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