Uttarakhand Technical University

Program: **B.Tech, Electrical & Electronics Engineering (EEE)**

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	EMFT	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	TEC502	Digital Signal Processing	3	1	0	30	20	50	100	150
5	TEC503	VLSI Technology	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	PEE553	Applied Instrumentation Lab	0	0	2	0	0	25	25	50
2	PEC552	Digital Signal Processing 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	TEC602	VLSI Circuit 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	Principle of Management	2	1	0	15	10	25	50	75
Practical/Design										
1	PEE652	Control System	0	0	2	0	0	25	25	50
2	PEE653	Power Electronics	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

TEC-501: ELECTROMAGNETIC FIELD THEORY

Unit-I:
Review of Vector analysis, Rectangular, Cylindrical and Spherical Coordinates and their transformation, gradient and cvrv in different coordinate systems. Electric field intensity, Electric Flux density, Energy and potential.

Unit-II:
Current and conductors, Diclectrics and capacitance, Poission's and Laplace's equation.

Unit-III:
Steady magnetic field, magnetic forces, materials and inductance, Time varying field and Maxwell's equation.

Unit-IV: Uniform plane waves, plane wave reflection and dispersion.

Unit-V: Transmission Lines and guided waves

Reference Books

2. Ramo S, Whinnery T.R and Vanduzer T, Field and Waves in Communication Electronics' John Wiely and Sons Third Ed.
1. Hyat, W.H. and Buck, J.A. "Engineering Electromagnetics" Tata McGraw Hill Publishing Co. Ltd. , New Delhi Seventh Ed.
2. G. S. N. Raju "Electromagnetic Field Theory and transmission lines", Pearson Edu.

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. Nagrath I. J. and Gopal M., "Control System Engineering", 5th Ed., New Age International Private Limited Publishers.
2. Kuo B. C., "Automatic Control Systems", 8th Ed., Wiley India.
3. Ogata K., "Modern Control Engineering", 4th Ed., 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., Prentice Hall of India Private Limited.
2. Cooper W. D. and Helfrick A. D, "Modern Electronic Instrumentation and Measurement Techniques", Pearson Education.

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. Proakis, J.G. & Manolakis, D.G., "Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall (India).

1. Sanjit K. Mitra, "Digital Signal Processing", Third Edition, TMH, 2005
2. Oppenheim A.V. & Schafer, Ronald W., "Digital Signal Processing", Pearson Education.
3. DeFatta, D.J., Lucas, J.G. & Hodgkiss, W.S., "Digital Signal Processing", John Wiley & Sons

TEC503: VLSI TECHNOLOGY

UNIT 1.

Introductin to VLSI Technology: Classification if ICs, Scale of integration, semiconductor and hybrid ICs Features of ICs,

CRYSTAL GROWTH: monolithic and hybrid ICs, crystal growth**,** Czochralski technique of crystal growth, wafer preparation and specifications, testing, measurements of parameters of crystals, Fabrication steps,

OXIDATION: Theory of growth of Silicon di oxide layer, calculation of SiO_2 thickness and oxidation kinetics, Dry wet and high pressure oxidation, plasma oxidation, properties of oxidation, defects induced due to oxidation.

UNIT 2.

EPITAXIAL PROCESS: Epitaxy and its concept, Growth kinetics of epitaxy, epitaxial growth, Low-temperature epitaxy, Si-epitaxy- growth chemistry of Si epitaxial layer, autodoping apparatus for epitaxial layer, apparatus for epitaxy, MBE system

DIFFUSION PROCESS: Diffusion models of solid, Ficks theory of diffusion, Solution of Fick`s law, diffusion parameters measurements schemes, Ion implantation- Scattering phenomenon, range theory, channeling, implantation damage, ion-implantation systems, Annealing

UNIT 3

LITHOGRAPHY: photolithography and pattern transfer, Optical and non optical lithigraphy, electron, X-ray and ion-beam lithography, contact/proximity and projection printers, alignment.

Photoresist and ETCHING:Types of photoresist, polymer and materials, Etching- Dry & Wet etching, basic regimes of plasma etching, reactive ion etching and its damages, lift-off, and sputter etching.

UNIT 4

METALLIZATION: Applications and choices, physical vapor deposition, patterning, problem areas.

