Syllabus of B.Tech – Electrical Engineering

Subject Code	EE303	Subject Title	POWER ELECTRONICS						
LTP	3 0 2	Credit	4	Subject Category	Univ. Core	Year	3rd	Semester	VI

Objectives of the Course

- To introduce the basic concepts of power electronics,
- To introduce types of converters, their characteristics, turn-on of SCR, gate characteristics,
- To know about AC-DC Converters, DC - DC Converters, AC-AC and DC-AC Converters.

Unit 1	**Power semiconductor Devices**: Power semiconductor devices their symbols and static characteristics; Characteristics and specifications of switches, types of power electronic circuits. Thyristor – Operation V- I characteristics, two transistor model; Triacs, GTOs, MOSFETs and IGBTs - static characteristics and principles of operation	**8L**
Unit 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 and step-up chopper and their operation with R-L load; Classification of choppers	**8L**
Unit 3	P**hase 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; 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.	**8L**
Unit 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) 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 **Inverters:** Single phase series resonant inverter; Single phase bridge inverters	**8L**
Unit 5	Three phase bridge inverters: 1200 and 1800 mode of operation; Voltage control of inverters; Harmonics reduction techniques; Single phase and three phase current source inverters.	**8L**

Text Books:

1. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd Edition, 2004.
2. P.S.Bimbhra, "Power Electronics" Khanna Publication.
3. Umanand "Power Electronics" Wiley India.

Reference Books

1. P.C. SEn, "Power Electronics", Mc Graw Hill
2. Dragan Maksimović and Robert Warren Erickson, "Fundamentals of Power Electronics", Springer

Outcome of the Course:

- **Articulate the basics of power electronic devices**
- **Express the design and control of rectifiers, inverters.**
- **Design of power electronic converters in power control applications**
- **Ability to express characteristics of SCR, BJT, MOSFET and IGBT.**
- **Ability to express communication methods.**
- **Ability design AC voltage controller and Cyclo-Converter.**
-

List of Experiments

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.
15. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE304	Subject Title	POWER SYSTEM ANALYSIS						
LTP	3 0 2	Credit	4	Subject Category	Univ. Core	Year	3rd	Semester	VI

Objectives of the Course

- To introduce the concepts of Load flow analysis, bus impedance/admittance matrix,
- To introduce load flow problem formulation and solution techniques,
- To introduce fault analysis, steady state and transient stability analysis, load frequency and voltage control and different type of distribution systems.

Unit 1	**Introduction:** Representation of power system components like synchronous machine, transformer, transmission line. One line diagram, Impedance and Reactance diagram, per unit system of calculation, Brief description of power system components like synchronous machine, transformer, busbar, transmission line and isolators.	**8L**
Unit 2	**Load Flow Analysis:** Bus classifications, Formation of bus admittance matrix by singular transformation, Formation of load flow problem, Gauss – Siedel and Newton – Raphson method of load flow analysis, Approximation of Newton – Raphson load flow analysis, Fast decoupled method.	**8L**
Unit 3	**Fault analysis:** Types of fault – shunt and series, Calculation of fault current and voltages for symmetrical short circuit, Symmetrical components, Sequence impedance, Unsymmetrical short circuits, Open conductor fault, Current limiting reactors	**8L**
Unit 4	**Stability Analysis:** Introduction to steady state and transient Stability of power systems, Swing equation, Equal area criteria, Solution of swing equation, Methods of improving stability	**8L**
Unit 5	**Distribution System & Substations:** Different types of distribution systems, Distribution from one and both ends, Ring mains, Unbalanced loading, 3 phase 4 wire and 3 phase 5 wire distribution system, Layout of distribution substation, Rural electrification and grounding.	**8L**

Text Books:

1.W.D. Stevenson, "Element of Power System Analysis", McGraw Hill, USA
2.C.L. Wadhwa, "Electrical Power Systems", New Age International Ltd., Third Edition
3.Ashfaq Husain, "Power System", CBS Publishers & Distributors, India
4.B.R. Gupta, "Power System Analysis & Design", S.Chand & Co, Third Edition
5.M.V. Deshpande, " Electrical Power System Design", Tata McGraw Hill

Reference Books

1.Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons, India
2.S.L. Uppal, " Electric Power", Khanna Publishers
3.S.N. Singh, "Electric Power Generation, Transmission & Distribution", PHI, New Delhi

Outcome of the Course:

- **Solve load flow problems using per unit values systems.**
- **Develop power system network models.**
- **Formulate and solve load flow problems using various techniques as per the requirements of complexity, computational time and accuracy.**
- **Calculate power losses in power system and develop economical power system operation scheme.**

List of Experiments **MATLAB Based**

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices
3. Solution of load flow and related problems using Gauss- Seidel Method.
4. Solution of load flow and related problems using Newton Raphson Method
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems

Syllabus of B.Tech – Electrical Engineering

Subject Code	EC352	Subject Title	BIO-MEDICAL INSTRUMENTATION						
LTP	3 0 2	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- Requirement of bio-medical and its application
- Concept of bio-potential electrodes and measurements related to them.
- Concepts of bio-transducers and measurements related to them.
- Concept of bio-medical instruments and their uses.

