

TEC034: TELEMETRY AND DATA TRANSMISSION

Unit-1.

Sampling Fundamentals:

Introduction to sampling theorem and sampling process, convolution, computing minimum sampling rate. Alising Errors.

Digital Modulation Techniques:

Review of PCM, DPCM, Methods of binary data transmission, Data Formats, DM code converters, PSK, QPSK, FSK, probability of error, phase ambiguity resolution and differential encoding, error detection, error correction, error correction codes.

Unit- 2 & 3

Data Handling System:

Block schematic, Sensors, Signal conditioners, Multiplexing- high level and low level, ADC- range and resolution, Word Format, Frame format, Frame synchronizer codes, R. F. links, X24, RS 422, RS423, RS 232C interfaces, Multi terminal configuration, Multiplier & Concentrator, Data Modems, Data transmission over telephone lines.

Data Reception Systems:

Bit synchronizers, frame synchronizers, subframe synchronizers, PLL, Display systems.

Unit-4

Remote Control:

Communication based processing control systems, pipelines, Operational security systems components, Pipeline control, Power system control, Programmable controllers for factory automation.

Command:

Tone command system, Tone digital command system, ON/OFF command and data commands.

Unit-5

Aerospace Telemetry:

Signal formation and conversion, Multiplexing techniques in telecontrol, Industrial telecontrol installations, reliability in telecontrol installations.

Text Books:

1. Patranabis," Telemetry Principles: Tata Mcgrew Hill.
2. Schweber," Data Communication " Mcgraw Hill.
3. Berder & Menjewlse," Telemetry Systems".

PEE851: ELECTRIC DRIVES LAB

Note: - Minimum 10 experiments are to be performed from the following out of which at least three should be simulation based.

1. To study speed control of separately excited dc motor by varying armature voltage using single-phase fully controlled bridge converter.
2. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.
3. To study speed control of separately excited dc motor using single phase dual converter (Static Ward-Leonard Control)
4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper
5. To study closed loop control of separately excited dc motor
6. To study speed control of single phase induction motor using single phase ac voltage controller.
7. To study speed control of three phase induction motor using three phase ac voltage controller
8. To study speed control of three phase induction motor using three phase current source inverter
9. To study speed control of three phase induction motor using three phase voltage source inverter
10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper
11. To study speed control of three phase slip ring induction motor using static scherbius slip power recovery control scheme

Simulation Based Experiments (using MATLAB or any other software)

12. To study starting transient response of separately excited dc motor
13. To study speed control of separately excited dc motor using single phase fully / half controlled bridge converter in discontinuous and continuous current modes.
14. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.
15. To study starting transient response of three phase induction motor
16. To study speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.