ANURAG
Engineering Engineers

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(AUTONOMOUS)

(Formerly CVSR College of Engineering)

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COURSE STRUCTURE AND DETAILED SYLLABUS

II, III & IV – B.Tech – I & II Semesters

R18-Regulations

ELECTRICAL AND ELECTRONICS ENGINEERING

FOR
B.TECH FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2018-19)

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II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A53008	PCC	Electrical Circuit Analysis	3	-	3
A53009	PCC	Fluid Mechanics and Hydraulic Machines	3	-	3
A53010	PCC	Electrical Machines – I	3	-	3
A53011	PCC	Electromagnetic Fields	3	-	3
A53012	PCC	Power Systems-I	2	-	2
A53001	BSC	Mathematics-III	3	-	3
A53203	PCC	Electrical Circuits & Simulation Lab	-	3	1.5
A53204	PCC	Electrical Machines Lab-I	-	3	1.5
A53007	MC	Gender Sensitization	2	-	0
		Total	**19**	**06**	**20**

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A54008	PCC	Switching Theory & Logic Design	3	-	3
A54009	PCC	Electrical Machines – II	3	-	3
A54010	PCC	Power Systems-II	2	-	2
A54011	PCC	Control Systems	3	-	3
A54012	PCC	Integrated Circuits & Applications	3	-	3
A54013	PCC	Analog Devices and Circuits	3	-	3
A54203	PCC	Analog Devices and Circuits Lab	-	3	1.5
A54204	PCC	Control Systems Lab	-	3	1.5
A54007	MC	Environmental Studies	2	-	0
		Total	**19**	**06**	**20**

III YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A55013	PCC	Electrical Measurements & Instrumentation	2	-	2
A55014	PCC	Power Electronics	3	-	3
A55015	PCC	Electrical Machines -III	3	-	3
A55016 A55017 A55018	PEC-I	Renewable Energy Technology Electrical Machine Design Control System Design	3	-	3
A55019	HSMC	Managerial Economics & Financial Analysis	3	-	3
A55006 A55021 A55022	OE-I	Logical Reasoning, Verbal & Quantitative Ability Disaster Preparedness and Planning Data Base Management Systems	3	-	3
A55204	PCC	Electrical Machines Lab-II	-	4	2
A55205	HSMC	Advanced English Communication Skills Lab	-	2	1
Total			**17**	**06**	**20**

III YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A56011	PCC	Switch Gear & Protection	3	-	3
A56012	PCC	Power System Analysis	3	-	3
A56013	PCC	Micro Processor & Micro Controllers	3	-	3
A56014	ESC	Python Programming	2	-	2
A56015 A56016 A56017	PEC-II	Signals & Systems Line Commutated and Active PWM Rectifiers Industrial Electrical Systems	3	-	3
A56001	HSMC	Entrepreneurship Development	3	-	3
A56204	PCC	Power Electronics & Simulation Lab	-	3	1.5
A56205	PCC	Measurements and Instrumentation Lab	-	3	1.5
Total			**17**	**06**	**20**

IV YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A57013	PCC	Power System Operation& Control	3	-	3
A57014	PCC	Power Semi Conductor drives	2	-	2
A57015 A57016 A57017	PEC-III	1. Electrical Distribution Systems 2. Flexible Alternating Current Transmission System 3. Electromagnetic Waves	3	-	3
A57018 A57019 A57020	PEC-IV	1. Electrical and Hybrid Vehicles 2. Power System Dynamics and Control 3. HVDC Transmission Systems	3	-	3
A57021 A57022 A57023	PEC-V	1. High Voltage Engineering 2. Smart Grid Technology 3. Digital Signal Processing	3	-	3
A57024 A57025 A57026	PEC-VI	1. Utilization of Electrical Energy 2. Electrical Energy Conservation and Auditing 3. Digital Control Systems	3	-	3
A57204	PCC	Power Systems Lab	-	3	1.5
A57205	PCC	Micro Processor & Micro Controllers Lab	-	3	1.5
A57206	PROJ	Mini Project	-	4	2
		Total	**17**	**10**	**22**

IV YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Classification	Subject	Lectures	T/P	Credits
A58007 A58004 A58008	OE-II	1. Management Science 2. Project Management 3. Technical and Business Communication Skills	3	-	3
A58009 A58010 A58006	OE-III	1. Intellectual Property Rights 2. Internet of Things 3. Nano science and Nano Technology	3	-	3
A58204	PCC	Technical Seminar	-	6	2
A58205	PCC	Comprehensive Viva Voce	-	-	2
A58206	PROJ	Project Work	-	15	10
		Total	**06**	**21**	**20**

T-Tutorial **P-Practical**

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B.Tech EEE II Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Electrical Circuit Analysis

Course Objectives:

1. To apply network theorems for electrical circuits with AC & DC Excitation.
2. To understand three phase circuits and network topology.
3. To analyze transients in a Electrical Circuits.
4. To perform synthesis on given Electrical Network from a given impedance/ admittance function.
5. To evaluate the network parameters of given electrical network.

Unit- I: Network Theorems (With D.C & A.C)
Superposition, Reciprocity, Thevinin's, Norton's, Maximum Power Transfer theorem, Milliman's and Compensation Theorems Analysis with dependent current and voltage sources.

Unit- II: Network Topology and Three Phase Circuits
Network Topology: Definitions - Graph - Tree, Basic cut-set and Basic Tie-set matrices for planar networks - Duality & Dual networks.
Three Phase Circuits: Phase sequence- Star and delta connection-Relation between line and phase voltages and currents in balanced systems. Analysis of balanced and unbalanced three phase circuits. Measurement of active and reactive power.

Unit- III: D.C & A.C Transient Analysis
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms .
Transient response of R-L, R-C, R-L-C circuits (series only) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms.

Unit- IV: Network Functions
The concept of complex frequency, Physical interpretation of complex frequency, Transform impedance and Transform circuits, Series and Parallel combination of elements, Terminal pairs or ports, Network functions for the one port and two port, poles and zeros of network functions, Significance of poles and zeros, Properties and Necessary conditions of driving point functions, Properties and Necessary conditions of transfer functions.

Unit- V: Two Port Networks
Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks

Text Books:

1. Electric circuits - A.Chakrabarthy, Dhanpat Rai & Sons,2006
2. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.

References Books:

1. Circuits & Networks - A.Sudhakar and Shyammohan S.Palli, Tata Mc Graw-Hill, 2017.
2. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Apply network theorems for the analysis of electrical circuits.
2. Apply the concepts of network topology to obtain Tie set and Cut set matrices and analyze three phase Circuits.
3. Obtain the transient and steady-state response of electrical circuits.
4. Illustrate the significance of poles and zeros of a given transfer function and network synthesis.
5. Design Two Port networks, their equivalent circuits and obtain their parameters.

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B.Tech EEE II Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Fluid Mechanics and Hydraulic Machinery

Course Objectives:

1. To understand the concept of fluid and its properties, hydrostatic forces.
2. To Study the basic laws of fluids, flow patterns and their corresponding problems.
3. To outline the concepts of boundary layer theory, flow separation, concepts of dimensional analysis.
4. To explain the hydrodynamic forces acting on vanes and their performance evaluation.
5. To summarize the importance, function and performance of hydraulic systems.

Unit – I: Fluid Statics
Definition of fluid, physical properties of fluids-specific gravity, viscosity, surface tension, vapor pressure. Atmospheric pressure, gauge and vacuum pressures, measurement of pressure – Piezometer, U-tube manometer, differential and inverted manometers.

Unit – II: Fluid Kinematics
Steam line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational &irrotational flows. Continuity equation for one dimensional flow and three dimensional flows.
Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for fluid flow along a stream line.Momentum equation and its application on force on pipe bend.
Measurement of Flow: Venturimeter, Orificemeter, Pitot tube.

Unit – III: Closed Conduit Flow
Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes – pipes in series and pipes in parallel, equivalent pipes, total energy line&hydraulic gradient line.
Boundary Layer Concepts: Definition, thickness, characteristics along the thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Unit – IV: Basics of Turbo Machinery
Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip velocity diagrams, work done and efficiency, flow over radial vanes.
Hydraulic Turbines: Classification of turbines, heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design. Draft tube theory, functions and efficiency.

Unit – V: Performance of Hydraulic Turbines
Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Centrifugal Pumps: Classification, working, works done, barometric head, losses and efficiencies, specific speed, performance characteristic curves, NPSH.

Reciprocating Pumps: Discharge, work done, power, slip, indicator diagrams.
Text Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery by MODI and SETH / Rajsons Publications
2. Fluid Mechanics and Hydraulic Machines by Rajput / S Chand Publications
3. Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal / Laxmi Publications.

Reference Books:

1. Fluid Mechanics and fluid power Engineering by D.S Kumar, S.K. Kataria& Sons
2. Fluid Mechanics and machinery by D. Rama Durgaiah, New Age International Publishers
3. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
4. Hydraulics, Fluid Mechanics and Hydraulic Machines by R.S.Khurmi / S.Chand Publications
5. Fluid Mechanics and Hydraulic Machines by SukumarPati / McGraw Hill Publication

Course Outcomes:
At the end of this course, students will have knowledge and ability to

1. Classify the properties of fluids and its measurement.
2. Analyze the flows and identify the fluids behavior in motion.
3. Develop the expression for Bernouli expression and to study the laws
4. Explain the performance of vanes and design the turbines.
5. Analyze the performance of hydraulic turbines, understand the basics of pumps, their types and efficiencies

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B.Tech EEE II Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Electrical Machines-I

Course Objectives:

1. To get basic knowledge of DC Generators
2. To understand necessity and conditions of parallel operation of DC Generators
3. To acquire basic knowledge of DC Motors
4. To know the various Speed control and methods of starting DC motors
5. To determine efficiencies of DC machines by various methods of testing

Unit- I: D.C. Generators – Construction & Operation

D.C. Generators – Principle of operation – Action of commutator – constructional features classification of DC generators – separately excited and self excited generators – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature –E.M.F Equation – Problems – Armature reaction – cross magnetizing and demagnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation.

Unit- II: Operating Characteristics of D.C. Generators

Build up of EMF – magnetization curve/OCC characteristics – critical field resistance and critical speed – causes of failure to self excite – remedial measures – load characteristics of D.C shunt, series and compound generators – parallel operation of D.C series generators – use of equalizer bar and cross connection of field windings – load sharing – problems and applications.

Unit- III: D.C. Motors

D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation – speed
control of D.C. Motors: armature voltage and field flux control methods – Ward-Leonard system.

Unit- IV: Losses and Efficiency of DC Machines

Principle of 3 point and 4 point starters – protective devices.
Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency, numerical problems.

Unit- V: Testing of D.C. Machines

Testing of D.C. machines: Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – separation of stray losses in a D.C. motor test.

Text Books:

1. Theory and performance of Electrical Machines- JB Gupta, SK kataria and sons, 14th Edition
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

References Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain basic concepts of DC generator
2. Obtain performance characteristics and perform parallel operation of DC generators
3. Explain basic concepts of DC motor
4. Apply various Speed control methods of DC motors
5. Test DC machines and determine their efficiency

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B.Tech EEE II Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Electromagnetic Fields

Course Objectives:

1. To gain basic concepts of vector algebra and vector calculus useful for comprehensive introduction and knowledge of vector calculus for electromagnetic fields and its application
2. Understand various laws of electromagnetism.
3. To understand the behavior of conductors, dielectrics and capacitance in static electric filed.
4. To understand the concepts of static magnetic fields.
5. To study time varying fields and maxwells equation.

Unit - I: Review of Vector Calculus

Vector algebra addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator-del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

Unit - II: Static Electric Field

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line and Surface charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Unit - III:Conductors, Dielectrics and Capacitance

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Unit - IV: Static Magnetic Fields,Magnetic Forces, Materials and Inductance

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Unit - V:Time Varying Fields and Maxwell's Equations

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions, Poynting theorem.

Text Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W. Hayt,"Engineering Electromagnetics", McGraw Hill Education, 2012

References Books:

1. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
2. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968
3. Dr. TVS Aruna Murthy "Electro- Magnetic Fields (Theory and Problems), S Chand Publications.2011

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain the basic concept of vector algebra.
2. Apply the basic laws of electromagnetism.
3. Analyze and drive expressions for behavior of conductors, Dielectrics and capacitance in electric fields.
4. Analyze the magnetic materials & magnetic fields.
5. Derive Maxwell's equation in various forms.

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| **2** | **0** | **2**

POWER SYSTEMS – I

Course Objectives:

1. To understand the process of Hydel and Thermal Power Generations.
2. To understand the process of Nuclear and Gas-Power Generators.
3. To understand the basic concepts of various substations and their components.
4. To familiarize with DC and AC Distribution systems.
5. To gain knowledge on economic aspects of Power Generation and Tariff methods

Unit- I: Hydel and Thermal Power Stations

Hydel Power Stations: Classification Hydro Electric Power Stations: Layout of Hydro station- selection of site – classification of hydro plants – classification of turbines – constituents of hydro station –Equation of power generation - numerical problems.

Thermal Power Stations: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses.- Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers, numerical problems.

Unit- II: Nuclear Power Stations and Gas Power stations

Nuclear Power Stations: Nuclear Fission and Chain reaction - Nuclear fuels – Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants - Radiation hazards: Shielding and Safety precautions. - Types of Nuclear reactors and brief description of PWR, BWR and FBR.

Gas Power Stations: Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only)

Unit- III: Substations and Gas Insulated Substations

Substations: Classification of substations, Air insulated substations - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub- Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas insulated substations (GIS): Advantages of Gas insulated substations, single line diagram of gas insulated substations, bus bar, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations...

Unit- IV: DC and AC Distribution Systems

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over -Head Distribution Systems- Requirements and Design features of Distribution Systems.

D.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.
A.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

Unit- V: Economic Aspects of Power Generation and Tariff Method
Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.
Tariff Methods: Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method - Tariff Methods: Flat Rate, Block-Rate, two-part, three – part, and power factor tariff methods and Numerical Problems.

Text Books:

1. A course in power systems - J.B. Gupta, S. K. Kataria & Sons, 2009.
2. Principles of Power Systems - V.K Mehta and Rohit Mehta, S.Chand Company Ltd., New Delhi 2004.

