UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN

STUDY AND EVALUATION SCHEME

B. TECH. Year 2nd Semester-IV

ELECTRICAL ENGINEERING, ELECTRICAL & ELECTRONICS ENGINEERING

(Effective from session 2008-09)

S.No	Course No.	Subject	Periods			Evaluation				Subject Total
						Sessional Exam.			Exam ESE	
		Theory	L	T	P	CT	TA	Total	Exam ESE	
1.	TEE 401	Electromechanical Energy Conversion-I	3	1	0	30	20	50	100	150
2.	TEE 402	Power Station Practice	3	1	0	30	20	50	100	150
3.	TEE 403	Electrical & Electronics Engineering Materials	3	1	0	30	20	50	100	150
4.	TEE 404	Microprocessors	3	1	0	30	20	50	100	150
5.	TEC 401	Electromagnetic Field Theory	3	1	0	30	20	50	100	150
Practical/Design										
6.	TEE 451	Electromechanical Energy Conversion-I Lab.	0	0	2	-	25	25	25	50
7.	TEE 452	Microprocessor Lab.	0	0	2	-	25	25	25	50
8.	TEE 453	Electrical Simulation Lab.	0	0	2	-	25	25	25	50
9.	GP 451	General Proficiency	-	-	-	-	-	100	-	100
10.	DIS 451	Discipline						100		100
		Total	15	5	6			525	575	1100

ELECTRO-MECHANICAL ENERGY CONVERSION –I (TEE – 401)

Unit – I

Principles of Electro-mechanical Energy Conversion - Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems(defining energy & Co-energy) , Singly Excited Systems; determination of mechanical force, mechanical energy, torque equation , Doubly excited Systems; Energy stored in magnetic field, electromagnetic torque , Generated emf in machines; torque in machines with cylindrical air gap . (7)

Unit – 2

D.C. Machines:- Construction of DC Machines, Armature winding ,Emf and torque equation , Armature Reaction ,Commutation , Interpoles and Compensating Windings, Performance Characteristics of D.C. generators. (9)

Unit –3

D.C. Machines (Contd.) :- Performance Characteristics of D.C. motors ,Starting of D.C. motors ; Concept of starting (3 point and 4 point starters) , Speed control of D.C. motors; Field Control , armature control and Voltage Control(Ward Lenonard method) ,Efficiency and Testing of D.C. machines(Hopkinson's and Swinburn's Test). (8)

Unit –4

Transformer :- Three phase transformer Construction, Three – phase unit transformer and Bank of three single phase transformers with their advantages , Three-phase transformer Groups(Phasor groups) and their connections , Y-Δ connection, Open delta connection , Three-phase/ 2 phase Scott connection and it's application.
(8)

Unit –5

Transformer (Contd) :

Sumpner's test , All day efficiency, polarity test Excitation Phenomenon in Transformers, Harmonics in Single phase and 3-phase transformers , Parallel operation and load sharing of Single phase and three phase transformers , Three winding transformers, Tertiary winding

Auto Transformer : Single phase Auto-transformer , Volt-amp relation, efficiency, Conversion of a two-winding Transformer to an Auto transformer, Saving in conductor material, Advantages , disadvantages and applications of autotransformers. (8)

Text Books :

1 I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill
2 Husain Ashfaq ," Electrical Machines", Dhanpat Rai & Sons
3 Irving L.Kosow,"Electric Machine and Tranformers", Prentice Hall of India.
4 B.R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New Age International.

Reference Books :

5. A.E. Fitggerald, C.Kingsley Jr and Alexander Kusko,"Electric Machinery" McGraw Hill, International Student Edition.
6. A.E. Clayton,"The Performance and Design of DC machines", Pitman &Sons
7. M.G. Say,"The Performance and Design of AC machines", Pit man & Sons
8. Langsdorf ;"Theory of Alternating Current Machinery", Tata McGraw Hill.