Unit 1	**ANATOMY AND PHYSIOLOGY:** Basic Cell Functions, Origin of Bio-potentials, Electrical Activity of Cells, components of man Instrument system, types of bio-medical stems, design factors and limitations of biomedical instruments, terms and transducers to various physiological events.	**8L**
Unit 2	**BIO-POTENTIAL ELECTRODE:** Types of bio-potential electrodes., Electrode-Electrolyte interface, half cell potential, Polarization- polarisable and non-polarisable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body surface recording electrodes for ECG, EMG, EEG. Electrodes standards.	**8L**
Unit 3	**BIO-TRANSDUCER:** Transduction Principles: Resistive Transducers Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. Strain Gauge type Blood pressure transducers. Thermo resistive transducer, Inductive Transducers, Capacitive Transducer Piezoelectric Transducer Bio potential Measurement.	**8L**
Unit 4	**BIOMEDICAL INSTRUMENTATION CARDIAC MEASUREMENT:** Cardiovascular System, Heart Structure, Cardiac Cycle, ECG Theory, ECG Electrodes, Electrocardiograph, Indicator dilution methods; Measurement of continuous Cardiac output derived from aortic pressure waveforms, cardiac Arrhythmias; Phonocardiogram, Measurement of heart rate, Blood pressure, Temperature, Respiration rate, Blood Flow meters.	**8L**
Unit 5	**BIOTELEMETRY AND ELECTRICAL SAFETY:** Bio-telemetry design, single channel bio telemetry transmitter and receiver system based on AM, FM and, pulse modulation. Significance of Electrical Danger, physiological effect of current, ground shock Hazards.	**8L**

Text Books:

1.Joseph J. Carr & John. M. Brown, 'Introduction to Biomedical Equipment technology'
2.R.S. Khandpur, 'Handbook of Biomedical Instrumentation', McGraw Hill.

Reference Books

1.J.G. Webster, 'Medical instrumentation application and design', Houghton Miffin Co., Boston USA.
2.Mohan Murali H, 'Monograph on Biomedical engineering', O.U. Press 1985.

Outcome of the Course:

The course provides an understanding of:

- **Bio-medical instruments and measurements.**
- **Principle of working of bio-medical transducers.**
- **Skills to use modern bio-medical tools and equipment for measurements related to human body.**

List of Experiments

1. Pulse measurement
2. Heartbeat measurement
3. Automatic BP measurement
4. Heart sound study using electronics stethoscope
5. ECG measurement

Following experiments to be done on the breadboard

6. Design of low noise and low frequency amplifier for biomedical application

7. Design of Instrumentation amplifier
8. Construction of chopper amplifier

Two Value Added Experiments to be added by Instructor.

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE348	Subject Title	ELECTRICAL MACHINE DESIGN						
LTP	3 0 2	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- To study and design the transformers and analyze them
- To study and design the induction motors
- To study and design the synchronous machines and dc machines

Unit 1	**INTRODUCTION** Standards & standardization, 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.	**8L**
Unit 2	**DESIGN OF TRANSFORMER** Output equation design of core, yoke and windings, overall dimensions, Computation of no load current to voltage regulation, efficiency and cooling system designs.	**8L**
Unit 3	**DESIGN OF SYNCHRONOUS MACHINES** Output equations of synchronous machines, specific electric and magnetic loadings, separation of main dimensions, Rotor design, Design of field system. Estimation of performance from design data. Flow chart for design of three phase synchronous generators	**8L**
Unit 4	**DESIGN OF INDUCTION MACHINES** Output equations , specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size, Rotor design of three phase induction motors. Circle diagram, Estimation of performance from design data. Flow chart for design of three phase induction motors	**8L**
Unit 5	**DESIGN OF DC MACHINES & COMPUTER AIDED DESIGN** Output equation, Main dimensions, Design of armature, commutator, flow chart for design of dc machines. Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis- , synthesis and hybrid methods.	**8L**

Text Books:

1. A.K. Sawhney, "Electrical Machine Design", Dhanpat Rai & Sons.
2. S. K. Sen, "Principles of Electrical Machine Design with Computer Programmes", Oxford & IBH Pub. Company

Reference Books

1. M.G. Say, "Alternating Current Machines", Pitman Publishing Company Ltd.
2. A.E. Clayton, "The Performance and Design of DC Machines", Pitman Publishing Company Ltd.
3. H. Cotton, "Advanced Electrical Technology" Wheeler Publishing.