References Books:

1. A Text Book on Power System Engineering - M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999
2. Gas turbine performance- PP Wals, P.Fletcher, Blackwell Publisher, 2004
3. Generation, distribution and utilization of Electrical energy- C.L.Wadhawa, New age International (P) Limited, Publishers 1997.

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Apply the knowledge of various sources of power generation
2. Design the Layout of Various Generating Power Stations.
3. Discuss functions of Substations.
4. Determine various parameters for AC &DC Distribution systems
5. Analyze economic aspects of Power Generations and Tariff Methods.

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B.Tech EEE II Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Mathematics-III
(Numerical Methods & Partial Differential Equations)

Course Objectives:

1. To determine the approximate solution of algebraic and transcendental equations using iterative methods and Interpolate the values for the given data.
2. To concepts of Numerical Differentiation to find the higher order derivatives for the tabulated values and finding integration of given data points with various step sizes by using Numerical methods.
3. To determine the solution of linear first order initial value problems using single and multi step methods.
4. To Formation of PDE's and solution of linear and non-linear PDE's using various methods.
5. To Classify PDE's and Solving One Dimensional Heat and Wave equations.

Unit-I: Solution of Non- linear Equations
Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – Newton-Raphson Method.
Interpolations:
Introduction- Finite differences (Forward Differences, Backward differences and divided difference) Lagrange's Interpolation formula, Newton divided, Newton's forward and backward difference interpolation formulae - Problems.

Unit-II: Numerical Differentiation using interpolation formulae.
Numerical integration: Newton's cotes qudrature formulae, Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.

Unit-III: Numerical solution of Ordinary Differential Equations
Solution by Taylor's series-Picard's Method of successive Approximations- Euler and modified Euler's methods -Runge-Kutta Method.

Unit-IV: Partial differential equations of First Order
Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations, Charpits Method.

Unit-V: Partial differential equations of Second Order
Method of separation of Variables for second order equations. Classification of general second order partial differential equations. Applications of Partial Differential Equations-One dimensional wave equation, Heat equation.

Text Books:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010
3. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

References Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Solve the algebraic and transcendental equations using numerical methods and also finding the polynomial using given set of tabulated values and estimation of the functional value within the data by Interpolation.
2. Apply the method of Numerical Differentiation and Numerical Integration for engineering problems.
3. Solve the first order initial value problems using Taylors, Euler and Runge-Kutta methods.
4. Using concepts of partial differential equations to solve linear and non-linear problems.
5. Solve Heat conduction and wave equations by using method of separation of variables and identify the consistent solution.

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B.Tech EEE II Year I Semester	**L**	**P**	**C**
	0	**3**	**1.5**

Electrical Circuits and Simulation Lab

Course Objectives:

1. To verify various network theorems.
2. To study Series and Parallel resonance Phenomena
3. To understand basic concepts of Inductances.
4. To study various types of network parameters.
5. To simulate DC and AC circuits using suitable software.

PART-A: Electrical Circuits

1) Verification of Norton's Theorem
2) Verification of Maximum Power Transfer Theorems.
3) Verification of Compensation Theorem.
4) Verification of Reciprocity Theorem
5) Verification of Millimann's Theorem.
6) Series and Parallel Resonance.
7) Determination of Self, Mutual Inductances and Coefficient of coupling.
8) Verification of Z and Y Parameters.
9) Verification of Transmission parameters
10) Verification of hybrid parameters.

PART-B: Simulation

1. Simulation of DC Circuits & AC Circuits.
2. Simulation of DC Transient response.
3. Simulation of Mesh Analysis.
4. Simulation of Nodal Analysis.

NOTE: Eight experiments are to be conducted from PART-A and any Two from PART-B

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Apply the various network theorems to simplify given electrical circuits.
2. Determine electrical resonance frequency for series and parallel circuits.
3. Determine network parameters.
4. Connect and perform experiments with various electrical components and instruments.
5. Apply suitable software for simulating and analyzing various electrical circuits

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B.Tech EEE II Year I Semester	**L**	**P**	**C**
	0	**3**	**1.5**

Electrical Machines Lab- I

Course Objectives:

1. To obtain magnetization characteristics of DC Generator
2. To understand characteristics of DC Machines by conducting load tests
3. To determine losses and efficiency of DC machines
4. To study methods of speed control of DC shunt motors.
5. To study separation of losses in DC machines.

List of Experiments:

1. Magnetization characteristics of DC shunt generator.
2. Load test on DC shunt generator.
3. Load test on Dc series generator.
4. Load test on DC compound generator.
5. Hopkinson's tests on DC shunt machines.
6. Fields test on DC series machines.
7. Swinburne's test on DC shunt machine.
8. Speed control of DC shunt motor.
9. Brake test on DC shunt motor.
10. Brake test on DC compound motor.
11. Separation of losses in DC shunts motor.
12. Retardation test on DC shunt motor.

Note: Any 10 experiments are required to be conducted.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Determine efficiency by conducting load tests on DC machines
2. To determine the efficiency of DC Generators by conducting load tests
3. To determine the efficiency of DC motor by conducting appropriate Tests
4. Distinguish between speed control techniques for above and below base speeds for DC shunt motor
5. Determine the constant & variable losses in DC motor by performing appropriate test.

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Gender Sensitization
(Mandatory Course)

Course Objectives:

1. To develop students sensibility with regard to issues of gender in contemporary India
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.

Unit-I: **Understanding Gender:**
Gender: Why should we study it? (Towards a world of equals: Unit-1)
Socialization: Making Women, Making Men (Towards a world of equals: Unit-2)
Introduction, Preparing for womanhood. Growing up male. First lesson in caste. Different Masculinities.
Just Relationships: Being Together as Equals (Towards a world of equals: Unit-12)
Mary Kom and Onler. Love and acid just do not mix. Love Letters. Mothers and Fathers. Further reading: Rosa Parks-The Brae Heart.

Unit-II: **Gender and Biology**
Missing Women: Sex Selection and its Consequences (Towards a world of equals: Unit-4)
Declining Sex Ration. Demographic Consequences.
Gender Spectrum: Beyond The Binary (Towards a world of equals: Unit-10)
Two or many? Struggles with Discrimination.
Additional Reading: Our Bodies, Our Health (Towards a world of equals: Unit-13)

Unit-III: **Gender and Labour**
Housework: The invisible Labour (Towards a world of equals: Unit-3)
"May Mother doesn't work". "Share the Load".
Women's work: its politics and economics (Towards a world of equals: Unit-7)
Fact and Fiction. Unrecognized and unaccounted work. Further Reading: Wages and Conditions of Work.

Unit-IV: **Issues of Violence**
Sexual Harassment: Say No! (Towards a world of equals: Unit-6)
Sexual Harassment, not Eve-teasing-coping with everyday Harassment-Further Reading: "Chupulu".
Domestic Violence: Speaking out (Towards a world of equals: Unit-8)
Is Home a Safe Place? – When Women Unite [Film]. Rebuilding Lives. Further Reading: New Forums for Justice.
Thinking about sexual Violence (Towards a world of equals: Unit-11)
Blaming the Victim- "I Fought for my life….." – Further reading: The Caste Face of Violence.

Unit-V: **Gender Studies**

Knowledge: Through the lens of gender (Towards a world of equals: Unit-5)
Point of View. Gender and the Structure of Knowledge. Further Reading: unacknowledged Women artists of Telangana.
Whose History? Questions for Historians and others (Towards a world of equals: Unit-9)
Reclaiming a past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Text Books:

1. " Towards a world of Equals; A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasantha, Rama Melkote, VasudhaNagaraj, AsmaRasheed, GoguShyamala, Deep Sreenivas and Susie Tharu.
2. Sen, Amartya. "More than one million Women are Missing". New York review of books 37.20 (20 December 1990). Print. ' We Were Making History….' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women 1989.

References Books:

1. TriptiLahari. "By the numbers: Where Indian Women Work. "Women's studies journal (14 November 2012) Available online at: http://blogs.wsj.com/indiarealtime/2012/11/14/ by the numbers where Indian women work/ >.
2. K. Satyanarayana& Susie Tharu (ed.) Steel are sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada hhtp://herpercollins.co.in/Bookdetail.asp? Book _code = 3732.
3. Monon, Nivedita, Seeing like a Feminist, New Delhi: Zubaan-Penguin Bokks, 2012.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be identify the basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will analyze a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Men and women students and professionals will be better equipped to work and live together as equals.

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Switching Theory and Logic Design

Course Objectives:

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
3. To implement simple logical operations using combinational logic circuits.
4. To design combinational logic circuits, sequential logic circuits.
5. To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

UNIT-1: Number Systems and Codes:
Review of number systems binary arithmetic, binary weighted and non-weighted codes. Error detecting and error correcting codes.

Boolean Algebra:
Postulates and theorems: representation of switching functions, SOP and POS forms Karnaugh Map representations, minimization using K Maps.

UNIT- II: Design of Combinational Circuits:
Tabular minimization – design of single output and multi output functions design using conventional AND, OR, NOT, NAND, NOR & EX-OR gates. Design using MSI & LSI devices, digital multiplexer/selector, decode demultiplexer, design of 4 bit adder, carry look-ahead adder, magnitude comparator, BCD converter. Logic implementations using ROM, PAL & PLA.

Unit-III: Introduction to Sequential Circuits:

Combinational versus sequential circuits, asynchronous versus synchronous circuits, state table and state diagram, state assignment, memory elements and their excitation functions, T flip flop, RS flip flop, JK flip flop and their excitation requirements. Design of synchronous sequential circuits like sequence detectors and binary counters.

UNIT-IV: Capabilities and Minimization of Sequential Machines:
Melay and Moore machines, capabilities and limitations of finite state machine, state equivalence and machine minimization.

UNIT-V: Algorithmic State Machines:
ASM chart, timing considerations, control implementation, design with multiplexers and PLA control. Introduction to unate functions and threshold logic.

Text Books:

1. Switching And Finite Automata Theory – By Zvi Kohavi, TMH Edition.
2. Digital Logic Computer Design – By M. Morris Mano, PHI.
3. Digital Logic Design Principles – By Norman Balbamian and Breadly, John Wiley

References Books:

1. Introduction to Switching Theory and Logic Design- By F. J. Hill and Peterson, John Wiley Publications.
2. Digital Logic – Applications & Design – By- John M. Yarbroough, Vikas Publications, 1997.
3. Digital System Design – By R. P. Jain TMH.
4. Digital Systems Principles, Applications– By Ronald J. Tocci, Pearson Education/Phil

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Understand numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
2. Apply simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
3. Design sequential circuits by using sequential functions/building blocks to build larger more complex circuits.
4. Design and analyze the circuits using Finite state machines and minimization of state machines.
5. Analyze the complex circuits and design with multiplexers and PLA controls

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Electrical Machines –II

Course Objectives:

1. To understand theory & operation of 1 phase Transformers
2. To understand theory & operation of 3 phase Transformers
3. To learn constructional and operation of 3phase induction motors
4. To analyze, the performance of 3 phase Induction Motor.
5. To learn construction & Principle of operation of 1 phase Induction Motor.

Unit- I: Single Phase Transformers

Types: - core and shell type - constructional details- minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams. Equivalent circuit - losses and efficiency-regulation. All day efficiency - effect of variations of frequency & supply voltage on iron losses.

Performance of transformers : OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test.

Auto transformers- auto transformers**-** equivalent circuit - comparison with two winding transformers.

Unit- II: Three Phase Transformers

Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Third harmonics in phase voltages-three winding transformers-tertiary windings. Determination of Zp, Zs and Zt transients in switching – off load and on load tap changing; Scott connection.

Parallel Operation of Transformers

Parallel operation single phase transformers with equal and unequal voltage ratios – Problems-

Parallel operation of three phase transformers (Basic concepts only).

Unit- III: Three Phase Induction Motors

Construction details of cage and wound rotor machines-production of a rotating magnetic field -principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and pf. at

standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors -equivalent circuit - phasor diagram - crawling and cogging.

Unit- IV: Performance of Three Phase Induction Motors

Circle diagram-no load and blocked rotor tests-predetermination of performance.
Methods of starting DOL, star-delta, auto transformer, starting current and torque calculations of Induction Motors.
Speed control-change of frequency- change of poles and methods of consequent poles; cascade

connection. Injection of an emf in to rotor circuit (qualitative treatment only)-induction generator principle of operation. Applications.

Unit- V: Single Phase Induction Motors

Single phase Induction motor – Constructional features- Double revolving field theory Equivalent circuit- spilt –Phase motors- Capacitor start Capacitor run motors. applications.

Text Books:

1. Theory and performance of Electrical Machines- JB Gupta, SK kataria and sons, 14th Edition
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

References Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Describe the constitutional details and theory of operation of 1 phase Transformers
2. Evaluate the performance of 3phase Transformers and operate transformers when connected in parallel
3. Describe the constructional details and principle of operation of 3 phase Induction Motor
4. Draw inference performance of 3 phase Induction Motor by theoretical calculations
5. Describe the constructional details and principle of operation of 1 phase Induction Motor

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Power Systems-II

Course Objectives:

1. To gain knowledge on the basic transmission line parameters.
2. Classify & study the performance of short, medium & long transmission lines.
3. To analysis of power system transients.
4. To gain knowledge on various factors governing the performance of transmission line.
5. To perform sag calculations and study underground cables.

Unit- I: Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems..

Unit- II: Performance of Short, Medium and Long Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems, Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems. Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves , Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models (numerical problems).

Unit- III: Power System Transients

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions, Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

Unit- IV: Factors Governing the Performance of Transmission line and Overhead Line Insulators

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line, Shunt Compensation. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Types of Insulators, String efficiency and Methods for improvement, Numerical Problems voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Unit- V: Sag and Tension Calculations and Underground Cables

Sag and Tension Calculations with equal and unequal heights of towers Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Capacitance of Single and 3-Core belted cables, Numerical Problems.

Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Principles of Power Systems - V.K Mehta and Rohit Mehta, S.Chand Company Ltd., New Delhi 2004

References Books:

1. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited Publishers, 1998.
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Determine the line parameters of Transmission lines.
2. Analyze the Performance of short, Medium, long Transmission lines.
3. Describe transients in power systems.
4. Assess various factors governing the performance of Transmission Lines.
5. Perform sag and tension calculations for various transmissions and also describe the features of Under Ground Cables.