VLSI PROCESS INTEGRATION: PMOS,NMOS and CMOS IC technology, MOS memory IC technology, bipolar IC fabrication.

UNIT 5

ASSEMBLY TECHNIQUE AND PACKAGING: Package types, packaging design consideration, VLSI assembly technologies.

YIELD AND RELIABILITY: Yield loss in VLSI, yield loss modeling, reliability requirements, accelerated testing.

SUGGESTED BOOKS:

1. S.M. Sze (Ed.) / VLSI Technology / M Hill. 1988.
2. R. K. SINGH /VLSI (Technology, Design & Basic Of Micro Elec.), Kataria & Sons
3. Microelectronic Circuits International Student Edition by Sedra / Smith

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

THER REFERENCES (Not required reading):

1. Thinking in C++ 2nd Edition by Bruce Eckel(available online)
2. G. Dromey, How to Solve It by Computer, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982.
3. The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.

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.

PEC552: DIGITAL SIGNAL PROCESSING LAB

1. Sampling & Waveform Generation, Quantization
2. PCM Encoding
3. Delta Modulation
4. Digital Modulation Schemes (ASK, PSK, FSK)
5. DFT Computation.
6. Fast Fourier Transform.
7. FIR Filter implementation, IIR Filter implementation.
8. Computational Experiments with Digital bank of Filters
9. Echo Cancellation generation and Filters implementation

NOTE: The institution can add 2 more practical in above prescribed list.

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. L.P. Singh, "Advanced Power System Analysis & Dynamics", New Age International
2. Hadi Sadat, "Power System Analysis", Tata Mc Graw Hill.
3. A.R. Bergen and V. Vittal, "Power System Analysis", Pearson Publication.

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. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
2. M.Gopal, "Control System; Principle and design", Tata McGraw Hill.
3. M.Gopal," Modern Control system", Tata McGraw Hill.
4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

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. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
2. A. Chakrabarti, Rai & Co. " Fundamental of Power Electronics & Drives" Ghanpat Rai & Co.
3. K. Hari Babu, "Power Electroncis" Switch Publications.

TEC602: VLSI CIRCUIT DESIGN

UNIT 1

REVIEW: Current conduction in MOSFET, Electrical Properties of MOS and BiCMOS, The Pass Transistor, CMOS.

UNIT 2

CMOS Inverter: Static CMOS inverter, layout, switching threshold and noise margin concepts and their evaluation, dynamic behavior, power consumption.

NMOS MOS pass transistor inverter.

COMBINATIONAL LOGIC: Static CMOS design, rationed logic, pass transistor logic, dynamic logic, cascading dynamic gates, CMOS transmission gate logic.

UNIT 3

SEQUENTIAL LOGIC: Static latches and registers, bi-stability principle, MUX based latches, static SR flip-flops, master-slave edge-triggered register, dynamic latches and registers, concept of pipelining, Timing issues.

UNIT 4

MEMORY AND ARRAY STRUCTURE: ROM, RAM, peripheral circuitry, memory reliability and yield, SRAM and DRAM design, flash memory, PLA,PAL, FPGA.

UNIT 5

DESIGN FOR TESTABILITY: Logic Testing, sequential Logic Testing, Guidelines to be adopted in Design for Test, Scan Designing Techniques, Built-In self Test (BIST)Techniques.

SUGGESTED BOOKS:

1. Basic VLSI Design by D.A. Pucknell & Eshraghian (PHI)
2. Modern VLSI Design Systems on Silicon by Wayne Wolf (Pearson Pub.)
3. R. K. Singh « VLSI DESIGN (With VHDL), Kataria & Sons » , 2nd Edition, 2010.

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.

Suggested Books:

6. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, *Introduction to Algorithms*, MIT Press, 2001.

7. A. Aho, J. E. Hopcroft and J. D. Ullman, *The Design and Analysis of Computer Algorithms*, Addison-Wesley, 1974

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

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.

REFERENCE BOOK:

1. Hirschey: Managerial Economics, Cengage Learning.
7. T. R. Banga and S.C. Sharma: Industrial Organisation and Engineering Economics, Khanna Publishers.
8. O.P. Khanna: Industrial Engineering and Management, Dhanpat Rai.
9. Joel Dean: Managerial Economics, PHI learning.