Power Station Practice (TEE 402)

Unit No.	Topic Name
1	**Introduction:** Electric energy demand and growth in India, electric energy sources. **Thermal Power Plant**: Site selection, general layout and operation of plant, detailed description and use of different parts. **Hydro Electric Plants**: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India
2	**Nuclear Power Plant**: Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding. **Gas Turbine Plant**: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications. **Diesel Plants**: Diesel plant layout, components & their functions, its performance, role and applications
3	**Sub-stations Layout**: Types of substations, bus-bar arrangements, typical layout of substation **Power Plant Economics and Tariffs:** Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff;. Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.
4	**Economic Operation of Power Systems**: Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling
5	**Non Conventional Energy Sources**: Power Crisis, future energy demand, role of Private sectors in energy management, **MHD generation:** Working principle, open and closed cycles, MHD systems, advantages, parameters governing power output. **Solar power plant:** Conversion of solar heat to electricity, Solar energy collectors, Photovoltaic cell, power generation, future prospects of solar energy use. **Wind Energy**: Windmills, power output with combined operation of wind turbine generation and isolated generating system, technical choices& economic size. **Geothermal Energy:** Earth energy, heat extraction, vapor turbine cycle, difficulties & disadvantages, **Tidal energy:** Tidal phenomenon, tidal barrage, tidal power Schemes. **Ocean Thermal Energy:** Introduction, energy conversion, problems.

Text Books:

1. B.R. Gupta,"Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad.

Reference Books:

1. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
2. S. L. Uppal, " Electrical Power", Khanna Publishers.

ELECTRICAL & ELECTRONICS ENGINEERING MATERIALS (TEE 403)

Unit – I

Crystal Structure of Materials:

A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth

B. Energy bands in solids, classification of materials using energy band. (8)

Unit – II

Conductivity of Metals:

Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials. (7)

Unit – III

Dielectric Properties of Material:

Polarisation and dielectric constant, dielectric constant of mono-atomic, poly atomic gases and solids, frequency dependence of electronic and ionic polarisabilities, dipolar relaxation, dielectric loss, piezoelectricity, ferroelectric materials. (8)

Unit – IV

Mechanism of Conduction in semiconductor materials:

Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET. (7)

Unit – V

Magnetic Properties of Material:

Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism,Ferromagnetism,AntiferromagnetismandFerrimagnetism, magnetostriction

Electrical Engineering Materials:

Properties and application of electrical conducting, semiconducting, insulating and magnetic materials, soft and hard magnetic materials, permanent magnetic materials, mechanical properties of metals, optical properties of solids. (10)

Text Books :

1 A.J. Dekker,"Electrical Engineering Materials" Prentice Hall of India
2 R.K. Rajput," Electrical Engg. Materials," Luxmi Publications.
3 C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S.Chand & Co.
4 Solymar, "Electrical Properties of Materials" Oxford University Press.

References :

5. Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.
6. Narula,"Material Science,"Tata McGraw Hill.
7. Van Vlash,"Elements of Material Science & Engineering" John Wiley & Sons.
8. G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials"Khanna Publishers.

MICROPROCESSORS (TEE 404)

Unit 1

Introduction To Microprocessor : 8085 Evolution Of Microprocessor, Register Structure, ALU, Bus Organization, Timing And Control, instruction set. (5)
Architecture of 16-bit Microprocessors: Architecture of 8086; (Bus Interface Unit, Execution unit) Register Organization, Bus operation, Memory segmentation. (3)

Unit 2

Assembly Language Programming: Addressing Modes and instruction set of 8086, Arithmetic and Logic instructions, Program Control Instructions (jumps, conditional jumps, subroutine call) Loop and string instructions , Assembler Directives. (7)

Unit 3

CPU Module : Signal Description of pins of 8086 and 8088 , Clock generator, Address and Data bus Demultiplexing, Buffering Memory Organization, Read and Write cycle Timings, Interrupt Structures, Minimum Mode, Maximum Mode Operation . (9)

Unit 4

Peripharal Interfacing : Programmed I/O, Interrupt Driven , I/O, DMA, Parallel I/O, (8255-PPI, Parallel port) , 8253/8254 programmable Timer/Counter Interfacing with ADC. (7)

Unit 5

(a) Peripheral Interfacing (Contd.)

8259 Programmable Interrupt controller, 8237 DMA controller (5)

(b) Concept of Advanced 32 bit Microprocessors: Pentium Processor. (4)

Text Books

1. Gaonkar, Ramesh S. /"Microprocessor Architecture, Programming, and Applications with the 8085"/Pen ram International Publishing /5th Ed.
2. Ray , A.K. & Burchandi, K.M./"Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing"/Tata McGraw Hill.
3. Hall D.V./"Microprocessors Interfacing"/Tata McGraw Hill /2nd Ed
4. B.P. Singh & Renu Singh, "Microprocessors and Microcontrollers" New Age International.