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Control Systems

Course Objectives:

1. To study mathematical models of physical system
2. To study the response of different order systems using standard test signals
3. To analyze the stability of the system in time domain and in frequency domain
4. To study the controllers used for various control system applications
5. To determine the stability analysis of the system using State Space Analysis

Unit -I: Introduction to Control System

Industrial Control examples. Mathematical models of physical systems. Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.– Representation by Signal flow graph - Reduction using Mason's gain formula

Unit -II: Time Response Analysis

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Unit- III: Frequency-Response Analysis

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Unit – IV: Classical Control Compensation Design Techniques

P,PI,PD and PID controllers determination of coefficient's.

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain

Unit- V: State Variable Analysis

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.

Text Books:

1. Control Systems Engineering – I.J.Nagrath and M.Gopal, New Age International (P) Limited, Publishers, 2nd edition, 2009.
2. Automatic Control Systems - B. C. Kuo, John wiley and son's., 8th edition, 2003.

Reference Books:

1. Modern Control Engineering –Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems - N.K.Sinha, New Age International (P) Limited Publishers, 3 rd Edition, 1998.
3. Control Systems – A. Nagoor kani, Published June 2006 by RBA Publications

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Model linear-time-invariant systems using transfer function
2. Analyze state-space representations.
3. Apply the concept of stability and its assessment for linear-time invariant systems.
4. Design simple feedback controllers.
5. Describe the concept of simple compensators

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Integrated Circuits & Applications

Course Objectives:

1. To introduced the basic building blocks of linear integrated circuits.
2. To understand the linear and non – linear applications of operational amplifiers.
3. To introduce the concepts of waveform generation and introduce some special function ICs.
4. To understand the theory and applications of PLL, and design ADC and DAC.
5. To understand and implement the working of basic digital circuits

UNIT I: Integrated Circuits
Introduction: Classification. Chip Size and Circuit Complexity, Ideal and Practical Op-Amp, Op-amp characteristics-DC and AC Characteristics. 741 Op-Amp and its Features, Modes of operation-inverting, non-inverting, differential.
Applications: Basic Applications of Op-Amp, Instrumentation Amplifier, V to I and I to V Converters, Sample & Hold Circuits, Differentiators and Integrators, Comparators, Schmitt Trigger, Multivibrators. Introduction to Voltage Regulators.

UNIT II: Active Filters & Oscillators
Active Filters: First Order and Second Order Low Pass, High Pass and Band Pass Filters. Active Band Reject and All Pass Filters.
Oscillators: Principle of Operation and Types of Oscillators – RC, Wien Bridge and quadrature type. Waveform Generators – Triangular, Saw Tooth, Square Wave.

UNIT III: 555 Timer & PLL
Introduction to 555 Timer: Functional Diagram, Monostable and Astable Operations and Applications, Schmitt Trigger.
PLL: Introduction, Block Schematic, Principles and Description of individual Blocks of 565, VCO.

UNIT IV: D-A & A- D Converters
Introduction, Basic DAC Techniques - Weighted Resistor Type, R-2R Ladder Type, Inverted R-2R Type. Different types of ADCs - Parallel Comparator Type, Counter Type, Successive Approximation Register Type and Dual Slope Type, DAC/ADC Specifications.

UNIT V: Digital Integrated Circuits Introduction
Classification of Integrated Circuits, Standard TTL NAND Gate-Analysis & Characteristics, TTL Open Collector Outputs, Tristate TTL, MOS & CMOS Open Drain and Tristate outputs, Comparison of Various Logic Families. IC interfacing- TTL driving CMOS & CMOS driving TTL.
Combinational Circuit ICs: Use of TTL-74XX Series & CMOS 40XX Series ICs,
Sequential Circuit ICs: Commonly Available 74XX & CMOS 40XX Series ICs.

Text Books:

1. Linear Integrated Circuits -D. Roy Choudhury, New Age International (p)Ltd, 3" Ed., 2008.
2. Digital Fundamentals - Floyd and Jain, Pearson Education,8th Edition, 2005.
3. Op-Amps and Linear Integrated Circuits - Concepts and Applications by James M.Fiore, Cengage/ Jaicc, 2/e, 2009.

Reference books:

1. Modern Digital Electronics - RP Jain - 4/e - TMH, 2010.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Design various applications of Op-Amps.
2. Design the circuits using special ICs like 555 timer, 723 voltage regulator and 565 PLL.
3. Design A/D and D/A Converters using ICs.
4. Design digital circuits using digital ICs.
5. Design different families of digital integrated circuits and their characteristics.

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Analog Devices and Circuits

Course Objectives:

1. To learn the characteristics of diode and how to make use of diode in different applications
2. To explain the operation and characteristics of transistors in different modes
3. To apply different biasing methods to make transistor stable
4. To explain the operation, design and Analysis of BJT and FET amplifiers.
5. To analyze feedback amplifiers and design of Oscillators

UNIT-I: P-N Junction Diode and Rectifiers:
Review of P-N Junction Diode,Volt-Ampere Characteristics, Transition and Diffusion Capacitances, Diode Equivalent Circuits, The P-N Junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic Components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, Voltage Regulation Using Zener Diode. Zener Diode Characteristics, Principle of Operation and Characteristics of Tunnel Diode.

UNIT-II: Bipolar Junction Transistor and Field Effect Transistor:
The Junction Transistor, BJT Operation, BJT Symbol, Transistor as an Amplifier, Common Base, Common Emitter and Common Collector Configurations.
The Junction Field Effect Transistor (Construction, Principle of Operation, Symbol), Pinch – Off Voltage –Volt –Ampere Characteristics, The JFET Small Signal Model, MOSFET (Construction, Principle of Operation, Symbol) MOSFET Characteristics In Enhancement and Depletion Modes.

UNIT-III: Transistor Biasing and Stabilization:
Operating Point, The DC and AC Load Lines, Need For Biasing, Types of biasing methods: Fixed Bias, Collector Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization Against Variation In $V_{BE}$and β, Bias Compensation Using Diodes and Transistors. Thermal Runway, Thermal Stability.

UNIT-IV: BJT and FET Amplifiers:
BJT Hybrid Model, Determination of h-Parameters From Transistor Characteristics, Analysis of A Transistor Amplifier Circuit Using h-Parameters, Comparison of CB, CE And CC Amplifier Configurations.FET Common Source Amplifier, Common Drain Amplifier, FET as Voltage Variable Resistor, Comparison of BJT And FET, The Uni Junction Transistor

UNIT–V: Feed Back Amplifiers and Oscillators:
Concepts of feedback. Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Simple problems.

Condition for oscillations. RC and LC type oscillators, Crystal oscillators, Frequency and amplitude stability of oscillators, Generalized analysis of LC oscillators, Quartz (Hartley, Colpitts), RC-phase shift and Wien-bridge oscillators.

Text Books:

1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and SatyabrataJit Tata McGraw Hill, 2nd Ed., 2007.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition,2006.
3. Introduction to Electronic Devices and Circuits- Rober T. Paynter PE.
4. Electronics Devices and Circuits – A. P. Godse Technical Publications.

Reference Books:

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
2. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
3. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
4. Electronic Devices and Circuits – Dr. K. Lal Kishore,2004,BSP

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Apply the diode concepts in different applications
2. Understand the BJT, FET and revolutionary MOSFET that lead to the development of integrated circuits and study their construction and characteristics
3. Compare different biasing methods and compensation methods to make transistor stable
4. Design and analyze simple basic amplifiers using both BJTs and FETs
5. Design and analyze feedback amplifiers and oscillators using BJTs

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Analog Devices and Circuits Lab

Course Objectives:

1. To operate and characterize the behavior of devices and circuits.
2. To understand the functionality of semiconductor devices.
3. To design and test rectifiers with and without filters
4. To design and test amplifiers circuits.
5. To design and test oscillator circuits

PART A: (Only for Viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specifications, Testing of R, L, C, Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's

2. Identification, Specification and Testing of Active Devices, Diodes, BJT's LOW power JFET's, MOSFET's, Power Transistors, LED's, SCR, UJT.

3. Study and operation of

- Multi-meters (Analog and Digital)
- Regulated Power Supplies
- Function Generator
- CRO

PART B (For Laboratory Examination – Minimum of 10 experiments)
List of Experiments:

1. Forward & Reverse Bias Characteristics of PN Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Half Wave Rectifier with & without filters.
4. Full Wave Rectifier with & without filters
5. Input &output characteristics of Transistor in CB Configuration.
6. Input &output Characteristics of Transistor in CE Configuration.
7. FET characteristics.
8. Measurement of h- parameters of transistor in CB, CE, CC configurations
9. Frequency Response of CC Amplifier.
10. Frequency Response of CE Amplifier.
11. Frequency Response of FET Amplifier (Common source).
12. SCR Characteristics
13. UJT Characteristics.

Requirements:

1. Regulated power supplies (RPS)		
2. CRO's	:	0-20MHZ
3. Function Generator	:	0-1 MHZ
4. Multimeters		
5. Decade Resistance Boxes / Rheostats		
6. Decade Capacitance Boxes		
7. Ammeters (Analog or Digital)	:	0-20μA, 0-50μA, 0-100μA, 0-200μA,0-10 mA
8. Voltmeters (Analog or Digital)	:	0-50V,0-100V, 0-250V
9. Electronic Components	:	Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, diodes Ge& Si type, Transistors NPN, PNP type

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Understand electronic test equipment to characterize the behavior of devices and circuits.
2. Plot the characteristics of semiconductor devices to understand their functionality.
3. Design and test rectifiers with filters
4. Design and test amplifier circuits and interpret the results.
5. Design and test oscillator circuits and interpret the results.

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Control Systems Lab

Course Objectives:

1. To familiarize with modeling of dynamical systems and the characteristics of control components like AC servo motor, Synchros and magnetic amplifier.
2. To study the effect of P, PI & PID control on second order system.
3. To provide the basic knowledge state space model for a given classical transfer function.
4. To learn the basics of Programmable Logic Control.
5. To simulate and analyze the stability and design the compensator.

List of Experiments:

Part - A

1. Time response of Second Order System
2. Effect of P, PI, PID controller on a Second Order System
3. Characteristics of Synchros
4. Lead and Lag Compensation –Magnitude and phase plot
5. Characteristics of AC Servomotor
6. Effect of feedback on DC Servomotor
7. Transfer function of a DC motor

Part – B

8. Simulation of OP-AMP based Integrator and Differentiator
9. Root Locus Plot, Bode Plot, Nyquist Plot and Polar Plot of Transfer Function
10. State space model for a given classical transfer function
11. Programmable Logic Controller
12. Temperature control using PID controller
13. Magnetic amplifier

Note:-All experiments from part A and Three experiments from part B to be conducted

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Analyze the physical systems represented in given transfer function.
2. Apply the knowledge of various control systems components for different applications like AC servo motor, Synchros.
3. Analyze the effect of P.PI & PID controllers on second order systems
4. Design a Lag and Lead compensator using magnitude and phase plot
5. Analyze and simulate design of various control system problems using software.

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Environmental Studies
(Mandatory Course)

Course Objectives:

1. To introduce the knowledge about Environment.
2. To introduce students to the concepts of pollution, Biodiversity
3. To develop an awareness about global Environmental problems.
4. To learn to protect environment and awareness on legal issues
5. To learn about importance of sustainable development and role of IT in environment.

Unit – I: Multidisciplinary nature of Environmental Studies:
Definition, Scope and Importance–Need for Public Awareness.
Ecosystems: Concept of an ecosystem–Classification, structure and function of differentecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids.
Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystemdiversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit – II: Natural Resources:
Renewable and non-renewable–Natural resources and associated
problems: Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest and tribal people: Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources: Equitable use of resources for sustainable lifestyles.

Unit – III: Environmental Pollution

Definition, Cause, effects and control measures of different kindsof pollution (Air, Water, Soil, Marine, Noise, Thermal, Nuclear, e –Waste)

Carbon Capture & Sequestration – different storage sources, major disadvantages,environmental effect**s**

Social Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

Unit – VI: Waste management technology

Solid waste Management: Causes, effects and controlmeasures of urban and industrial wastes. - Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

Waste water and sewage treatment technology: primary, secondary and tertiary treatments.

Bioremediation, Phyto-remediation, ZLD (zero liquid discharge), membrane technology.

Application of GIS and GPS system in environmental science.

Environmental policy, Rules and regulations.EIA (Environmental Impact Assessment) &EMP (ENVIRONMENTAL Management Plan) – Environment Protection Act. - Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act –Forest Conservation Act.-Public awareness. Global environmental problems and global efforts.

Unit – V: Towards sustainable future

Concept of sustainable development, threats of sustainability,population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources.Urban sprawl, sustainable cities and sustainable communities, human health. Role of IT in environment, environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha, University Press Private Limited, Reprinted in 2005.
2. Environmental Studies: From Crisis to Cure by R.Rajagopalan, Oxford University Press, 2nd Edition, 2005

References Books:

1. Environmental Science: Towards a Sustainable Future by Richard T.Wright. PHL Learning Private Ltd .New Delhi, 2008
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela. PHI Learning Pvt. Ltd. 4th edition, 2008

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Understand fundamental physical and biological principles that govern natural processes.
2. Understand fundamental concepts from the social sciences and humanities underlying environmental thought and governance
3. Integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
4. Communicate integrated perspectives on complex environmental problems in the form of written and oral argument to both professional and lay audiences.
5. Design and conduct independent research that contributes to environmental thought and/or problem solving.

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B.Tech EEE III Year I Semester

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Electrical Measurements & Instrumentation

Course Objectives:

1. To know the operation of various measuring instruments like Voltmeters/ Ammeters.
2. To study the basic principle of operation CT, PT, pf meters & frequency meters.
3. To understand the power measurement using wattcmeters and energy measurement by using energy meters.
4. To learn how to measure the unknown voltage & current using potentiometer and to study the methods of measurement of R, L & C elements.
5. To study about oscilloscopes & Transducers and their applications.

Unit-I: Measuring Instruments

Errors in Measurements, Classification – deflecting, control and damping torques – Ammeters and Voltmeters – Permanent Magnet Moving Coil, moving iron type instruments, dynamometer type – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters basic principle & operation – Extension of range of Electrostatic Voltmeters.