Outcome of the Course:

- **Students will be able to learn the applications of transformer and induction motor and application regarding representation using piece wise linearization and least square error method.**
- **Students will be able to formulate the mathematical modelling of transformer design, output equation, design dimension of core and yoke.**
- **Students will be able to learn the fundamentals of electrical circuits and thermal circuits of cooling method.**
- **Students will be able to learn the basics of induction motor stator design, electrical and magnetic loading, types and design of winding.**

List of Experiments **Design using MATLAB/Simulink/C**

1. Design of a single phase transformer for distribution
2. Design of a three phase distribution transformer
3. Design of a three phase power transformer
4. Design of a d.c. machine
5. Design of a synchronous generator
6. Design of a synchronous motor.

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE349	Subject Title	NON-CONVENTIONAL ENERGY RESOURCES						
LTP	3 1 0	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- To introduce fundamentals of various renewable energy source
- The technologies used to harness usable energy from solar, wind, fuel cells
- The technologies used to harness usable energy from ocean geothermal Biomass energy sources.

Unit 1	**Introduction** Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits, present energy scenario.	**8L**
Unit 2	**Solar Cells** - Theory of solar cells. Solar cell materials, solar cell power plant, limitations. Solar Thermal Energy Solar radiation flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	**8L**
Unit 3	**Geothermal Energy** - Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. **Magneto-hydrodynamics** (MHD) Principle of working of MHD Power plant, performance and limitations.	**8L**
Unit 4	**Fuel Cells** - Principle of working of various types of fuel cells and their working, performance and limitations. Thermo-electrical and thermionic conversions, Principle of working, performance and limitations. **Wind Energy**: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. **Bio-mass** - Availability of bio-mass and its conversion theory.	**8L**
Unit 5	**Ocean Thermal Energy Conversion** (OTEC) - Availability, theory and working principle, performance and limitations. **Wave and Tidal Wave** - Principle of working, performance and limitations. Waste Recycling Plants	**8L**

Text Books:

1.D.S. Chauhan, “Non-Conventional Energy Resources”, New Age International

2.B.H. Khan, “Non-Conventional Energy Resources”, Tata McGraw Hill

Reference Books

1. Andra Gabdel, "A Handbook for Engineers and Economists".
2. A. Mani, "Handbook of Solar radiation Data for India".
3. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
4. F.R. the MITTRE, "Wind Machines" by Energy Resources and Environmental Series.
5. Frank Kreith, "Solar Energy Hand Book".
6. N. Chermisinogg and Thomes, C. Regin, "Principles and Application of Solar Energy".
7. N.G. Calvert, “Wind Power Principles”.

Outcome of the Course:

- **Identify renewable energy sources.**
- **Understand the mechanism of solar, wind and ocean energy sources.**
- **The understanding of various technologies involved in power generation from renewable energy sources.**
- **Understand the methods to handle the biomass in a productive way.**

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE350	Subject Title	SPECIAL ELECTRICAL MACHINES						
LTP	3 1 0	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- To study regarding construction working and purpose of special 3 phase a.c. machines
- To study working and characteristics of servomotors
- To study working, construction and applications of special ac and dc motors

Unit 1	**Poly-phase AC Machines:** Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power), Introduction to multiphase machines.	**8L**
Unit 2	**Single phase Induction Motors:** Construction, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor start, capacitor-run and shaded pole motors. **Two Phase AC Servomotors:** Construction, torque-speed characteristics, performance and applications	**8L**
Unit 3	**Stepper Motors:** Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications. **Switched Reluctance Motors:** Construction; principle of operation; torque production, modes of operation, drive circuits	**8L**
Unit 4	**Permanent Magnet Machines**: Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors. **Single phase synchronous motor**; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators.	**8L**
Unit 5	**Single Phase Commutator Motors:** Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, Linear force, and applications	**8L**

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.
2. P.C. Sen "Principles of Electrical Machines and Power Electronics" John willey & Sons, 2001

Reference Books

1. G.K.Dubey "Fundamentals of Electric Drives" Narosa Publishing House, 2001
2. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987
3. M.G. Say "Alternating current Machines" , Pitman & Sons

Outcome of the Course:

- **Able to distinguish between normal types of motors and special types of motors**
- **Understand the working of servomotors, stepper motors reluctance motors**
- **Understand and able to select the suitable motor for the type of load**

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE351	Subject Title	INDUSTRIAL ELECTRICAL SYSTEMS						
LTP	3 1 0	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- To be able to understand the electrical wiring systems for various applications
- To be able to understand various components of industrial electrical systems.
- To be able to analyze and select the proper size of various electrical system components.