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 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

Uttarakhand Technical University

Program: **B.Tech, Electrical & Electronics Engineering (EEE)**

Year: 4 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: 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	TEC701	Optical Fiber Communication System	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	PEC751	OFC Lab	0	0	2	0	0	25	25	50
3	PEE753	Industrial Training Seminar	0	0	2	0	0	25	25	50
4	PEE754	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	SCADA & Energy Management	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	PEE852	Project	0	0	2	0	0	100	200	300
3	DIS850	Discipline	0	0	0	0	0	0	50	50

LIST OF ELECTIVE – I

TEE 011: Utilization of Electrical Energy and Traction
TEE 012: Digital Control System
TIC011: Fiber Optics and Laser Instrumentation
TIC012: Analytical Instrumentation

LIST OF ELECTIVE – II

TEE 021: Modern Control System
TEE 022: Bio-Medical Instrumentation
TEE 023: Power Plant Engineering
TIC 023: System Design Using Microcontroller

LIST OF ELECTIVE – III

TEE 031: Power Quality Improvement Techniques
TEE 032: Power Converter Application
TEE 033: EHV AC & DC TRANSMISSION
TEC 033: Adaptive Signal Processing
TEC 034: Embedded Systems

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, design considerations of electromagnetic relays.

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, Ungraounded 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.

Reference Books:

1. Power system protection & switchgear, Badriram & D.V. Vishwakarma, TMH
2. Switchgear & Protection, M.V. Deshpande, TMH

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.

Reference Books:

1. Siman Haykin,"Neural Networks "Prentice Hall of India.
2. Moore, Digital control devices, ISA press, 1986.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

TEC701: OPTICAL FIBRE COMMUNICATION SYSTEMS

UNIT 1

INTRODUCTION: Demand of Information Age, Block Diagram of Optical fiber Communication System, Technology used in OFC System, Structure and types of Fiber, modes and Configuration**,** mode theory for circular guide modal equation, modes in optical fiber, linearly polarized modes, attenuation factors, pulse broadening in optical fiber, single mode fiber, mode field diameter, single distortion in single mode fiber, Derivation of material dispersion and waveguide dispersion. Attenuation, Signal Degradation in Optical Waveguides, Pulse Broadening in Graded index fiber Waveguides, Mode Coupling.

UNIT 2

OPTICAL SOURCES:

LED: Visible LED, Infrared LED, LED structure and configuration, Loss mechanism, Application of LED, operating Characteristics materials for Visible LED.

LASER: Principle of LASER Action, Efficiency of LASER Diode, principles and structures, index guided and gains guided lasers, mode separation, quantum well laser, laser modulation.

UNIT 3

OPTICAL DETECTORS: Optical Absorption in semiconductors, Types of Photo Diodes, Principle of photo detection, working and structures of p-i-n and APD photo detectors, noises in photo detectors, SNR, detector response time effects, comparison of various photo detectors.

UNIT 4

ANALYSIS AND PERFORMANCE OF OPTICAL RECEIVER: Receiver Sensitivity, Photodiode for optical receiver, Optical Receiver Design, recent receiver circuits, System configuration and power budget.

UNIT 5

OPTICAL NETWORKS: WDM concepts and principles, passive components, SONET/SDH networks, performance of WDM.

SUGGESTED BOOKS

1. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
2. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005

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 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.

Reference Book:

1. H.Pratab."Modern electric traction" Dhanpat Rai & Sons.
2. C.L. Wadhwa,"Generation, Distribution and Utilization of Electrical Energy "New Age International Publishers.

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.

TIC011: FIBRE OPTICS AND LASER INSTRUMENTATION

UNIT 1

OPTICAL FIBRES AND THEIR PROPERTIES Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT 2

INDUSTRIAL APPLICATION OF OPTICAL FIBRES Fibre optic sensors–Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT 3

LASER FUNDAMENTALS Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT 4

INDUSTRIAL APPLICATION OF LASERS Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT 5

HOLOGRAM

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components.

TEXT BOOKS

1. J.M. Senior, ‘Optical Fibre Communication – Principles and Practice’, Prentice Hall of India, 1985.
2. R.K Singh, ` Optical Fibre Communication System`, Wiley India
. Wilson and J.F.B. Hawkes, ‘Introduction to Opto Electronics’, Prentice Hall of India, 2001.