Reference Book :

5. Liu and Gibson G.a./"Microcomputer Systems: The 8086/8088 Family"/Prentice Hall (India)/2nd Ed.
6. Brey, Barry B./"INTEL microprocessors"/Prentice Hall (India)/4th Ed.
7. Ram B.,"Adavanced Microprocessor & Interfacing/Tata McGraw Hill "
8. Renu Singh & B.P. Singh, "Microprocessors and Interfacing & Applications" New Age International.

ELECTROMAGNETIC FIELD THEORY (TEC-401)

Unit-I

Review of Vector analysis, Rectangular, Cylindrical and Spherical coordinates and their transformation. Divergence, 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-5

Transmission lines, and guided waves

Text Book

Mayt, W.H. and Buck, J.A. 'Engineering Electromagnetics Tata McGraw Hill Publishing Co. Ltd., New Delhi Seventh edition.

Reference Books

1. Jordan E.C. and Balmain K.G. 'Electromagnetic' wave and radiating systems. PHI Second edition.
2. Krans, F 'Electromagnetics ' Tata McGraw Hill Fifth edition.
3. Ramo S, Whinnery T.R. and Vanduzer T, 'Field and Waves in Communication electronics' John Wiely and Sons Third edition.

ELECTROMECHANICAL ENERGY CONVERSION- I LAB (TEE 451)

Note: Minimum eight experiments are to be performed from the following list:

1 To obtain magnetization characteristics of a d.c. shunt generator
2 To obtain load characteristics of a d.c. compound generator (a) Cummulatively compounded (b) Differentially compounded
3 To obtain load characteristics of a dc shunt generator
4 To obtain load characteristics of a dc series generator
5 To obtain efficiency of a dc shunt machine using Swinburn's test
6 To perform Hopkinson's test and determine losses and efficiency of DC machine
7 To obtain speed-torque characteristics of a dc shunt motor
8 To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control
9 To obtain speed control of dc separately excited motor using Ward Leonard method
10 To study polarity and ratio test of single phase and 3-phase transformers
11 To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test
12 To obtain 3-phase to 2-phase conversion by Scott connection
13 To perform open circuit and short circuit tests on a three phase transformer and determine parameters of equivalent circuit

MICROPROCESSOR LABORATORY (TEE 452)

A. Study Experiments

1 To study 8085 based microprocessor system
2 To study 8086 and 8086A based microprocessor system
3 To study Pentium Processor

B. Programming based Experiments (any four)

4 To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5 To develop and run a program for arranging in ascending/descending order of a set of numbers
6 To perform multiplication/division of given numbers
7 To perform conversion of temperature from ^{0}F to ^{0}C and vice-versa
8 To perform computation of square root of a given number
9 To perform floating point mathematical operations (addition, subtraction, multiplication and division)

C. Interfacing based Experiments (any four)

10 To obtain interfacing of RAM chip to 8085/8086 based system
11 To obtain interfacing of keyboard controller
12 To obtain interfacing of DMA controller
13 To obtain interfacing of PPI
14 To obtain interfacing of UART/USART
15 To perform microprocessor based stepper motor operation through 8085 kit
16 To perform microprocessor based traffic light control
17 To perform microprocessor based temperature control of hot water.

TEE 453: Electrical Simulation Lab

Note: Minimum eight experiments are to be performed from the following list: The experiments are based upon circuit simulation using PSPICE or MULTISIM software:

1 Verification of principle of superposition with dc and ac sources
2 Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits
3 Verification of Tellegin's theorem for two networks of the same topology
4 Determination of transient response of current in RL and RC circuits with step voltage input
5 Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically damp and overdamp cases
6 Determination of frequency response of current in RLC circuit with sinusoidal ac input
7 Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters
8 Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values
9 Determination of image impedance and characteristic impedance of T and ∏ networks, using O.C. and S.C. tests
Write Demo for the following (in Ms-Power point)
10 Verification of parameter properties in inter-connected two port networks : series, parallel and cascade also study loading effect in cascade
11 Determination of frequency response of a Twin – T notch filter

UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN

STUDY AND EVALUATION SCHEME

B. TECH. YEAR 3RD, SEMESTER-VI

ELECTRICAL ENGINEERING

(Effective from session 2008-09)