Unit 1	**Electrical System Components:** LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices	**8L**
Unit 2	**Residential and Commercial Electrical Systems:** Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.	**8L**
Unit 3	**Illumination Systems** Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.	**8L**
Unit 4	**Industrial Electrical Systems I :** HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.	**8L**
	Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Selection of UPS and Battery Banks.	
Unit 5	**Industrial Electrical System Automation:** Study of basic PLC, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.	**8L**

Text Books:

1. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R.D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. Web site for IS Standards.
3. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Outcome of the Course:

- **Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.**
- **Understand various components of industrial electrical systems.**
- **Analyze and select the proper size of various electrical system components.**
- **To be able to design an illumination scheme for a given building, workshop etc.**

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE352	Subject Title	DIGITAL CONTROL SYSTEM						
LTP	3 0 2	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- To introduce the state variable representation of continuous and discrete data control systems, stability analysis and time response analysis using state model,
- The concepts of controllability and observability, basic concepts of digital control systems, their stability analysis,
- Use of state feedback for pole placement design, basic concepts and stability analysis of non linear systems

Unit 1	**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.	**8L**
Unit 2	**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.	**8L**
Unit 3	**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.	**8L**
Unit 4	**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.	**8L**
Unit 5	**Optimal digital control:** Discrete Euler Lagrange equation, max. min. principle, otpimality & Dynamic programming, Different types of problem and their solutions.	**8L**

Text Books:

1. B.C.Kuo, "Digital Control System", Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

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.

Outcome of the Course:

- Possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function.
- Find out the time response of a given system and design of different basic controller (P, PI, PID)
- Understand the basic knowledge of servo & servomotor.
- Gain knowledge of finding out system stability in time and frequency domain.
- To draw different plots of control system and compensation design using these plots.

Syllabus of B.Tech – Electrical Engineering

Subject Code	EE353	Subject Title	POWER STATION PRACTICE						
LTP	3 1 0	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- The course has been designed to fulfill the requirement of power industry.
- The course aims to provide basic fundamentals of economics involved with power generation
- The course aims to provide basic fundamentals of various techniques used for optimization of generation cost.

Unit 1	**Economics of Generation** :Types of loads, demand factor, group diversity factor and peak diversity factor, load curve, load duration curve, load factor, capacity factor and utilization factor, base load and peak load stations, operating and spinning reserves, load forecasting, capital cost of power plants, depreciation, annual fixed and operating charges.	**8L**
Unit 2	**Tariff and Power Factor Improvement** General tariff form and different types of tariffs, Tariff option for DSM. Causes and effect of low power factor, necessity of improvement and use of power factor improvement devices.	**8L**
Unit 3	**Coordinated Operation of Power Plants** Advantages of Coordinated operation of different types of power plants, hydrothermal scheduling: short term and long term. Coordination of various types of power plant.	**8L**
Unit 4	**Electrical Equipments in Power Plants** Governors for hydro and thermal generators, excitation systems; exciters and automatic voltage regulators (AVR), bus bar arrangements.	**8L**
Unit 5	**EHV Substation** Layout of EHV substation, brief description of various equipments used in EHV substations, testing and maintenance of EHV substations equipments. Gas insulated substations (GIS).	**8L**

Text Books:

1. B.R. Gupta, Generation of Electrical Energy, (Euresia Publishing House).
2. M.V. Deshpande, Elements of Electrical Power Station Design, (Wheeler Publishing House).

Reference Books

1. S. Rao, Electrical Substation-Engineering and Practice, (Khanna).
2. S.N. Singh, Electric Power Generation, Transmission and Distribution (PHI).

Outcome of the Course:

- Understanding the economics of power generation.
- Apply design of various new technologies to optimize the economical relations.
- Formulate and solve coordination problem of power system plants.

Subject Code	EE354	Subject Title	DIGITAL SIMULATION OF POWER SYSTEM						
LTP	3 0 2	Credit	4	Subject Category	Electives	Year	3rd	Semester	VI

Objectives of the Course

- The objectives of the course are to make the student understand the operation and control of a modern power system,
- To introduce various problems encountered in proper operation of the system and their mitigation.
- Students will learn how to analyze a large interconnected power system through digital simulation.