Unit-II: Instrument Transformers

Current Transformer and Potential Transformer – Ratio and phase angle errors – design considerations- Type of P.F. Meters – dynamometer and moving iron type – 1- phase and 3-phase meters – Frequency meters – Resonance type and Weston type – Synchroscopes.

Unit-III: Measurement of Power and Energy

Single phase dynamometer wattmeter, LPF and UPF, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing.

Unit IV: Measurement of R, L & C and Potentiometers

Measurement of R, L & C: Method of measuring Low Resistance with Kelvin's double bridge, Medium resistance –Whetstone's bridge, High resistance – loss of charge method.

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge.Wien's bridge – Schering Bridge.

Potentiometers: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage.A.C. Potentiometers: polar and coordinate types– applications.

Unit- V: Oscilloscopes, Digital Voltmeters and Transducers

Oscilloscopes: Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes-applications of CRO-Measurement of phase and frequency-lissajous patterns-Sampling oscilloscope - analog and digital type.

Digital Voltmeters: Successive approximation, ramp, dual-Slope integration continuous balance type.

Transducers: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT, LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples**.**

Text Books:

1. Electrical & Electronic Measurement & Instruments - A.K. Sawhney Dhanpat Rai & Co. Publications, 3rd Edition
2. Electrical & Electronics measurements and Instrumentation- ER.R.K Rajput, S.Chand Publications-Fourth Edition

Reference Books:

1. Electrical Measurements – Buckingham and Price, PHI
2. Transducers and Instrumentation - D.V.S Murthy, Prentice-Hall Of India Pvt. Limited, 2nd edition, 2004.
3. Electrical Measurements: Fundamentals, Concepts, Applications – Reissland, M.U, New Age International (P) Limited, Publishers.
4. Electrical Measurements and measuring Instruments – E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publications.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Describe the construction, principle & operation of various measuring instruments.
2. Analyze the various measuring instruments in order to extend the range & minimize the errors
3. Measure 3 phase active & reactive power by various methods.
4. Find unknown AC & DC emf, currents using various potentiometers & Use various bridges to find unknown R, L & C values and its quality & dissipation factors for capacitance.
5. Demonstrate the principle of operation of CRO and its applications & explain the importance and working principle of various Transducers.

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B.Tech EEE III Year I Semester | **L** | **T** | **C**
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Power Electronics

Course Objectives:

1. To learn the basic concepts of power electronic devices and their characteristics
2. To understand the various triggering & commutation methods for SCRs
3. To study the principle of operation of single phase and three phase line commutated converters
4. To understand the principle of operation of AC Voltage controllers and Cyclo converters
5. To study the principle of operation of various types of Choppers and Inverters

Unit-I: Power Semi Conductor Devices and Commutation Circuits

Thyristors – Silicon Controlled Rectifiers (SCRs) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors .Basic theory of operation of SCR – Static characteristics and Dynamic characteristics of SCR - Turn on and Turn off times – Turn on and turn off methods- Salient points. Types of Power Supplies.

Two transistor analogy of SCR - UJT firing circuit - Series and parallel connections of SCRs Snubber circuit details – Specifications and Ratings of SCRs, BJT, IGBT - Numerical problems.

Unit-II: Single Phase Half Controlled and Fully Controlled Converters

Phase control technique - Single phase Line commutated converters Midpoint and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load with continuous current mode of operation –Derivation of average load voltage and current - Active and Reactive power inputs to the converters without and with Freewheeling Diode.

Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load for continuous current mode of operation. Derivation of average load voltage and current – Line commutated inverters. Active and Reactive power inputs to the converters without and with Freewheeling Diode. Effect of source inductance – Derivation of load voltage and current – Numerical problems.

Unit-III: Three Phase Line Commutated Converters

Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage With R and RL loads.

Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

Unit-IV: AC Voltage Controllers & Cyclo Converters

AC voltage controllers – Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms. Firing circuits -Numerical problems.

Cyclo converters – Single phase midpoint Cyclo converters with Resistive and inductive loads (Principle of operation only) – Bridge configuration of single phase Cyclo converter (Principle of operation only) – Waveforms

Unit-V: Choppers and Inverters

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R, RL and RLE loads for continuous and discontinuous current modes. Step up Chopper – load voltage expression. Morgan's chopper – Jones chopper (Principle of operation only) -Waveforms - AC Chopper – Problems.

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter-Bridge inverters -120^{o} and 180^{o} modes of operation – Waveforms – Simple forced commutation circuits for bridge inverters. Voltage control techniques for inverters-Pulse width modulation techniques – Numerical problems.

Text Books:

1. Power Electronics-P.S. Bimbhra- Khanna Publishers, 4^{th} Edition
2. Power Electronics – M.D. Singh & K.B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 2^{nd} edition.

Reference Books:

1. Power Electronics: Circuits Devices and Applications – M.H. Rashid, Prentice Hall of India, and 3rd edition.
2. Thyristorised Power Controllers – G.K. Dubey, S.R Doradra, A. Joshi and R.M.K. Sinha, New Age international Pvt Ltd. Publishers latest edition.
3. Power Electronics – P.C. Sen, Tata Mc Graw-Hill Publishing

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Evaluate the characteristics of various Power Electronics devices such as SCR, MOSFET, IGBT and TRIAC
2. Analyze different types of Trigerring and commutation techniques for SCR
3. Use concepts of Power Electronic devices in Single Phase and three phase controlled rectifiers for speed control of DC Motor
4. Analyze the operation of AC voltage controllers, Cyclo Converters with different loads
5. Use Inverters, Choppers for speed control of AC and DC Motors.

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B.Tech EEE III Year I Semester	**L**	**T**	**C**
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Electrical Machines- III

Course objectives:

1. To understand principle of operation & characteristics of synchronous Generators
2. To gain knowledge of various methods to determine voltage regulation of synchronous generators
3. To understand parallel operation of synchronous Generators
4. To study the principle of operation of Synchronous motors
5. To learn the principle of Operation & applications of special motors.

Unit-I: Construction-Principle of Operation & Characteristics of Synchronous Generator

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

Unit-II: Voltage Regulation of Synchronous Generators

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – Salient pole alternators – two reaction theory – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators. Numerical Problems.

Unit-III: Parallel Operation of Synchronous Generators

Synchronizing alternators with infinite bus bars – Synchronizing power and synchronizing torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's. Numerical Problems.

Unit-IV: Synchronous Motors

Principle of operation-methods of starting-phasor diagram-Variation of current and power factor with excitation-synchronous condenser-Mathematical analysis for power developed-circle diagrams of synchronous machines-hunting and its suppression-damper windings. Numerical Problems.

Unit-V: Special Motors

Basic Principle of operation and application of AC series motor-Universal motor-Stepper motor –shaded pole motor-Reluctance motor-BLDC motor (Elementary treatment only)

Text Books:

1. Theory and performance of Electrical Machines- JB Gupta, SK kataria and sons, 14th Edition
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

References Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the principle of operation of Synchronous motors
2. Describe different methods of voltage regulation and parallel operation of Synchronous Generators
3. Operate synchronous generators in parallel
4. Describe the constructional details and principle of operation of Synchronous motors
5. Explain the operation of special motors and their applications in daily life.

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B.Tech EEE III Year I Semester

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Renewable Energy Technology
(Professional Elective - I)

Course Objectives:

1. To learn about photovoltaic energy conversion & its basics.
2. To understand solar panels such as flat plate collectors, dish collectors and converter systems.
3. To learn Renewable energy sources, like Wind Energy & Bio-Mass.
4. To understand about geothermal, ocean, tidal and wave energy & concepts of DEC.
5. To learn about various converter topologies for Wind Power Generation.

Unit – I: Solar Radiation and Solar Energy Collection

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, photovoltaic energy conversion, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Unit – II: Solar photovoltaic

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating
collectors, orientation and thermal analysis, advanced collectors.

Unit-III: Wind Energy and Bio-Mass

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, tip speed ratio stall & Pitch Control performance characteristics, Betz criteria.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Unit-IV: Geothermal, Ocean, Tidal and Wave Energy

Geothermal Energy: Methods of harnessing the energy.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants.

Tidal and Wave energy: Potential and conversion techniques.

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Seebeck effect, MHD generators (Ideal and Practical).

Unit-V: Wind Generator Topologies

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Text Books:

1. Non-Conventional Energy Sources - G.D. Rai, Khanna Publishing House, 2011.
2. Renewable Energy Technologies - Ramesh & Kumar , Narosa Publishing House.

Reference Books:

1. Non-Conventional Energy Systems - K Mittal, Wheeler Publishing Co.
2. Renewable energy resources- Tiwari and Ghosal, Narosa Publishing House, 2007.
3. Non-Conventional Energy - Ashok V Desai,Wiley Eastern Ltd, New Delhi, 2003.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Describe Renewable energy sources, generating systems, its performance characteristics and potential in India
2. Explain about solar photovoltaic energy conversion systems.
3. Analyze the Non conventional energy sources like Wind Energy & Bio Mass.
4. Illustrate the types of energy generating systems, construction, principle, operation and applications.
5. Demonstrate the different topologies of wind energy conversion system.

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B.Tech EEE III Year I Semester

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Electrical Machine Design
(Professional Elective - I)

Course Objectives:

1. To know the fundamental requirements for designing various electrical machines like transformers, IMS and Synchronous Motors
2. To expose the student the basic requirements for designing the transformers using dimensions rating space factors, cooling methods etc.
3. To study and acquire basic concepts necessary for design the induction motors
4. To provide the knowledge required for designing the various parts of synchronous machines and the winding details suitable for various ratings
5. To learn the need of CAD analysis design optimization methods FEM based design and complex structures of PMSM, BLDC and SRMS

Unit- I: Introduction
Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

Unit- II: Transformers
Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Unit- III: Induction Motors
Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Unit- IV: Synchronous Machines
Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Unit- V: Computer aided Design (CAD):
Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Text Books:

1. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory, Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.

References Books:

1. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
2. A.Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
3. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
4. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D
machine design package.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain the concepts for design of various machines
2. Analyze the designing of transformers of different ratings
3. Design the induction motors of various ratings.
4. Design the synchronous machines with various ratings and specifications
5. Apply the concepts and knowledge of CSD, FEM based machines design for various applications and also able to use PMSM, BLDC, SRM for various applications,

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Control Systems Design
(Professional Elective - I)

Course Objectives:

1. To expose the student to design specifications and its physical relivence
2. To provide the students with basic knowledge to design the classical control System in the time domain
3. To learn the design of the classical control system in the frequency domain
4. To introduce the design of PID controllers and control system design in state space representation
5. To learn to design control systems in state space and also understand the effect of non linear parameters on system performance.

Unit- I: Design Specifications
Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

Unit- II: Design of Classical Control System in the time domain
Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

Unit- III: Design of Classical Control System in frequency domain)
Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

Unit- IV: Design of PID Controllers
Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

Unit- V: Control System Design in State Space
Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Nonlinearities and its effect on system performance
Various types of non-linearties. Effect of various non-linearties on system performance. Singular points. Phase plot analysis.

Text Books:

1. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall, 2010.

Reference Books:

1. B. C. Kuo, “Automatic Control system”, Prentice Hall, 1995
2. N. Nise, “Control system Engineering”, John Wiley, 2000.
3. I. J. Nagrath and M. Gopal, “Control system engineering”, Wiley, 2000.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain the various design specifications and design problems in classical control systems
2. Design of classical control system in the time domain such as Lag, Lead, lag-Lead compensator
3. Design of classical control systems in frequency domain such as Feedback and Feed forward compensator design using Bode Diagram
4. Design and analysis of PID controllers in time and frequency domain in different order systems
5. Analyze the non linearties and its effects on systems performance.

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B.Tech EEE III Year I Semester	**L**	**T**	**C**
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Managerial Economics and Financial Analysis

Course Objectives:

1. To explain the fundamentals of the key elements of a business organization.
2. To learn practical approach to various functional areas of decision making.
3. To compare different pricing Strategies.
4. To enhance a knowledge of capital Budgeting Techniques.
5. To solve the problems using Rations analysis.

Unit – I: Introduction to Managerial Economics
Definition, Nature and scope of Managerial Economics, Demand Analysis- Demand Determinants, Law of Demand and its exceptions.
Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Methods of Demand Forecasting (Survey Methods, Statistical Methods, Expert Opinion Method, Test Marketing, Controlled Experiments, Judgmental Approach to Demand Forecasting)

Unit – II: Theory of Production and Cost Analysis
Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs.
Cost Analysis: Cost concepts, Opportunity Cost, Out of Pocket Costs vs. Imputed Costs. Breakeven Analysis (BEA) – Determination of Breakeven Point (simple problems), Managerial Significance and limitations of BEA.

Unit – III: Market Structures& Pricing Policies
Market structures: Types of Competition, Features of Perfect Competition, Monopoly and Monopolistic Competition, Price - Output determination in Perfect Competition and monopoly.
Objectives and Policies of Pricing: Objectives of pricing**,** Methods of Pricing - Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two - Part Pricing, Block Pricing, Peak Load Pricing, Cross Subsidization.

Unit – IV: Introduction to Financial Accounting
Accounting, Double-Entry Book Keeping, Journal, Ledger, and Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Unit – V: Financial Analysis through ratios
Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and Quick Ratio), Activity Ratios (Inventory Turnover Ratio and Debtor Turnover Ratio), Capital Structure Ratios (Debt – Equity, Interest Coverage Ratio), and Profitability Ratios (Gross Profit Ratio, Net Profit Ratio, Operating Profit Ratio, P/E Ratio and EPS).