TIC012: ANALYTICAL INSTRUMENTATION

UNIT 1

ELECTROMAGNETIC RADIATION – different regions, their wavelengths, frequencies and energies - interaction of EM radiations with matter – atomic, molecular, electronic interaction - Basic principles of spectroscopy – emission and absorption of radiations – resonance - radiation sources – dispersing and resolving techniques – detectors - typical atomic emission and absorption spectrographs in the UV and visible region.

UNIT 2

MOLECULAR SPECTRA – electronic, vibrational and rotational energies and spectra characteristic bands of radicals, OH, CH, CO, etc., - IR absorption – spectroscopy – single and double beam spectrophotometers - instrumentation techniques for analyzing solid, liquid and gaseous samples – sample handling techniques.

UNIT 3

MICROWAVE SPECTROSCOPY – NMR, ESR and EPR spectroscopy – basic principles – instrumentation techniques and applications - principles of ion optics – ion sources – single focusing and double focusing mass spectrometers – principles and application

UNIT 4

Principles of X-ray fluorescence spectrometry and flame photometry – detection of X-rays and nuclear radiations – ionization chamber - proportional counter – GM counter - scintillation counter - solid state detector - gamma ray spectrometers – isotope dilution and tracer techniques for quantitative estimation and analysis.

UNIT 5

ELECTROCHEMICAL METHODS – electrical conductivity of liquids conductivity and water purity – practical measurements and application – sulphur dioxide monitor – determination of pH – oxygen analyzers. Principles of gas and liquid chromatography – process chromatography – operation of typical process chromatography.

REFERENCE BOOKS

1. H.H. Willard, L.L. Merrit, J.A. Dean and F.A. Settle, Instrumental methods of Analysis, 6th edition - CBS Publishers and Distributers, 1986.
2. B.E.Noltingk (Edtr,) Jone's Instrument Technology, Vol. 2, Fourth Edition, Butterworths, 1986 (chapters 4 &5 for unit 5)
1. D.A. Skoog and D.M. West, Principles of Instrumental Analysis, 2 nd edition, Holt-Saunders, 1980.

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

PEC751: OFC LAB

Design of following ckt using appropriate software like VHDL/ FPGA and OFC kits.

1) 3-input NAND gate.
2) Half adder, Full Adder
3) D-Latch, T Flip Flop
4) Serial in-serial out shift register, Bidirectional shift Register
5) 3 Bit synchronous counter
6) To set up Fiber Optic Analog link.
7) To set up fiber Optic Digital link.
8) Measurement of Propagation loss and numerical aperture.
9) Characterization of laser diode and light emitting diode.

- NOTE: The institution can add 2 more practical in above prescribed list.

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: SCADA & ENERGY MANAGEMENT SYSTEM

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, transducers, RTUs, 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, mimic 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. Multicontrol 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.

Books Recommended:

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th Edition.

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. 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)
3. Ananthi, S. –A Text Book of Medical Instruments-2005-New Age International
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. A.Sherryet. Al. (Editors), Modern power station practice, Vol.6 (Instrumentation controls and testing), Pergamon Press, 1971.

TIC023: SYSTEM DESIGN USING MICROCONTROLLERS

UNIT 1

REVIEW OF MICROCONTROLLERS: Features of Typical Microcontroller – on Board peripherals – Processor Selection criteria – Microcontroller Design Specifications – Word length – Performance Issues - Power consumption – Package Types – Electrical requirements – Reset Hardware – oscillator Design – power Consideration - Development Tools –Firmware Development options – Assembly Language Vs High level Language Programming.

UNIT 2

MCS51 MICROCONTROLLER AND INTERFACING: Intel MCS51 Architecture – Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, Connection to RS 232, Interrupts Programming, External Memory interfacing , Introduction to 16 bit Microcontroller

UNIT 3

PIC MICROCONTROLLER AND INTERFACING: Introduction, CPU architecture, registers, instruction sets addressing modes Loop timing, timers, Interrupts, Interrupt timing, I/o Expansion, I 2C Bus Operation Serial EEPROM, Analog to digital converter, UART-Baud Rate-Data Handling-Initialization, Special Features - serial Programming- Parallel Slave Port.

UNIT 4

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

UNIT 5

REAL TIME OPERATING SYSTEMS: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. System Design Issues – Design of Industrial Control System.