Unit 1	**Network Matrices:** Graph-theoretic approach for the formation of network matrices – Y BUS , Y BR and Z LOOP ; Z BUS building algorithms, Simulation example.	**8L**
Unit 2	**Short Circuit Studies:** Representation of 3-phase networks. Short circuit studies using 3-phase Z BUS matrix. Fault impedance and admittance matrices for various types of faults. Simulation example.	**8L**
Unit 3	**Power System Control:** Automatic generation control (AGC). Voltage control methods. Reactive power compensation, static VAR systems, FACTS devices.	**8L**
Unit 4	**Optimal System Operation**: Unit commitment. Optimal power flow solution, Hydro–Thermal load scheduling; short range and long range. Determination of Loss-Formula. Simulation example.	**8L**
Unit 5	**Computer Control and Automation:** Database for control: SCADA, State estimation. Contingency analysis and power system security assessment. Modern energy control centres	**8L**

Text Books:

1. Hadi Sadat*: Power System Analysis; (McGraw Hill)

Reference Books

1. Nagrath and Kothari: Power System Analysis; 4th edition (TMH)
2. Grainger and Stevenson: Power System Analysis; (McGraw Hill)
3. El-Abiad and Stagg: Computer Methods in Power System Analysis; (McGrawHill)
4. Wood and Wollenberg: Power Generation Operation and Control; Wiley, NY

Outcome of the Course:

- Model the power system for various studies.
- Analyze the system for different short circuit conditions.
- Address the problem of frequency and voltage control under varying load conditions of the system.
- Optimize the generation scheduling in a hydro-thermal mix including the effect of system losses and maintaining the desired operating conditions.
- Analyze large data, in an interconnected power system, obtained through SCADA and utilize them for state estimation, contingency analysis and security assessment.

Subject Code	CS214	Subject Title	Operating Systems					
LTP	3 1 0	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

This course will facilitate the students to learn the different components and various functioning of an operating system.

Unit 1: Introduction to Operating System. (8)

Introduction: Components of a computer System, Operating system: User view & System view, Evolution of operating system, Single Processor & Multiprocessor systems, Real Time System, Distributed Systems, Multimedia Systems, Handheld Systems.

Operating System Structure: Operating System Services, User Operating System Interfaces: Command-Line and GUI, System Calls.

Unit 2: Management & Scheduling (6)

Process Management: Process Concept, Process States, Process Transition Diagram, Process Control Block (PCB).

CPU Scheduling: Scheduling Concepts, Performance Criteria, Scheduling Queues, Schedulers, Scheduling Algorithms: Preemptive & Non Preemptive: FCFS, SJF, Priority, Round-Robin

Unit 3 Concurrent Processes & Deadlocks (8)

Concurrent Processes: Principle of Concurrency, Producer / Consumer Problem, Co-operating Processes, Race Condition, Critical Section Problem, Peterson's solution, Semaphores, Classical Problem in Concurrency- Dining Philosopher Problem; Inter Process Communication models and Schemes.

Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock.

Unit-4 Memory Management (7)

Memory Management: Bare machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Cache memory.

Unit- 5: File Systems & I/O Management (7)

File System: Different types of files and their access methods, various allocation methods.

I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK).

COURSE OUTCOME:

At the end of the course, the student will able to :

CO1. Learn the general architecture& functioning of computers with operating system.

CO2. Describe, contrast and compare differing structures for operating systems.

CO3. Understand and analyze theory and implementation of: processes, resource control (concurrency etc.).

CO4. Understands physical and virtual memory, scheduling, I/O and files

TEXT BOOKS

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley,6th Edition 2006.
2. D M Dhamdhere, "Operating Systems: A Concept based Approach", PHI. 3rd Edition.2017..

REFERENCES

Harvey M. Dietel, " An Introduction to Operating System", Pearson Education ,1st Edition 2009

Subject Code	CS205	Subject Title	Dot Net Technologies						
LTP	3 0 2	Credit	4	Subject Category	DC	Year	2nd	Semester	IV

OBJECTIVE:

This course aims to provide the knowledge to understand the concepts and elementary use of .NET library such as development of windows application and website creation through ASP.NET. Students are also able to learn about the different validation and use of controls available in Visual Studio.

Unit 1: Introduction to Dot Net (8)

Introduction .NET framework, features of .Net framework, architecture and component of .Net, elements of .Net (CLS.CTS, CLR &BCL). Assembly, type of assemblies, create dll file, how to create and install shared assemblies.

Introduction to C#: C# Language Fundamentals, Namespace, Using Directive, Defining custom namespaces, Default Assignment and variable scope, Basic input and output with the console class, Understanding value types and reference types, Converting between value type and reference type: Boxing and Unboxing, Operators and Expressions, Iterations constructs, control flow constructs, Understanding static methods, Method parameter modifiers, Array manipulation, String manipulation, Enumerations, Defining structures.