Text Books:

1. Varshney & Maheshwari, Managerial Economics, Sultan Chand & Sons, 2014.
2. S.A. Siddiqui and A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013

References Books:

1. R. K. Sharma & Shashi K Gupta, Financial and Management Accounting, 4th Ed., Sultan Chand.
2. S. N. Maheshwari& S. K. Maheshwari, Financial Accounting, Vikas 2012.
3. M. Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, PHI, 2012.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Describe the concept of demand and its determinants in Managerial decisions.
2. Analyze the cost concepts and breakeven analysis in production.
3. Evaluate the market structures and different Pricing Strategies.
4. Apply the capital budgeting techniques in financial decisions.
5. Explain application of ratios in solving of business problems and taking correct decisions

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III Year B.Tech. EEE – I Sem	L	T / P / D	C
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LOGICAL REASONING, VERBAL AND QUANTITATIVE ABILITY

(OE-1)

Pre requisites: Basic Mathematics, Statistics and English

Course Outcomes:

1. Enhance the problem solving ability of the students with focusing on basic concepts of arithmetic, algebra, geometry data analysis.
2. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

Unit I:

Number Systems: Classification of numbers, Squares, Fractions, Simplifications, Divisibility Test, Power Cycle, Reminder Cycle, Factors, LCM, HCF, Application of LCM & HCF

Ratio and Proportion: Tricks to solve ratio, proportions, continuous proportions, Variations, Ages

Percentages: Percentage Increase/ Decrease , Results on population , Results on Depreciation, Simple Interest , Principal , Interest , Amount , Application of Simple Interest, Compound Interest , Compound Annually , Compound Half-yearly , Compound Quarterl, Difference between Compound Interest and Simple Interest

Unit II:

Geometry: Lines , Properties of lines , Triangles, Properties of Triangles, Angles , Sectors , Chords , Planes , Quadrilateral

Mensuration: Area & Perimeter of Triangle, Quadrilateral, Rectangle, Square, Parallelogram, Trapezium, Surface Area & Volume of 3D Figures

Data Interpretation: Table Charts, Pie Charts, Bar Graphs, Line Graphs

Data Sufficiency: Problems On all quant and Logical topics

Unit III:

Seating Arrangement: Circular arrangement, row arrangement, column arrangement, Square arrangement, Double row arrangement

Syllogisms: Two Statements & Conclusion, Three Statements & Conclusion, Six Statements

Unit IV:

Number Series: Letter Series, Number Series, Letter & Number Series

Analogy: Simple Analogy, Double Analogy, Word Analogy, Number Analogy, Choosing Analogy Pairs

Coding & Decoding: Letter Coding, Number Coding, Symbol Coding, Letter - Number Coding, Letter - Symbol Coding, Direct Coding, Indirect Coding

Blood Relations: Based on Dialogue or conversation, Based on puzzles

Unit V:

Nouns: Types of nouns, rules, usages and error spotting

Pronouns: Types of nouns, rules, usages and error spotting

Articles: Definite and indefinite articles, Omission of articles, rules, usage and error spotting

Adjectives and Adverbs: Types of nouns, rules, usages and error spotting

Preposition: Types of nouns, rules, usages and error spotting

Text Books:

1. Verbal and Non Verbal Reasoning - *R.S.Agarwal*.
2. Quantitative Aptitude - *R.S.Agarwal*.
3. Quantitative Aptitude - *Abhijit Guha*.

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B.Tech EEE III Year I Semester

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Disaster Preparedness and Planning
(Open Elective – I)

Course objectives:

1. To know the concept, definition and terminology of the Disaster Management.
2. To know the classification & occurrence of disasters in India and elsewhere.
3. To know and analyze the socio-economic, environmental & political and gender etc., aspects of disasters impacts.
4. To know the Pre, Post and emergency management mitigation strategies &activities of Disaster Management Cycle.
5. To know the environment of vulnerable Disaster areas &to implement developmental activities to minimize the impacts.

Unit – I: Introduction
Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

Unit – II: Disasters
Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit – III: **Disaster Impacts**
Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

Unit – IV: Disaster Risk Reduction (DRR)
Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit – V: Disasters, Environment and Development
Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text Books:

1. Disaster Management - *H.K. Gupta* - University Press, India, 2003.
2. Handbook of Disaster Management: techniques & Guidelines - *Singh B.K., Rajat* Publications, 2008.
3. Disaster Mitigation: Experiences and Reflections - *PardeepSahni*
4. Disaster Risk Reduction in South Asia - *PradeepSahni*- Prentice Hall, 2004.

Reference Books:

1. Disaster Management - *Ghosh G.K*., APH Publishing Corporation, 2006.
2. Disaster Management - *R.R Singh* - Rawat Publication, New Delhi, 2000.
3. Space Technology for Disaster Mitigation in India (INCED) - *R.R. Singh*, University of Tokyo, 1994
4. Disaster Management in Hills- *Dr. Satender*- Concept publishing co., New Delhi, 2003
5. Action plan For Earthquake, Disaster, Mitigation in Disaster Management - *A.S. Arya , V.K. Sharma* , IIPA publications, New Delhi, 1994
6. An overview on Natural &Man made Disaster & their Reduction - *R.K. Bhandani*, CSIR, New Delhi
7. Manuals on Natural Disaster management in India - *M.C. Gupta*, National Centre for Disaster Management, IIPA, New Delhi, 2001

Course Outcome:

At the end of this course, students will have knowledge and ability to

1. Acquire knowledge of concepts and terminology to understand disaster Management.
2. Acquaint with different disasters in India and other parts of the world.
3. Classify, assess the magnitude & intensity of various impacts of disasters.
4. Learn the management methods (Risk & crisis Mgmt) at various stages of Disaster.
5. Learn effective sustainable environmental modification techniques to decrease the vulnerability in disaster prone areas

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B.Tech EEE III Year I Semester | **L** | **T** | **C**
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Database Management Systems
(Open Elective-I)

Course Objectives:

1. To provide a sound introduction to Database management systems, Databases and its applications,
2. To familiarize the participant to give a good formal foundation on the relational model of data
3. To present SQL and procedural interfaces to SQL comprehensively
4. To give an introduction to systematic database design approaches conceptual design, logical design ,schema refinement and physical design
5. To introduce the concepts of transactions and transaction are processing and the issues and techniques relating to concurrency and recovery manager.

Unit -I: Introduction to Database System Concepts

Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features,

Unit- II: Introduction to SQL

Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions Nested Sub queries, Modification of the Database.

Intermediate and Advanced SQL: Join Expressions, Views , Integrity Constraints, SQL Data Types, Authorization. Functions and Procedures, Triggers

Unit -III: Formal Relational Query Languages

The Relational Algebra, Tuple Relational Calculus, The Domain Relational Calculus.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Decomposition Using Multi valued Dependencies, More Normal Forms.

Unit -IV: Indexing and Hashing

Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

Unit -V: Concurrency Control

Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup Systems.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.
2. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.

Reference Books:

1. Peter Rob & Carlos Coronel, Data base Systems design, Implementation and Management ,7th Edition, 2007.
2. RamezElmasri, Shamkanth B. Navrate, Fundamentals of Database Systems, Pearson Education, 2008.
3. C.J. Date ,Introduction to Database Systems, Pearson Education

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Design Entity-Relationship Model for enterprise level databases.
2. Develop the database and provide restricted access to different users of database and formulate the Complex SQL queries.
3. Analyze various Relational Formal Query Languages and various Normal forms to carry out Schema refinement
4. Use of suitable Indices and Hashing mechanisms for real time implementation.
5. Analyze various concurrency control protocols and working principles of recovery algorithms.

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Electrical Machines- II Lab

Course Objectives:

1. To understand the various tests performed on 1-Phase Transformers.
2. To study 3 phase to 2 phase conversion by means of Scott connections
3. To obtain performance of three phase induction motor from circle diagram.
4. To evaluate the different methods to calculate regulation of alternators.
5. To determine X_d & X_q of Salient Pole Synchronous Machines

List of Experiments:

Part A

1. O.C. & S.C. Tests on single phase transformer.

2. Sumpner's test on a pair of single phase transformers.

3. Brake test on three phase squirrel cage induction motor.

4. No-load & blocked rotor tests on three phase Slip ring Induction motor.

5. Regulation of three phase alternator by synchronous impedance (EMF & MMF) method.

6. V and inverted V curves of three - phase Synchronous motor.

7. Equivalent circuit of single phase induction motor.

8. Slip test on salient pole synchronous machine.

Part B

1. Parallel Operation of Single Phase Transformers.

2. Separation of core losses of a single phase transformer.

3. Scott connection of Transformers.

4. Regulation of a three phase alternator by ZPF & ASA method.

5. Efficiency of a three phase alternator.

6. Measurement of sequence Impedance of a 3phase alternator.

Note:-All experiments from part A and two experiments from part B to be conducted.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Connect two 1 phase transformers in parallel and study their operation, determine the various losses in the 1 phase transformers by performing necessary test
2. Connect two transformers in Scott connection and demonstrate 3 phase to 2 phase conversion.
3. Obtain the performance characteristics of 3-Phase Induction Motor.
4. Calculate voltage regulation of alternator by performing appropriate tests.
5. Draw V and inverted V curves for a given synchronous motors

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Advanced English Communication Skills Lab

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organize ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

1. **Vocabulary Building** – synonyms and antonyms, Word Roots, One-Word Substitutes, Prefixes and Suffixes, Study of Word Origin, Analogy, Idioms and Phrases.
2. **Reading Comprehension –** Reading for Facts, Guessing meanings from context, Scanning, Skimming, Inferring Meaning, and Critical Reading.
3. **Writing Skills** –Structure and presentation of different types of writing - Resume Writing /E-Correspondence/Statement of Purpose.
4. **Technical Writing**- Technical Report Writing, Research Abilities/Data Collection/Organizing Data/Tools/Analysis.

5. **Group Discussion** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Coherence.
6. **Presentation Skills** – Oral presentations (individual and group) through JAM sessions/Seminars, Written Presentations through Projects/ PPTs/e-mails etc.
7. **Interview Skills** – Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Interview through Telephone and Video-Conferencing.

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Clarity Pronunciation Power – part II
- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.
- TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- The following software from _train2success.com'
  i. Preparing for being Interviewed,
  ii. Positive Thinking,
  iii. Interviewing Skills,
  iv. Telephone Skills,
  v. Time Management
  vi. Team Building,
  vii. Decision making
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Text Books:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. English Language Communication : A Reader cum Lab Manual Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
7. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
10. English for Technical Communication for Engineering Students, Aysha Vish hwamohan, Tata Mc Graw-Hil 2009.
11. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/Cambridge University Press.
12. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

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SWITCH GEAR AND PROTECTION

Course Objectives:

1. To introduce students to power system protection and switchgear
2. To provide students the knowledge on theory, construction, applications of main types Circuit breakers, Relays
3. To understand the protection of generators and transformers.
4. To gain knowledge on protection of feeders from over- voltages and other hazards
5. To understand various types of neutral grounding and over voltage protection schemes.

Unit - I: Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages. - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures.

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF_6 circuit breakers.

Unit-II: Electromagnetic and Static Relays

Principle of Operation and Construction of Attracted armature, Balanced Beam, Induction Disc and Induction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types.

Applications of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance and Mho Relays. Static relays:-introduction, phase comparators, amplitude comparators, static relays versus electromagnetic relays.

Unit-III: Generator and Transformer Protection

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on (%) Winding Unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problems on Design of CTs Ratio in differential protection, Buchholtz relay Protection.

Unit-IV: Feeder and Bus-Bar Protection

Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay. Protection of Bus bars – Differential protection

Unit-V: Neutral Grounding and Protection against Over Voltages

Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages – Ground wires, Ground Rods and counter poise - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination.

Text Books:

1. Power System Protection and Switchgear - Badri Ram, D.N Viswakarma, TMH Publications.
2. Switchgear and Protection – Sunil S Rao, Khanna Publishers

Reference Books:

1. Transmission network Protection -Y.G. Paithankar, Taylor and Francis, 2009.
2. Power System Protection and Switch Gear - Bhuvanesh Oza, TMH 2010.
3. Electrical Power systems – C.L. Wadhwa, New Age International (P) Limited, Publishers, 6th Edition.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Describe the operation principle of different types of circuit breakers and relays.
2. Illustrate various protection schemes used for Generators & transformers.
3. Analyze different protection schemes used in feeders and busbars.
4. Distinguish between different types of Neutral Grounding and lightning arresters.
5. Explain the causes of over voltages in power systems and protection schemes used.

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Power System Analysis

Course Objectives:

1. To give idea for the formation of Z-bus , Y-bus by different methods.
2. To provide comprehensive coverage of the power flow solution of an interconnected system using Gauss-Seidal method during normal operation.
3. To introduce Iterative techniques like NR and Fast Decoupled method for solving Non linear power flow equations.
4. To study fault analysis and symmetrical component theory.
5. To study power system transient and steady state stabilities.

Unit-I: Power System Network Matrices

Graph theory: Definitions, Bus incidence Matrix, Y_{bus} formation by direct and singular transformation methods, Numerical Problems.

Formation of Z_{bus}: Partial network, algorithm for the modification of Z_{bus} for addition element for the following cases: addition of element from a new bus to reference, addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses. Modification of Zbus for the changes in network (problems).

Unit –II: Power Flow Studies

Necessity of power flow studies- data for power flow studies- derivation of static load flow equations- load flow solution using Gauss seidel Method: Acceleration Factor, load flow solution with and without P-V buses, Algorithm and Flowchart, Numerical load flow Solution for Simple Power systems (Max 3- buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample one iteration only) and finding line flows and losses for the given Bus Voltages.

Newton Raphson Method in Rectangular and Polar Co-ordinates form: Load flow solution with or without PV busses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

Unit-III: Short Circuit Analysis

Per unit system representation. Per unit equivalent reactance network of three phase Power System, Numerical Problems.

Symmetrical fault Analysis: short circuit current and MVA Calculations, Numerical Problems.

Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances.

Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedances, Numerical Problems.

Unit-IV: Power System Steady State Stability Analysis
Elementary concepts of Steady State, Dynamic and Transient Stabilities.
Description of Steady State Stability Power limit, Transfer Reactance, Synchronizing Power Coefficient, Power angle curve and determination of steady state stability and methods to improve steady state stability.

Unit-V: Power System Transient State Stability Analysis
Derivation of Swing Equation, Determination of Transient Stability by Equal Area Criterion. Application of EAC, Critical Clearing Angle calculation. Solution of swing equation, Point by point method, Methods to improve transient state stability.

Text Books:

1. Modern Power System Analysis- I.J.Nagrath and D.P.Kothari, Tata McGraw-Hill Publishing Company, 2nd edition, 2003.
2. Computer Techniques in Power System Analysis - M.A.Pai, TMH Publications, 2nd edition, 2006.