REFERENCES:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997.

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. C. Sankarm,"Power Quality" CRC Press USA.
2. Barry W. Kennedy, "Power Quality Primer "McGraw Hill.
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:

3. K.R. Padiyar, "HVDC Power Transmission: Technology and System Reactions" New Age International

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.

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, principle of half wave transmission.

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:

1. M.H Rashid,"Power Electronics: Circuit, Devices and Applications "Prentice hall of India.
2. S .Rao, "EHV AC & HVDC Transmission Engineering and practice" Khanna Publishers.

TEC 033: ADAPTIVE SIGNAL PROCESSING

UNIT 1

INTRODUCTION: Definition and characteristics, general properties open and closed loop adaptation.

UNIT 2

ADAPTIVE LINEAR COMBINER: General description, input signal and Weight vectors, desired response and error performance function, gradient and minimum mean square, alternative definition of gradient, decorelection of error and input components.

UNIT 3

THEORY OF ADAPTATION WITH STATIONARY SIGNALS: Input correlation matrix, Eigen values and eigenvectors of the correlation matrix, and their geometrical significance. Basic ideas of gradient search methods, gradient search by newton's method and method of steepest descent, gradient component estimation by derivative measurement, effects of gradient noise, on weight vector solution, excess MSE, time constant and mis-adjustment, performance comparison of Newton and S.D. methods.

UNIT 4

ADAPTIVE ALGORITHMS: Least mean square algorithm, convergence, learning curve noise in Weight vector misadjustment and performances of LMS algorithms, sequential regression algorithm, adaptive recursive LMS algorithm, random search algorithm.

RECURSIVE LEAST SQUARE ALGORITHM: Preliminaries, matrix inversion lemma, exponentially weighted RLS algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS algorithm

UNIT 5

ADAPTIVE FILTER STRUCTURES: Lattice structures, all poles and all zeroes versions, adaptive lattice predictor. Lattice LMS algorithms, and lattice SER algorithms, adaptive filters with orthogonal signals, DFT and lattice preprocessors.

ADAPTIVE FILTER APPLICATIONS: (i) Adaptive modeling and systems identification. (ii) Inverse adaptive modeling, equalization and deconvolution

SUGGESTED BOOKS:

1. Adaptive Signal Processing, Widrow and Stearns, Pearson Education
2. Adaptive Filter Theory, Simon Haykin, Pearson Education

TEC 034: EMBEDDED SYSTEMS

UNIT 1

INTRODUCTION: Embedded systems and its applications, Embedded Operating system, Design parameters of an embedded system and its significance, design life cycle, tools introduction, hardware and software partitioning and co-design.

UNIT 2

HARDWARE FUNDAMENTALS FOR THE EMBEDDED DEVELOPERS : Digital circuit parameters- Open collector outputs Tristate outputs I/O sinking and Sourcing, PLD's, Watchdog Timers, Hardware design and development.

CUSTOM SINGLE PURPOSE PROCESSORS: Optimizing program, FSMD, Data path & FSM.

GENERAL PURPOSE PROCESSORS AND ASIP'S (Application Specific Instruction set Programming): Software and operation of general purpose processors-Programmers View Development Environment-ASIPs Microcontrollers-DSP Chips.

UNIT 3

INTRODUCTION TO MICROCONTROLLERS AND MICOPROCESSORS: Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.

RTOS -Tasks, states, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes.

UNIT 4

ADVANCED PROCESSOR-(only architectures) 80386, 80486, ARM and DUAL CORE, Core to DUO, i3, i5, i7 (References)

COMMUNICATION BASICS: Microprocessor Interfacing I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel protocols and wireless protocols.

UNIT 5

REAL WORLD INTERFACING: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Key board, Latch Interconnection, PPI.

SUGGESTED BOOKS:

1. Embedded System Design-Frank Vahid/Tony Givargis, John Willey@2005.
2. Microcontroller (Theory and Applications) Ajay V Deshmukh, Tata McGraw-Hill@2005.
3. An Embedded Software Primer-David E.Simon, Pearson Education @ 1999.

REFERENCES:

1. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
2. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hintz, Daniel Tabak, Tata McGraw-Hill@2005.
3. 8051 Microcontrollers & Embedded Systems 2nd Edition-Sampath Kr, Katson Books2006.

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.