Unit 2: Object Oriented Aspects Of C# (8)

Object Oriented Aspects Of C#: Formal definition of the class, Constructor, type of constructor, Destructor, member access modifier(Public, Private, Protected, Internal and Protected Internal), Encapsulation, Polymorphism: Method Overriding and Method Overloading, Override, Virtual, new Keywords, Inheritance: Types of Inheritance and Ineterface ,Abstraction, Sealed Class, Property, Set and get operator ,Indexer, Reflection, Delegates and Events.

Unit 3 Exception Handling in C# (8)

Exception, Bug, Error, Exception Handling in .Net, Type of Exception, finally statement, throw and rethrow, difference between System Level Exception and Application Level Exception, Nested try block, Custom Exception, throwing our own exceptions, checked and unchecked operator, handling multiple exception. Garbage collection: Basics, working, finalizing a method, Dispose (), IDisposable Interface, System.GC Type.

Unit-4 Architecture (7)

Three tier architecture, MVC architecture, Entity Framework. **Windows Forms:** All about windows form, MDI form, creating Windows applications, adding controls to forms, handling Events, and using various Tools

Unit- 5: Database & Web Application (8)

ADO.NET- ODBC, OLEDB, and SQL connected mode, disconnected mode, dataset, data view, data table, data column, data row, data-reader, data adapter.

Web Based Application: Web based application Development On .Net: ASP.NET**,** Differences between ASP and ASP.NET, understanding post back, understanding page life cycle, State management, Master pages.

COURSE OUTCOME:

On successful completion of this course, student should be able to:

CO1. To have knowledge of the structure and model of the programming language C #.
CO2. To Use the programming language C # for various programming technologies.
CO3. To develop software in C #.
CO4. To design web applications using ASP.NET..

TEXT BOOKS

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2nd edition 2004.
2. J. Liberty, "Programming C#", O'Reilly,2nd edition 2002.

REFERENCES

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill,2nd edition 2004.
2. Robinson et al, "Professional C#", 2nd ed., Wrox Press, 2002.
3. Andrew Troelsen, "C# and the .NET Platform", A! Press, 1st edition 2003.

SR.NO.	EXPERIMENT NAME
1	Program in C# to demonstrate System.Array class members like Clone(), Copy(), Clear() ,Sort() and Reverse().
2	Program in C# to demonstrate System. String members like Contains(),Insert(),Remove(),Replace() and ToUpper().
3	Program in C# Create a Simple Calculator using Text Boxes and Button Tools of Visual Studio which also calculates %, modulus, Root, Clear, Sign Change, and Result
4	Design Login form and create windows form using basic form controls application.
5	Design a form in C# that takes the details of a person (Name, Address and DOB) and enables Radio Button to vote if the age of the person is above 18 and then shows a thanks message.
6	Create a form using Menu Strip Tool and add the following options:-File, Edit,Help. Also add submenu ,for File add :- Open,Close and Exit. For Edit add:- Cut, Copy and Paste.For Help add:-Help and About.
7	Create a windows application which stores an Item (Item_Id, Name,Price,Weight,Type,quantity) in a database. After that there will be a button to view the Detail of Items added. After that create another form from which Item can be removed and Updated.
8	Create a Registration Form with all validations to store the information of a Student in a database. Create Another windows form to assign Elective Subjects to all the students.
9	Create a website for a book store, which sold and give books on rent to customers. Also Store the information of customers
10	Write a Program to demonstrate System.Array class members like Clone(), Copy(), Clear() ,Sort() and Reverse().

Subject Code	CS346	Subject Title	Introduction to Big Data Analytics *(Departmental Elective 3/4)*					
LTP	3 0 2	**Credit**	4	**Subject Category**	DE	**Year**	3rd	**Semester**	VI

OBJECTIVES: The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Unit 1 Introduction **(6 L)**

Examples, data science articulated, history and context, technology landscape.

Unit 2 Data Manipulation at Scale **(8 L)**

Databases and the relational algebra ,Parallel databases, parallel query processing, in-database analytics ,MapReduce, Hadoop, relationship to databases, algorithms, extensions, languages ,Key-value stores and NoSQL; tradeoffs of SQL and NoSQL

Unit 3 Analytics **(7 L)**

Topics in statistical modeling: basic concepts, experiment design, pitfalls, Topics in machine learning: supervised learning (rules, trees, forests, nearest neighbor, regression), optimization (gradient descent and variants), unsupervised learning.

Unit 4 Communicating Results **(7 L)**

Visualization, data products, visual data analytics, Provenance, privacy, ethics, governance.

Unit 5 Special Topics **(9 L)**

Graph Analytics: structure, traversals, analytics, PageRank, community detection, recursive queries semantic web.

LEARNING OUTCOMES

The students learning outcomes are designed to specify what the students will be able to perform after completion of the course:

CO1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

CO2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

CO4. The student will learn about the graph analytics and its application.