S.No	Course No.	Subject	Periods			Evaluation				Subject Total
						Sessional Exam.			Exam ESE	
Theory			L	T	P	CT	TA	Total		
1.	TEE 601	Power System Analysis	3	1	0	30	20	50	100	150
2.	TEE 602	Conventional and Computer Aided Design of Electrical Machines	3	1	0	30	20	50	100	150
3.	TEE 603	Power Electronics	3	1	0	30	20	50	100	150
4.	TEE 604	Switchgear and protection	3	1	0	30	20	50	100	150
5.	TCS 605	Object Oriented Systems and C^{++}	3	1	0	30	20	50	100	150
Practicals/Design										
6.	TEE 651	Power Electronics Lab	0	0	2	-	25	25	25	50
7.	TEE 652	Electrical Machine Design Lab.	0	0	2		25	25	25	50
8.	TCS 655	Object Oriented Systems & C^{++} Lab	0	0	2		25	25	25	50
9.	GP 651	General Proficiency	-	-	-	-	-	100	-	100
10.	DIS 651	Discipline	-	-	-	-	-	100	-	100
		Total						525	575	1100

TEE - 601: Power System Analysis

Unit No. Topic Name

1 ***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 machine, internal voltage of loaded machines under transient conditions.

2 ***Unsymmetrical faults:***

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.

Formation of Z_{bus} using singular transformation and algorithm, computer method for short circuit calculations.

3 ***Load Flows:***

Introduction, bus classifications, nodal admittance matrix (Y_{BUS}), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

4 ***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 state and transient stability and methods of improvement.

5 ***Traveling Waves:***

Wave equation for uniform Transmission lines, velocity of 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.

Text Books:

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Kothari & Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill.
4. Chakraborthy, Soni,Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
5. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill

Reference Books:

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

TEE – 602: Conventional And Computer Aided Design of Electrical Machines

Unit No. **Topic Name**

1 ***Basic Considerations:***

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

2 ***Transformer Design:***

Output equation design of core, yoke and windings, overall dimensions,
Computation of no load current to voltage regulation, efficiency and cooling system designs.

3 ***Design of rotating machines – I:***

Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size.
Core and armature design of dc and 3-phase ac machines

4 ***Design of rotating machines – II:***

Rotor design of three phase induction motors.
Design of field system of DC machine and synchronous machines.
Estimation of performance from design data

5 ***Computer Aided Design:***

Philosophy of computer aided design, advantages and limitations.
Computer aided design approaches analysis, synthesis and hybrid methods.
Concept of optimization and its general procedure.
Flow charts and 'c' based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines.

Text Books :

1. A. K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Sons.
2. K.G. Upadhyay," Conventional and Computer Aided Design of Electrical Machines" Galgotia Publications.

Reference Books :

1. M.G. Say, "The Performance and Design of AC Machines" Pitman & Sons.
2. A.E. Clayton and N.N. Hancock, "The Performance and Design of D.C. Machines" Pitman & Sons.
3. S.K. Sen, "Principle of Electrical Machine Design with Computer Programming" Oxford and IBM Publications.

TEE – 603: Power Electronics

Unit No. Topic Name

1 ***Power semiconductor Devices:***

Power semiconductor devices their symbols and static characteristics
Characteristics and specifications of switches, types of power electronic circuits
BJTO operation steady state and switch characteristics, switching limits
Operation and steady state characteristics of MOSFET and IGBT
Thyristor – Operation V- I characteristics, two transistor model, methods of turn-on
Operation of GTO, MCT and TRIAC

2 ***Power Semiconductor Devices(Contd)***

Protection of devices.Series and parallel operation of thyristors.Commutation techniques of thyristor
DC-DC Converters: Principles of step-down chopper, step down chopper with R-L load
Principle of step-up chopper, and operation with RL load, classification of choppers

3

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 impedance
Single phase and three phase dual converters

4

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 configurations and comparison)
Single phase transformer tap changer.
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

5

Inverters

Single phase series resonant inverter ,Single phase bridge inverters,Three phase bridge inverters,Voltage control of inverters,Harmonics reduction techniques,Single phase and three phase current source inverters

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd Edition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics"Tata MC Graw Hill, 2005

Reference Books:

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

SWITCHGEAR AND PROTECTION (TEE – 604)