Reference Books:

1. Computer Methods in Power System Analysis - G.W. Stagg & A.H. El-Abiad, International Student Edition, 1968.
2. Power System Analysis - Grainger and Stevenson, Tata McGraw-Hill Publishing Company,1st Edition , 2003.
3. Power System Analysis - Hadi Saadat, Tata McGraw-Hill Publishing Company, 2nd Edition,
2002.

Course Outcomes:
At the end of this course, students will have knowledge and ability to
1. Formulate different network matrices.
2. Analyze different load flow study methods.
3. Describe different types of faults in power systems and perform short circuit analysis.
4. Explain the concepts of steady state stability and its significance.
5. Analyze the transient stability of power system.

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B.Tech EEE III Year II Semester	**L**	**T**	**C**
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Microprocessors and Microcontrollers

Course Objectives:

1. To understand the concepts of microprocessors, different addressing modes and programming of 8085.
2. To understand the basic concepts of 8086.
3. To Study about interrupt structure, communication standards and Serial communication and programming of 8086.
4. To understand the basic concepts of 8051.
5. To interface 8051 with realtime applications.

UNIT-I: 8085 Microprocessor
Evolution of microprocessors, The 8085 Microprocessor, Microprocessor communication and bus timings, Generating control signals, 8085 MPU and its architecture and pin diagram, Decoding and Executing an Instruction, Instruction set and Assembly Language programming.

UNIT–II: 8086 Microprocessor
8086 architecture, register organization, memory segmentation, programming model, memory Addresses, physical memory organization, signal descriptions of 8086, timing diagrams.

UNIT–III: Instruction set and Assembly Language programming of 8086
Addressing modes, assembler directives, macros, simple programs involving logical, arithmetic expressions and string manipulations. Interrupt structure of 8086, Serial communication standards, 8251 USART architectures and interfacing, RS-232C. I/O Interface with 8255-PPI, various modes of operation and interfacing to 8086, 8257 DMA controller to 8086, Memory interfacing to 8086.

UNIT-IV: **8051 Microcontroller**
Architecture, I/O ports, register set, Memory organization, Addressing modes and Instruction set of 8051, Interrupts in 8051, Interrupt Priority in the 8051.

UNIT–V: 8051 Interface
Timers/Counters and Serial communication registers in 8051, Interface with Keyboard & Displays, Serial data communication and Timer/Counter Interfacing program.

Text Books:

1. Ramesh S Goankar, “Microprocessor Architecture Programming and Applications with the 8085, Penram International Pvt.Ltd.
2. A.K. Ray & Bhurchandi Advanced Microprocessors and peripherals –, TMH publications.

Reference Books:

1. Kenneth Ayala and Dhanunjay Gadre, 'The 8051 microcontroller' Penram International/ Thomson,1995.
2. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd, TMH publications.
3. 8086 Micro Processor -Kenneth J. Ayala, Penram International/ Thomson,1995.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Write the assembly language programs of 8085 for simple applications.
2. Write assembly language programs for different addressing modes of 8086.
3. Apply the knowledge of interrupt structure of 8086, communication standards and Serial communication in 8086 interfacing.
4. Write the assembly language programs of 8051 for simple applications.
5. Design 8051 interfacing with different peripherals.

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Python Programming

Course Objectives:

1. To understand the basics and function of Python Programming Language.
2. To understand the string operation and sequences used in Python Programming Languages.
3. To know the classes and objects in Python Programming Language.
4. To use the re-usability concepts in Python Programming Language.
5. To use Exception Handling mechanism in Python Programming Language.

Unit – I: Introduction to Python
Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations

Functions and Modules
Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings, Built-in Functions,

Unit – II: Strings and Regular Expressions
String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.
Sequence: List, Tuples, Dictionaries.

Unit-III: Implementation of classes and objects in Python:
Classes and Objects, Class Method and Self Argument. The __Init__Method, Class Variables and Object Variables, The _Del__Method, Public and Private Data Members, Private Methods, Buil-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection(Destroying Objects).

Unit – IV: Implementation of Inheritance in Python:
Inheriting Classes in Python, Types of Inheritance, Composition/Containership, Abstract Classes and Interfaces, Meta class,

Implementation of Operator Overloading in Python:
Introduction, Implementing Operator Overloading, Overriding Methods

Unit – V: Exception Handling in Python:
Introduction, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block
Python Packages:
Introduction to Numpy, Pandas, Matplotlib, Tkinter

Text Books:

1. "ReemaThareja", Python Programming using Problem Solving Approach, First Edition, Oxford Higher Eduction.
2. James Payne, Beginning Python using Python 2.6 and Python 3

Reference Books:

1. Kenneth A.Lambert, Fundamentals of Python
2. Charles Dierach, Introduction to Computer Science using Python

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Identify the differences between scripts and programs
2. Solve the problems based on decision control statements
3. Develop programs on functions and data structures.
4. Write the programs on string operations
5. Use the object oriented techniques for solving real time problems

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Signals and Systems
(Professional Elective-II)

Course Objectives:

1. To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series
2. To get the idea of signal representation in Fourier transforms domain and sampling
3. To understand operation of linear systems and corresponding responses of system
4. To present the concepts of convolution and correlation integrals and make the foundation for advanced courses.
5. To analyze the system using Laplace and Z-transforms

UNIT-I: Signal Analysis and Fourier Series:
Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.
Representation of Fourier series, Continuous time periodic signals,Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

UNIT-II: Fourier Transforms and Sampling
Deriving Fourier Transform from Fourier Series, Fourier Transform ofarbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Sampling theorem–Graphical and analytical proof for Band Limited Signals,Types of Sampling -Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples.

UNIT-III: Signal Transmission Through Linear Systems: Linear System, Impulseresponse, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics,.

UNIT-IV: Convolution and Correlation of Signals: Concept of convolution in Timedomain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Energy density spectrum, Parseval's Theorem, Power density spectrum, Relation between Auto Correlation function and Energy/Power spectral density function.

UNIT-V: Laplace Transforms and Z-Transforms
Review of Laplace Transforms (L.T), Partial fraction expansion,Inverse LaplaceTransform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various classes of signals, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Fundamental difference between Continuous and Discrete time signals,Discrete time signal representation using Complex exponential and Sinusoidal components, Periodicity of Discrete time signal using complex exponential signal, Concept of Z-Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

References Books:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
3. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.Publications, 2nd Edition, 2005.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Represent any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.
2. Express periodic signals and non-periodic signals in terms of Fourier transform and representation of the spectrum and to design a system for sampling a signal.
3. Understand the principle of linear system, filter characteristics of a system and its band width,
4. Understand the concepts of auto correlation and cross correlation and power Density Spectrum.
5. Find Laplace transform and Z-transform of various signals and response of the system using Laplace transform and Z-transform

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Line-Commutated and Active PWM Rectifiers
(Professional Elective – II)

Course Objectives:

1. To study controlled rectifier circuits with various types of passive filters.
2. To learn the basics of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. To understand the operation of 1 phase AC-DC single switch boost converter
4. To study the principle of operation of AC- DC bidirectional boost converter
5. To understand the operation of 1 phase AC-DC flyback converter

Unit-I: Thyristor rectifiers with passive filtering
Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape.

Unit-II: Multi-Pulse converter
Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Unit-III: Single-phase AC-DC single-switch boost converter
Review of dc-dc boost converter, power circuit of single-switch AC-DC converter, steady state analysis, unity power factor operation, closed-loop control structure.

Unit-IV: AC-DC bidirectional boost converter
Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase AC-DC boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

Unit-V: Isolated single-phase AC-DC flyback converter
DC-DC flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of AC-DC flyback converter, steady state analysis, unity power factor operation, closed loop control structure.

Text Books:

1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
2. G. De, “Principles of Thyristorised Converters”, Oxford & IBH Publishing Co, 1988.

References Books:

1. J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", Addison-Wesley, 1991.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Analyze thyristor rectifiers with different types of filtering Circuits
2. Compare and contrast 3,6 and 12 poles converter circuits
3. Explain the principle operation of single phase single switch boosts converters
4. Describe the operation of AC-DC bidirectional boost converter
5. Explain the operation of isolated single-phase AC-DC flyback converter

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B.Tech EEE III Year II Semester

L	T	C
3	0	3

Industrial Electrical Systems
(Professional Elective – II)

Course Objectives:

1. To gain knowledge on various LT wiring system components
2. To study the requirements of residential and commercial electrical Systems
3. To study in detail about illumination systems
4. To study the components of HT and LT systems in detail. Also to gain knowledge on UPS & batteries
5. To learn about industrial automation using PLC and SCADA.

Unit – I: 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

Unit – II: 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.

Unit – III: 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.

Unit – IV: 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.

Industrial Electrical Systems - II

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit – V: Industrial Electrical System Automation

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Reference Books:

1. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.Web site for IS Standards.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the various electrical system components
2. Design of residential and commercial wiring systems
3. Explain the terms and components of illumination systems
4. Describe the HT, LT system and batteries applications
5. Explain how industrial automation is achieved using PLC and SCADA.

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B.Tech EEE III Year II Semester	**L**	**T**	**C**
	3	**0**	**3**

Entrepreneurship Development

Course Objectives:

1. To provide insights into basic characteristics and process of entrepreneurship
2. To develop a business idea and prepare a bankable project report
3. To identify the methods to initiate ventures and the sources of finance
4. To create awareness about the legal challenges of entrepreneurship and IPR
5. To know and apply the various strategic and managerial concerns in the growth stage of the firms

Unit- I: Introduction
Introduction to Entrepreneurship – Characteristics, Qualities, Key Elements and Skills of an Entrepreneur, entrepreneurial stress, Corporate entrepreneurship, Entrepreneurial process.

Unit –II: Business Plan Preparation
Search for business idea, project identification, project formulation and development, contents of business plan and Preparation of a Bankable Project Report.

Unit-III : Launching Entrepreneurial Venture
Opportunities identification, Methods to initiate Ventures, Creating new ventures, Acquiring existing ventures, Franchising.Sources of finance, Forms of capital requirements, funding agencies and supporting institutions.

Unit IV: Legal challenges of Entrepreneurship
Intellectual Property Protection – Patents, Copyrights, Trademarks and Trade Secrets. The challenges of new Venture Startups- Poor financial understanding, critical factors for new venture development, Evaluation process, Feasibility criteria approach.

Unit V: Strategic perspectives in Entrepreneurship
Strategic planning- Strategic Action, Strategic Positioning, Business Stabilization, Building the adaptive firms, understanding the growth stage, unique managerial concern of growing ventures.

Text Books:

1. D F Kuratko and T V Rao “Entrepreneurship- A South-Asian Perspective “Cengage Learning, 2012
2. Vasant Desai, Small Scale Industries and Entrepreneurship, HPH, 2012.

References Books:

1. Rajeev Roy, Entrepreneurship, 2e, Oxford, 2012.
2. B.Janakiram and M.Rizwana, Entrepreneurship Development: Text& Cases, Excel Books,2011.
3. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
4. Robert Hisrich et al, Entrepreneurship, 6e, TMH, 2012.
5. Nandan H, Fundamentals of Entrepreneurship, PHI, 2013
6. Shejwalkar, Entrepreneurship Development, Everest, 2011
7. Khanka, Entrepreneurship Development, S.Chand, 2012

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Interpret concepts and process of entrepreneurship.
2. Apply idea development strategies and prepare a bankable project report
3. Analyse various opportunities towards initiating ventures.
4. Recognize legal challenges of entrepreneurship.
5. Assess the strategic perspectives of entrepreneurship

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B.Tech EEE III Year II Semester	**L**	**P**	**C**
	0	**3**	**1.5**

Power Electronics and Simulation Lab

Course Objectives:

1. To provide basic foundation for analysis of performance of Power Electronics Converters and semiconductor switches.
2. To get practical exposure of different power electronic circuits like rectifiers, inverters, choppers and cyclo converters
3. To study the characteristics of MOSFET, IGBT, SCR
4. To understand the firing & commutation circuits used in thyristor based power electronic circuits
5. To design the simulate power electronic converters using appropriate software.

List of Experiments:

PART – A

1. Study of Volt - Ampere characteristics of SCR, MOSFET & IGBT.
2. Gate firing circuits for SCR.
3. Single phase ac voltage controller with R and RL loads.
4. Single phase half controlled bridge rectifier with R and RL loads with and without freewheeling Diode.
5. Single phase fully controlled bridge rectifier with R and RL loads.
6. Forced commutation circuits (Class A, Class B, Class C, Class D & Class E).
7. DC Jones chopper with R and RL loads.
8. Single phase parallel inverter with R and RL loads.
9. Single phase series inverter with R and RL loads.
10. Single phase Cyclo converter with R and RL loads.

PART –B

1. Simulation of single phase full converter using RLE load.
2. Simulation of Single phase AC voltage controller using RLE load.
3. Simulation of single phase inverter with PWM control.
4. Simulation of 3-ph full converter using RLE load.

Note: Any 8 experiments from part – A and any 2 experiments from part - B.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the characteristics SCR, IGBT and MOSFET
2. Investigate different firing and commutation circuits used in thyristor based power electronic circuits
3. Analyze the operation of voltage controllers
4. Examine the performance of various types of rectifiers, inverters, choppers and cyclo converters
5. Design various power electronic converters using simulation software.

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B.Tech EEE III Year II Semester

L	P	C
0	3	1.5

Measurements and Instrumentation Lab

Course Objectives:

1. To calibrate the various meters to find the % error in measuring various quantities.
2. To analyze the various measuring instruments in order to extend the range & minimize the errors.
3. To perform experiment for the measurement of 3 phase active, reactive power & choke coil parameters
4. To illustrate the capacitance pick up characteristics of LVDT.
5. To know how to use the various bridges to find unknown R, L&C values and its quality & dissipation factor of capacitance.

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Measurement of % ratio error and phase angle of given C.T. by comparison.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Calibration LPF wattmeter using Phantom loading.
10. Measurement of 3 phase power with single watt meter and 2 No's of C.T.
11. Dielectric oil testing using H.T. testing Kit
12. LVDT and capacitance pickup – characteristics and Calibration

Course Outcomes

At the end of this course, students must have knowledge and ability to

1. Calibrate the various measuring instruments.
2. Find the ratio & phase angle errors of CTs.
3. Measure the 3 phase active, reactive power & choke coil parameters.
4. Measure the unknown voltage & current using potentiometer.
5. Measure unknown values of R, L & C using appropriate bridges and calculate dissipation factor of capacitance

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B.Tech EEE IV Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Power System Operation & Control

Course Objectives:

1. To understand the economic operation of thermal-thermal Power Systems.
2. To demonstrate the necessity of economic dispatch in hydro thermal scheduling.
3. To model different power system components contributing for Automatic Generation Control
4. To analyze single area load frequency control and 2 area load frequency control.
5. To know how to control reactive power in power system.