Text Book:

1- Mayer-Schönberger, V., & Cukier, K. *Big Data: A Revolution That Will Transform How We Live, Work, and Think*. Boston: Houghton Miffin Harcourt, 2013.

Reference Book:

1- Frank J. Olhorst Big Data Analytics: Turning Big Data into Big Money (Wiley and SAS Business Series),2015

Subject Code	IT346	Subject Title	ADVANCED WEB TECHNOLOGY						
LTP	3 0 2	Credit	3.5	Subject Category	L T P	Year	3rd	Semester	VI

Course Objective:

1. The overall goal of the advanced web technology is to make familiar students with various kind of web as well as android applications.
2. The student will learn how to form attractive web pages using ruby and rail server along with HTML and CSS.
3. The student will also learn how to make portable android applications.
4. The student will get practical experiences of these techniques by the implementation, debugging and testing in Programming language like Ruby, Rail server, Android Studio. (During the Lab).

Detailed Syllabus

UNIT 1

Revised tour of basics: HTML with CSS, sample codes in java script, introduction to XML with CSS, working with images, revision of mysql installation and commands. (**4 L)**

UNIT 2

Web development and Bootstrap: Introduction to bootstrap, history of bootstrap, responsive website, usage of bootstrap, first webpage with bootstrap Bootstrap controls – buttons, table, images, button groups, dropdown, collapse, tabs, forms etc. (**10 L)**

UNIT 3

Ruby Introduction: what is ruby?, brief history of ruby, ruby on rails download and installation, first program in ruby, ruby variables and data types- numbers, Boolean, strings etc., puts and print, String functions: length, reverse, upcase, downcase etc., writing comments. (**15 L)**

UNIT 4

Ruby on rails: introduction to rails, installation of DBMS, writing test application for database connections, starting rails web server and open application, sample website project on rails. (**5 L)**

UNIT 5

Android Application Development: introduction to android, download and installation of android studio, understand the structure of hello project, design sample app in SDK, configuration and launching of emulator, load application using mobile phone, introduction to sqllite. (**6 L)**

Learning Outcome

Having successfully completed this course, the student will demonstrate:
1. An ability to perform web applications and solve the real world problem.
2. Ability to work on live web as well as android project in MNCs.

Text book [TB]:

1. Michael Hartl, Ruby on rails tutorial (rails 5) learn web development with rails, ed 4, online

Reference books [RB]:

1. Head First Android Development A Brain-Friendly Guide By Dawn Griffiths, David Griffiths Publisher: O'Reilly Media, 2015.
2. Programming Ruby 1.9 & 2.0: The Pragmatic Programmers' Guide (The Facets of Ruby) 4th Edition by Dave Thomas (Author), Andy Hunt (Author), Chad Fowler (Author)

List Of Practical's

SR.NO.	EXPERIMENT NAME
1	Design bordered table for storing details of all employees in IT department using bootstrap. Also highlight HOD of department.
2	Insert an image in the webpage in different shapes like circle, rectangle etc.
3	Design login form using bootstrap classes.
4	Design one page web poster of your project using bootstrap.
5	Downloading and installation of ruby on rails.
6	Create a module for simple calculator function.
7	Write a program to calculate factorial of a no using ruby.
8	Write first database application using rails and map the web server.
9	Develop your own website by using bootstrap and rails.
10	Create some basic android applications like: working with button, ToggleButton, checkbox, date-time picker, AlertDialog box etc.
11	Create a MediaPlayer application in android using the above concepts.

Syllabus of B.Tech – Electrical Engineering

Subject Code	HS304	Subject Title	Aptitude and Soft Skills IV						
LTP	3 0 0	Credit	0	Subject Category	AC	Year	III	Semester	VI

Course Outline: Aptitude and Soft Skills IV is the final step of programme and the module is designed to enhance the analytical and interpersonal skills of students to make them ready to face various placements, interviews. It will also help them learn various personality development techniques by enhancing their GD and PI skills. Mock Placement Drive will test and improve students by Feedback Sharing & Error Correction.

Course Objective:

1. Align themselves with the placement requirements and their needs
2. Learn analytical and employability skills
3. Prepare students for job placements so that they could clear the selection process successfully and give them strategies and skills to crack GD as well as PI to get selected with decent job offers

Course Pre/Co-requisite (if any):

1. Understanding grammar, number system and basic arithmetic, analytical reasoning concepts, covered in Aptitude and Soft Skills III
2. Professional profile building and Self introduction

Detailed Syllabus

UNIT 1: QUANTITATIVE APTITUDE 11 HOURS

Partnership 02 hours

Introduction & types; Speed, Distance and Time: Average Velocity; Race tracks - Straight and Circular; Trains; Boats and Streams.