Unit No.	Topic Name
I.	**Introduction to Power System** Introduction to protective system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.
II	**Relays** Electromagnetic, attraction and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relays **Relay Applications and characteristics** Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay **Static relays** Comparison with electromagnetic relays, classification and their description, over current relays, directional relay, distance relays, differential relay
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
IV	**Circuit Breaking** Arc phenomenon, Properties of arc, arc extinction theories, , Recovery Voltage and Restriking Voltage, current chopping, resistance switching, capacitive current interruption, , circuit breaker ratings. **Testing of Circuit breakers** Classification, testing station and equipments, testing procedure, direct and indirect testing
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, Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding. Circuit breaker Need for circuit breakers, types of circuit breakers, operating modes, principles and constructional details of Air Blast, Bulk Oil, Minimum Oil, SF_6, Vacuum Circuit Breakers , D.C. circuit breakers

Text Books:

1) Switchgear and Protection Sunil S. Rao (Khanna Publishers)
2) Power System Engg. Soni Gupta & Bhatnager (Dhanpat Rai&Sons)
3) A Course in Electrical Power C.L.Wadhawa (New Age international Pvt. Ltd)
4) Power system protection and switchgear B.Ram (Wiley Eastern Ltd.)

Reference Books:

1.) Power system Protection & Switchgear Badriram & D.V.Vishwakarma (TMH)
2) Switchgears & Protection M.V. Deshpande (THM)

TCS:605 Object Oriented Systems and C++

Unit No.	Topic Name
I	Object & classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract classes, Generalization, Multiple Inheritance, Meta data.
II	Events and States, Operations and Methods, Nested state diagrams, Concurrency, Relation of Object and Dynamic Models.
III	Functional Models, Data flow diagrams, Specifying Operations, Constraints, OMT Methodologies, examples and case studies to demonstrate methodology
IV	Principles of object oriented programming, Tokens, Expressions , classes, Functions, Constructors, Destructors, , Functions overloading, Operator Overloading, I/O Operations. Real life applications, Inheritance Extended Classes, Pointer. Virtual functions, Polymorphisms, Working with files, Class templates, Function templates,Exception handling, String manipulation. Translating object oriented design into implementations.
V	Introduction to Unix/Linux operating systems. Concept of file system, handling ordinary files,concept of shell, vi editor, Basic ile attributes, concept of process, Basic system administration.

Text Books:

1. Rambaugh James etal, "Object Oriented Design and Modeling",PHI-1997
2. Balagurusamy E," Object Oriented Programming with C++", TMH,2001 '
3. Sumitabha Das “Unix concepts & application” TMH

Reference Books:

1. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
2. Lipman, Stanley B, Jonsce Lajoie, .. *C++* Primer Reading", AWL, 1999
3. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
4. Berzin Joseph, "Data Abstraction: the object oriented approach using *C++",* McGraw Hill
5. Budd, Timothy, "An Introduction to Object Oriented Programming", Pearson 2000

.

TEE-651: Power Electronics Laboratory

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 free wheeling 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:

1. To obtain simulation of SCR and GTO thyristor.
2. To obtain simulation of Power Transistor and IGBT.
3. To obtain simulation of single phase fully controlled bridge rectifier and draw load voltage and load current waveform for inductive load.
4. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
5. 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.

References:

1. M.H.Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd Edition, prentice Hall of India.
2. D.W. Hart, "Introduction to power Electronics" prentice hall Inc. 1997.

TEE 652: Electrical Machine Design Laboratory:

Note: Students should opt any two from the following:

1. Conventional and computer aided design of Three-phase transformer.
2. Conventional and computer aided design of three phase induction motor
3. Conventional and computer aided design of three phase synchronous machine
4. Conventional and computer aided design of a dc shunt motor

   Students should design first by conventional method with respect to desired output performance. Later on, they should develop computer program and again with respect to desired output performance, design should be carried out and results should be compared.

TCS:655 Object Oriented Systems & C++ Lab

1. Programs to demonstrate arithmetic , relational operators, pointers & I/O functions of C++
2. Programs to demonstrate
   a. Constructors
   b. Destructors
   c. Inheritance
   d. Polymorphism
   e. Operator Overloading
   f. Function overloading
3. Program to demonstrate
   a.In-Line function
   b.Virtrual Function.
   c. Friend functions
4. Programs to demonstrate File operations in C++
5. Programs to demonstrate unix commands