Unit - I: Economic Operation of Power Systems

Optimal operation of Generators in Thermal Power Stations, - Heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected.

Optimum generation allocation including the effect of transmission line losses – Loss coefficients, General transmission line loss formula.

Unit - II: Hydro Thermal Scheduling

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems-Short term hydrothermal scheduling problem.

Unit- III: Modeling of Turbine, Generator and Automatic Controllers

Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function.

Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Generator – Load Model.

Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

Unit- IV : Load Frequency Control

Necessity of keeping frequency constant. Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response –Controlled and Uncontrolled cases.

Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias Control. Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

Unit-V: Reactive Power Control

Overview of Reactive Power control – Reactive Power compensation in transmission systems –advantages and disadvantages of different types of compensating equipment for

transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

Text Books:

1. Modern Power system Analysis - D P Kothari and I J Nagrath - Tata McGraw-Hill - 4th Edition.
2. Power System Operation and Control - S. *Sivanagaraju* - Pearson Education India, 1st Edition.

Reference Books:

1. Operation and Control In Power Systems - P S R Murthy.
2. Power generation, Operation and Control – Allen J Wood.
3. Power System Analysis – C.L. Wadhwa, Newage International – 6th Edition.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Analyze the economic operation of thermal-thermal Power Systems.
2. Demonstrate the necessity of economic dispatch in hydro thermal scheduling.
3. Model different power system components contributing for Automatic Generation Control
4. Analyze single area load frequency control and 2 area load frequency control.
5. Explain the importance of reactive power control in power systems.

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B.Tech EEE IV Year I Semester

L	T	C
2	0	2

POWER SEMI CONDUCTOR DRIVES

Course Objectives:

1. To learn DC Drives control by 1-Φ controlled converters.
2. To gain knowledge on DC Drives control by 3-Φ controlled converters.
3. To understand four quadrant operation of DC drives using Dual converters and choppers.
4. To know control of Induction Motors from stator side and rotor side.
5. To gain knowledge about control of Synchronous Motor drive using various Inverters.

Unit – I: Control of DC Motors by Single Phase Converters

DC Motors and their performance characteristics, Four quadrant operation a drive-Introduction to Thyristor controlled Drives, 1-Φ Semi and Fully controlled converters connected to separately excited D.C Motor – continuous current operation - Output Voltage and Current waveforms, Voltage, Speed and Torque expressions, Speed - Torque Characteristics- numerical Problems.

Unit – II: Control of DC Motors by Three Phase Converters

3-Φ Semi and Fully controlled converters connected to separately excited D.C Motor – continuous current operation - Output Voltage and Current waveforms, Voltage, Speed and Torque expressions, Speed - Torque Characteristics- numerical Problems.

Unit–III: Four Quadrant Operation of DC Motors by Dual Converters & Choppers

Introduction to phase controlled four quadrant operation – Four quadrant operation of D.C motors by Dual Converters – Closed loop operation of DC motor in motoring mode (Block Diagram Only).

Single quadrant, two quadrant and four quadrant chopper fed separately excited dc motors – Continuous current operation, Output voltage and current wave forms, Voltage, Speed and torque expressions, speed - torque characteristics – numerical Problems.

Unit – IV: Control of Induction Motors

From stator side: Variable Voltage Control of Induction Motor by 3- Φ AC Voltage Controllers – Motoring and Braking modes of Operation, Voltage and Current Waveforms, Speed - Torque characteristics, Introduction to *V/f* control of Induction motors, *V/f* Control of Induction Motors by Voltage Source Inverter and Current Source Inverter, Speed - Torque characteristics and their comparison – numerical problems. Various PWM control techniques used for converters

From rotor side: Static Rotor resistance control – Derivation of Expression for External Resistances, Numerical Problems. Slip power recovery Schemes – Static Scherbius and Static Kramer Drives – Derivation for the Expression of Voltage, Speed - Torque characteristics – performance, advantages and applications – numerical problems.

Unit – V: Control of Synchronous Motors

Separate & Self control of Synchronous Motors, Operation of self controlled synchronous motors by voltage source inverter and current source inverter – Load commutated CSI fed Synchronous Motor Operation, Output Voltage and Current Waveforms, Speed - Torque characteristics, Applications and Advantages.

Text Books:

1. Fundamentals of electric Drives – G K Dubey, Narosa publications, 2nd edition, 2002.
2. Elements of Electric Drives – J. B. Gupta, Rajeev Manglik and Rohit Manglik, S. K. Kataria and Sons, 2011.

Reference Books:

1. Electric Motor Drives – Modeling, Analysis and Control – R. Krishnan, Pearson Prentice Hall, 2007.
2. Power Electronics Circuits, Devices and applications - M.H.Rashid, Pearson Education - Third Edition – First Indian reprint 2004.
3. Modern Power Electronic and AC Drives - B.K.Bose, Pearson Publications - 1st edition

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the principle of operation of 1 phase rectifier fed separately excited DC motor with necessary equations and wave forms
2. Explain the principle of operation of 3 phase rectifier fed separately excited DC motor with necessary equations and wave forms
3. Describe the four quadrant operation of DC drives when driven by dual converters and choppers
4. Explain the concepts of speed control of induction motor from stator and rotor side
5. Describe the speed control of Synchronous motor through self and separate control

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B.Tech EEE IV Year I Semester | **L** | **T** | **C**
3 | **0** | **3**

Electrical Distribution Systems
(Professional Elective-III)

Course Objectives:

1. To explain the principles of design and operation of electric distribution systems and feeders.
2. To understand the basic design of distribution substations.
3. To gain knowledge on the purpose of distribution system protection and the principle of coordination between various protective devices
4. To illustrate compensation methods for voltage drops and pf improvements.
5. To learn different voltage control methods.

Unit – I: General Concepts

Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor, loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

Distribution Feeders: Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.

Unit – II: Substations

Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations.

System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

Unit – III: Protection

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers.

Coordination: Coordination of Protective Devices: General coordination procedure.

Unit – IV: Compensation for Power Factor Improvement

Capacitive compensation for power-factor control. Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), Power factor correction,

capacitor allocation - Economic justification - Procedure to Determine the best capacitor location.

Unit – V: Voltage Control

Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop Compensation.

Text Books:

1. Electric Power Distribution system, Engineering – Turan Gonen, Mc Graw-hill Book Company, 1986.
2. Electric Power Distribution – A.S. Pabla, Tata Mc Graw-hill Publishing company, 4th edition, 1997.

Reference Books:

1. Electrical Power Distribution and Automation - S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2006
2. Electrical Power Distribution Systems - V.Kamaraju, Tata McGraw-Hill Education, 2009.
3. Electrical Power Distribution and Automation by S.Ram Murthy, PHI Publications.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the general concepts about distribution systems and feeders
2. Describe the layout of substations and perform system analysis of radial networks and 3 phase balanced lines.
3. Demonstrate the necessity of protection of various distribution system devices and illustrate coordination of various protective devices.
4. Explain the importance of power factor improvement
5. Describe the principle of various voltage control methods.

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B.Tech EEE IV Year I Semester

L	T	C
3	0	3

Flexible Alternating Current Transmission System
(Professional Elective-III)

Course Objectives:

1. To study the characteristics of AC transmission and the effect of Shunt and Series Compensation
2. To learn the working principle of shunt devices and their operating characteristics
3. To know the difference between shunt and series FACT devices
4. To acquire the knowledge of VSC based series FACTS controllers
5. To study the application of FACTS devices for Power System Control

Unit –I: Transmission Lines and Series/Shunt Reactive Power Compensation
Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

Unit –II: Thyristor-based Flexible AC Transmission Controllers (FACTS)
Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Unit –III: Voltage Source Converter based shunt (FACTS) controllers
Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM

Unit –IV: Voltage Source Converter based series (FACTS) controllers:
Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

Unit –V: Application of FACTS
Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Text Books:

1. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
2. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.

References Books:

1. T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New York, 1983.
2. G. T. Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1991
3. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Understand the characteristics of AC transmission and the effect of Shunt and Series Compensation
2. Understand the working principle of shunt devices and their operating characteristics
3. Compare the difference between shunt and series FACT devices
4. Explain the application of FACTS devices
5. Identify the application of FACTS devices for Power System Control

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B.Tech EEE IV Year I Semester | **L** | **T** | **C**
| **3** | **0** | **3**

Electromagnetic waves
(Professional Elective-III)

Course Objectives:

1. To learn the concepts of distributed elements in transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
2. To study the solution to real life plane wave problems for various boundary conditions.
3. To provide field equations for the wave propagation in special cases such as lossy
   and low loss dielectric media.
4. To study the plane waves in different media interface to calculate phase and velocity in different media
5. To analyze TE and TM mode patterns of field distributions in a rectangular wave-guide. Understand and analyze radiation by antennas.

Unit-I: Transmission Lines

Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

Unit-II: Maxwell's Equations

Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

Unit-III: Uniform Plane Wave

Homogeneous unbound medium, Wave equation for time harmonic fields,Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

Unit-IV: Plane Waves at Media Interface

Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

Unit-V: Waveguides

Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

Text Books:

1. R. K. Shevgaonkar, **"**Electromagnetic Waves**"**, Tata McGraw Hill, 2005.
2. D. K. Cheng, "Field and Wave Electromagnetics**"**, Addison-Wesley, 1989.

Reference Books:

1. M. N.O. Sadiku, "Elements of Electromagnetics**"**, Oxford University Press, 2007.
2. C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2012.
3. C. A. Balanis, "Antenna Theory: Analysis and Design**"**, John Wiley & Sons, 2005.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Analyze transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
2. Provide solution to real life plane wave problems for various boundary conditions.
3. Analyze the field equations for the wave propagation in special cases such as lossy
   and low loss dielectric media.
4. Analyze the plane waves in different media interface to calculate phase and velocity in different media
5. Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide. Understand and analyze radiation by antennas.

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B.Tech EEE IV Year I Semester

L	T	C
3	0	3

Electrical and Hybrid Vehicles
(Professional Elective-IV)

Course Objectives:

1. To learn about the Comphrensive overview of hybrid Electrical Vehicles.
2. To present about the Hybrid Electrical Drive Trains
3. To understand about the configuration and control of Trains
4. To know about Energy Storage requirements in Hybrid & Electric vehicles
5. To illustrate about Energy management strategies

Unit- I: Introduction:
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Unit- II: Hybrid Electric Drive-trains
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit- III: Electric Trains
Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit- IV: Energy Storage
Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

Unit- V: Energy Management Strategies

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles, Design fundamentals, CRC Press 2003.
2. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.

References Books:

1. James lerminie, John Lowry, Electic vehicle Technology, Explaned Wiley, 2003.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the importance of hybrid and electric vehicles.
2. Illustrate the drive-train topologies of electric vehicles & hybrid vehicles.
3. Demonstrate the configuration and control of various electrical machines used in electric drive-trains.
4. Choose proper Energy Storage systems for vehicles applications.
5. Identify various energy management strategies.

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Power System Dynamics and Control
(Professional Elective-IV)

Course Objectives:

1. To understand the concept of Control and Operation of Power System, Power System Dynamic Model
2. To impart knowledge on modeling of Synchronous Machine Models, controllers
3. To have knowledge on modeling of power system components
4. To know the stability analysis of Power System
5. To understand the planning measures of stability

Unit-I: Introduction to Power System Operations

Introduction to power system stability. Power System Operations and Analysis of linear Dynamical Systems & Numerical Methods Control. Stability problems in Power System. Impact on Power System Operations and control.

Analysis of Linear Dynamical System and Numerical Methods

Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysisusing Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.

Unit-II: Modeling of Synchronous Machines and Associated Controllers

Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

Unit-III: Modeling of other Power System Components

Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads.

Unit-IV: Stability Analysis

Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governordroop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools:Transient Stability Programs, Small Signal Analysis Programs.

Unit-V: Enhancing System Stability

Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures-Preventive Control. Emergency Control.

Text Books:

1. K.R. Padiyar, “Power System Dynamics, Stability and Control”, B. S. Publications, 2002.
2. P. Kundur, “Power System Stability and Control”, McGraw Hill, 1995.

Reference Books:

1. P. Sauer and M. A. Pai, “Power System Dynamics and Stability”, Prentice Hall, 1997
2. P.M .Anderson & A.A. Fouad,”Power System Control & Stability”, IEEE Press
3. R.Ramanujam,” Power System Dynamics”,PHI publications.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Understand concept of Control and Operation of Power System
2. Understand the Power System Dynamic Model to find solution with different technique
3. Analyze the analysis of Synchronous Machine Models, excitation System, Speed Governing Model
4. Discuss the modeling of Transmission Lines and Loads stability
5. Analyze the angle stability and voltage of Power System

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B.Tech EEE III Year II Semester	**L**	**T**	**C**
	3	**0**	**3**

HVDC Transmission Systems
(Professional Elective – IV)

Course Objectives:

1. To understand the concepts of HVDC transmission, types of HVDC links, apparatus required for HVDC Transmission etc.
2. To get the Knowledge on analysis of various converters used in HVDC systems
3. To study the concepts of Reactive power requirement and control in HVDC systems
4. To introduce the concepts of Protection of various converters used in HVDC systems against over currents and voltages
5. To gain the Knowledge on causes of harmonics and filter design concepts.

Unit – I: Basic Concepts

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C Transmission.

Unit – II: Analysis of HVDC Converters, Converter Control

Choice of Converter configuration – Analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance**.**
Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control

Unit-III: Reactive Power Control in HVDC, Power Flow Analysis

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers. Modeling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow

Unit-IV: Converter Fault & Protection

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

Unit –V: Harmonics & Filters

Generation of Harmonics – Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

Types of AC filters, Design of Single tuned filters –Design of High pass filters.

Text Books:

1. HVDC Transmission – S. Kamakshaiah and V. Kamaraju – TMH – 2011.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao, Khanna Publishers, 1990.