Time and Work 02 hours

Basic concepts (relationship between men, days and work); Understanding group efficiency; Alternate work; Negative work; Wages; Pipes and Cisterns.

Permutation and Combination 02 hours Basic Principles of Counting (Addition and Multiplication); Arrangements around- Circular, Square and Rectangular tables and in straight lines, circular permutation, selection, distribution.

Probability 02 hours

Introduction, various types of events; Classical definition of probability; Random and Discrete variables; Bayes' Theorem and question types.

Data Interpretation 03 hours

Introduction; Different ways of representing data- Narration based, pictorial, pie chart, Bar graph, line charts; various questions based upon them.

UNIT 2: VERBAL APTITUDE 09 HOURS

Cloze test 02 hours

Intricacies of cloze test, correct use of specific adjectives, concept of sentence improvement, writing concept, auxiliaries and modals.

Words 02 hours

Concept of consistency, precision, concision in terms of reading and writing, advance word choice with respect to placement papers, SAP (Subject-Audience-Purpose) approach.

Clauses 02 hours

Subordinate Clauses- The noun clause, the adjective clause, the adverb clause, Analysis of simple and complex sentences, prepositional phrases, transformation of sentences.

Vocabulary **01 hour**

Revisiting vocabulary- high, medium and low frequency words, organization of ideas an thoughts in order to understand the text- The Pyramid Principle.

Questions **02 hours**

Various test taking skills in accordance with the placement papers.

UNIT 3: LOGICAL REASONING **11 HOURS**

Deductive Logic **03 hours**

Premises and conclusion structure, Quality of deductive argument, Categorical arguments, Syllogism, Conditional Arguments- If..then, only if..then, If and only if , Either or.

Puzzles **02 hours**

Grouping and selection, Double line up, Binary logic- truth teller-lie teller, Team formation and miscellaneous puzzles.

Set Theory and Critical Reasoning-II **03hours**

Union and Intersection of sets, Use of venn diagrams in problem solving with two, three, four set, concept of maxima-minima through Venn diagram.

Critical reasoning II: Statement and Inference, cause and Effects, Statement and Arguments- Strengthen or Weaken the argument, Statement Assertion and Reason.

Non-Verbal Reasoning **01 hour**

Mirror-image, Water-image, Spotting out the embedded figures, Completion of incomplete pattern, Figure matrix, Paper folding, Paper cutting, Grouping of identical figures, Counting figures, Non verbal series / analogies / odd man out.

Data Sufficiency **02 hours**

Data Sufficiency based on logical reasoning field like Coding-Decoding / Puzzle Test / Blood Relations / Mathematical calculations / clock / calendar / etc.

UNIT 4: SOFT SKILLS **08 HOURS**

Group Discussion **04 hours**

Importance, Do's & Don'ts, Personality Traits, Tips and Strategies, Types of Group Discussions.

Suggested Exercises, Games & Activities: Mock Group Discussions (on basic topics), with feedback sharing and error analysis.

Personal Interview **04 hours**

Importance, Do's & Don'ts, Personality Interview, Tips and Strategies, Etiquette Rules.

Suggested Exercises, Games & Activities: Mock Personal Interviews (contd.) with feedback sharing and error analysis.

Learning Outcomes:

By the end of this semester, students will:

1. Be prepared for the upcoming placements and they will also be ready for other competitive exams.
2. Improve their GD and PI Skills and be able to have firsthand experience of a Placement drive and gain sufficient confidence to perform well.

Text book [TB]:

1. Quantitative Aptitude **:** How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition, 2018.
2. Logical Reasoning **:** A Modern Approach to Logical Reasoning-R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude : English is Easy- Chetanand Singh, BSC Publication-2018.
4. Soft Skills : Group Discussion on Current Topics by P. N. Joshi; Upkar Prakashan-2010.

Reference books [RB]:

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal, S. Chand Publications-2017.
   Quantitative Aptitude: Quantitative Aptitude-Saurabh Rawat & Anushree Sah Rawat Savera Publishing House, 1st edition-2016.
2. Logical Reasoning: Logical Reasoning and Data Interpretation for the CAT - Nishit K Sinha, Pearson India; 5th edition-2016.
   Logical Reasoning: Wiley's Verbal Ability and Reasoning - P A ANAND, Wiley-2016.
3. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, Oxford University Press-2003.
   Verbal Aptitude: Fun with grammar- Suzanne W. Woodward Pearson Education ESL-1996.
4. Soft Skills: A Complete Kit for Group Discussion by S. Hundiwala; Arihant publications; edition-2018.
   Soft Skills: Basic Interviewing Skills by Raymond L. Gorden, Waveland Press, Inc.; 1 edition-1998.