Reference Books:

1. HVDC Transmission – J.Arrillaga, IEE, 2nd Edition, 1998.
2. Direct Current Transmission – E.W.Kimbark, Volume I, John Wiley & Sons, 1971.
3. Power Transmission by Direct Current – E.Uhlmann, B.S.Publications
4. HVDC Power Transmission Systems: Technology and system Interactions– K.R.Padiyar, New Age International (P) Limited, 1990.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Classify different types of HVDC links, compare AC&DC Transmission systems
2. Analyze various types of HVDC converters
3. Identify the importance of reactive power control in HVDC systems and provide the solution for power flow problem in HVDC Network
4. Categorize various types of converter faults and choose the type of protection scheme.
5. Investigate the causes of harmonics and design the suitable filter to mitigate concerned harmonics.

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

High Voltage Engineering
(Professional Elective – V)

Course Objectives:

1. To know High Voltage Engineering & its applications
2. To get the knowledge of dielectric materials.
3. To study the generation and measurement of high voltages and currents
4. To understand the over voltage phenomena and insulation co-ordination
5. To understand the need for testing high voltage equipments for their withstanding capability

Unit I: Introduction to High Voltage Technology and Applications
Electric Field Stresses, Gas / Vaccum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

Unit II: Break Down in Gaseous, Solid and Liquid Dielectrics
Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

Unit III: Generation and Measurements of High Voltages and Currents
Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

Unit IV: Over Voltage Phenomenon and Insulation Co-ordination
Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Unit V: Non-Destructive and High Voltage Testing of Material and Electrical Apparatus

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

Text Books:

1. High Voltage Engineering - M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition, 2009.
2. High Voltage Engineering: Fundamentals - E.Kuffel, W.S.Zaengl, J.Kuffel, Elsevier publications, 2nd Edition, 2000.

Reference Books:

1. High Voltage Engineering - C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
2. High Voltage Insulation Engineering - Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Engineering, theory and Practice, Mazen Abdel Salan, Hussian Anis, Andan Ei Morshedy, Roshdy Radwan, Marcel Dekker

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the concepts of high voltage technology and its applications
2. Describe the properties and applications of gaseous, liquid and solid dielectrics
3. Explain the concepts of generation and measurement of high voltages and currents
4. Analyze the over voltage phenomena and insulation coordination
5. Describe the methods of high voltage testing of materials and electrical apparatus

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Smart Grid Technologies
(Professional Elective-V)

Course Objectives:

1. To study the difference between conventional grids and smart grids and its self healing capacity
2. To know the importance of smart grid components in deployment of smart grids
3. To know the importance of intelligent electronic devices and their applications for monitoring and protection.
4. To gain knowledge on problems associated with distributed micro grids integrated with conventional grid system
5. To acquire knowledge on power quality issues of integrated smart grids for control and monitoring

Unit I: Introduction to Smart Grid

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Unit II: Smart Grid Technologies

Part 1: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Unit III: Smart Grid Technologies

Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

Unit IV: Micro grids and Distributed Energy Resources

Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources.

Unit V: Power Quality Management in Smart Grid

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley

Reference Books:

1. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press
3. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the difference between conventional grids and smart grids and its self healing capacity
2. Demonstrate the importance of smart grid components in deployment of smart grids
3. Illustrates the importance of intelligent electronic devices and their applications for monitoring and protection.
4. Investigate problems associated with distributed micro grids integrated with conventional grid system
5. Analyze power quality issues of integrated smart grids for control and monitoring

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Digital Signal Processing
(Professional Elective – V)

Course Objectives:

1. To define and use Discrete Fourier Transforms (DFTs)
2. To use Z - transforms and filter structure to analyze a digital system function
3. To understand simple IIR filters
4. To learn the design procedures used for filter bank and FIR filter
5. To learn to program a DSP processor to filter signals

UNIT-I: DFT & FFT
DFS representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier transforms: Properties of DFT, Linear convolution of sequences using DFT, Computation of DFT, Relation between Z-transform and DFT
Fast Fourier transform (FFT)-Radix-2 decimation intime and decimation in frequency FFT Algorithms.

UNIT- II: Realization of Digital Filters
Review of Z-transform,Application of Z-transforms, Solution of difference equations of digital filters, Block diagram representation of linear constant coefficient difference equations, Basic structures of IIR systems, Transposed forms, Basic structures of FIR systems, System function.

UNIT-III: IIR Digital Filters
Analog filter approximations-Butter worth andChebyshev, Design of IIR Digital filters from analog filters, Impulse Invariant and Bilinear methods, Analog-Digital transformations.

UNIT-IV: FIR Digital Filters & Multirate DSP
Characteristics of FIR Digital Filters, Frequency response,Design of FIR digital filters using Window techniques, Frequency sampling technique, Comparison of IIR&FIR filters,Decimation, Interpolation, Samplingrate conversion, Implementation of sampling rate conversion.

UNIT–V: Introduction to DSP Processors
Introduction to programmableDSPs , Multiplier and Accumulator, Modified Bus Structures and Memory,Access, schemes in DSPs, Multiple access emory, Multiport memory, VLSIArchitecture, Pipelining, Special addressing, Architecture of TMS 320C5X-Introduction,Bus structure, Central Arithmetic Logic unit, Auxiliary registrar, Index Registrar, Auxiliary Register, Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, Program controller, Some flags in the status registers, On-chip registers, On-chip peripherals.

Text books:

1. Digital Signal P Processing, principles,Algorithms,andApplications:JohnG.Proakis, DimitrisG.Manolakis,Pears on Education/PHI,2007
2. Digital Signal Processing-Architecture, Programming and Applications, B.venkataramani, M.Bhaskar, TATA McGraw Hill,2002

Reference Books:

1. Digital Signal Processing: AndreasAntoniou,TATA McGraw Hill,2006
2. Digital Signal Processing: MHHayes, schaum's Outlines,TATAMc-Graw Hill,2007
3. DSP Primer-C. Britton Rorabaugh,Tata McGraw Hill,2005
4. Fundamentals DSP using Matlab-Robert J.Schilling,Sandra L.Harris,Thomson,2007
5. Digital Signal Processing-Alan V.Oppenheim, RonaldW. Schafer,PHI Ed.,2006
6. Discrete Time signal processing-A.V Oppenheim and R.W.Schaffer,PHI

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Understand the spectra of signals that are to be processed by a discrete time filter, and to compute the DFT by various algorithms.
2. Analyze and Implement a digital filter structures
3. Design and realize IIR by butterworth and chebyshev methods
4. Design and realize FIR by windowing methods
5. Apply signal processing algorithms in DSP processor

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B.Tech EEE IV Year I Semester

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Utilization of Electrical Energy
(Professional Elective – VI)

Course Objectives:

1. To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
2. To acquaint with the different types of heating and welding techniques.
3. To study the basic principles of illumination and its measurement and to understand different types of lightning system including design.
4. To understand the basic principle of electric traction including speed–time curves of different traction services.
5. To acquaint with the different types of Tractive efforts & estimate specific energy consumption level at various modes of operation.

Unit – I: Electric Drives

Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, types of industrial loads, continuous, intermittent and variable loads, load equalization, applications of electric drives.

Unit – II: Electric Heating & Welding

Advantages and methods of electric heating, Resistance heating ,Induction heating and Dielectric heating. Electric welding, Resistance and Arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

Unit – III: Illumination Fundamentals & Various Illumination Methods

Introduction, terms used in illumination, laws of illumination, polar curves, Discharge lamps, MV , SV and LED lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of interior lighting and flood lighting.

Unit – IV: Electric Traction – I

System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking, plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

Unit – V: Electric Traction-II

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation, adhesive weight and coefficient of adhesion.

Text Books:

1. Utilization of Electric Energy – E. Openshaw Taylor, Orient Longman Private Limited, 1971.
2. Art & Science of Utilization of electrical Energy – Partab, Dhanpat Rai & Sons, 2nd edition, 1986.

Reference Books:

1. Generation, Distribution and Utilization of electrical Energy – C.L.Wadhwa, New Age International (P) Limited, Publishers, 1997.
2. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
3. Utilization of Electricval Power & Electrical traction – JB Gupta, SK Kataria & sons-eight edition

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Analyze right drive for a particular application and able to design suitable schemes for Electrical welding, heating, drives, illumination and traction
2. Describe various methods of heating & welding of electrical equipments.
3. Design Illumination systems for various applications.
4. Discuss about various Methods of braking system of electric traction and understand the speed-time characteristics of different services in traction systems.
5. Solve the mathematical aspects involved in tractive effort and specific energy consumption.

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Electrical Energy Conservation and Auditing
(Professional Elective – VI)

Course Objectives:

1. To gain knowledge to the students about current energy scenario, energy conservation audit and management
2. To gain knowledge and skills support assessing the energy efficiency, energy auditing and energy management.
3. To study different techniques for maximizing the efficiency in electrical systems
4. To obtain basic knowledge of various energy efficient technologies in electrical systems
5. To learn different industrial applications for estimating the energy

Unit-I: Energy Scenario

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

Unit-II: Energy Management & Audit

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Unit-III: Energy Efficiency in Electrical Systems

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Unit-IV: Energy Efficiency in Industrial Systems

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.
Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Unit-V: Energy Efficient Technologies in Electrical Systems

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Text Books:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)

Reference Books:

1. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain present energy scenario
2. Explain the concepts of Energy Management
3. Apply the methods for improving energy efficiency in different Electrical Systems.
4. Differentiate the methods of improving energy efficiency in different Industrial Systems
5. Use different energy efficient devices for various applications.

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B.Tech EEE IV Year I Semester	**L**	**T**	**C**
	3	**0**	**3**

Digital Control Systems
(Professional Elective – VI)

Course Objectives:

1. To gain knowledge about Discrete representation of continuous system
2. To know about Discrete System analysis
3. To gain knowledge about stability of Discrete time system.
4. To acquire knowledge about state space approach for discrete time systems
5. To know about design of digital control system

Unit 1: Discrete Representation of Continuous Systems
Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modeling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency.ZOH equivalent.

Unit 2: Discrete System Analysis
Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

Unit 3: Stability of Discrete Time System
Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

Unit 4: State Space Approach for discrete time systems
State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Unit 5: Design of Digital Control System
Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Discrete output feedback control
Design of discrete output feedback control.

Text Books:

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

Reference Books:

1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”, Addison-Wesley, 1998.
2. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.
3. Discrete Time Control Systems by K. Ogata, Dorling Kindersley pvt ltd

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Demonstrate discrete representation of continuous system
2. Apply the knowledge of Discrete System analysis.
3. Determine stability of discrete systems.
4. Apply state space approach for discrete systems.
5. Design control system

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B.Tech EEE IV Year I Semester	L	T	P	C
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Power System Lab

Course Objectives:

1. To understand generator and transformer protection system.
2. To understand the performance characteristics of various types of relays.
3. To use software packages to find solutions to Power System problems.
4. To perform load flow studies and short circuit analysis using appropriate software.
5. To study the design and modeling of transmission line parameters

List of Experiments

1. Performance and Testing of Transmission Line Model.
2. Determination of Transmission Line Parameters.
3. Characteristics of Over Current Relay.
4. Performance and Testing of Generator Protection System.
5. Performance and Testing of Transformer Protection System
6. Develop MATLAB program for Y BUS formation and G-S Load Flow Analysis.
7. Develop MATLAB program for N-R and FDLF Load Flow Analysis.
8. Develop MATLAB program for Short Circuit Analysis.
9. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
10. Load Flow Analysis Using ETAP.
11. Short Circuit Analysis Using ETAP.
12. Transient Stability Analysis Using ETAP.

NOTE: - From the above any 10 Experiments have to be conducted

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand power industry practices for design, operation and planning.
2. Analyze the performance characteristics of various types of relays.
3. Use software packages to find solutions to Power System problems.
4. Apply knowledge of load flows for planning and future expansion of Power Systems.
5. Design and modeling of transmission line parameters

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B.Tech EEE IV Year I Semester

L	p	C
0	3	1.5

Microprocessors & Microcontrollers Lab

Course objectives:

1. To understand the fundamentals of assembly level programming of microprocessors.
2. To understand the concepts of Assembly language programming and its applications.
3. To learn to develop the assembly level programming using 8086 instruction set.
4. To learn to develop the assembly level programming using 8051 instruction set.
5. To learn to interface peripherals with 8086 and 8051.

LAB Note: Minimum of 12 experiments to be conducted.

List of Experiments: The Following programs/experiments are to be written for assembler and execute the same with 8086 Microprocessor and 8051 microcontroller.

1. Programs for 16 bits arithmetic operations for 8086 (using Various Addressing Modes).

2. Program for sorting an array and to generate Fibonacci series for 8086.

3. Programs for string manipulations for 8086.

4. Program for digital clock design using 8086.

5. Interfacing ADC and DAC to 8086.

6. Parallel communication between two microprocessors using 8255.

7. Interfacing to 8086 and programming to control stepper motor using.

8. To interface Seven Segment Display using 8086

9. Programming using arithmetic, logic and bit manipulation instructions of 8051.

10. Program and verify Timer / Counter in 8051.

11. Program and verify Interrupt handling in 8051.

12. UART Operation in 8051.

13. LCD interface with 8051.

14.Keypad Interface with 8051.

Course outcomes:

At the end of this course, students must have knowledge and ability to

1. Build a program on a microprocessor using instruction set of 8086.
2. Analyze the problems and apply a combination of hardware and software to address the problem
3. Contrast how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
4. Experiment with standard microprocessor interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters
5. Design 8051 microcontroller interface with I/O peripherals.

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B.Tech EEE IV Year II Semester	**L**	**T**	**C**
	3	**0**	**3**

Management Science
(Open Elective – II)

Course Objectives:

1. To explain the concepts of Management theories and practices.
2. To analyze the interrelated functional activities of management.
3. To access the key activities of a manager in HR and Marketing.
4. To know the various techniques in Project Management.
5. To explain the contemporary issues and challenges faced by an organization.

Unit-I: Introduction to Management
Nature and importance of management, Functions of Management, Taylor's Scientific Management Theory, Fayol's principles of management, Maslow's theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two factor Theory of Motivation. Systems Approach to Management, Leadership Styles, Social Responsibilities of Manager, Organization levels and types of organization structures.

Unit-II: A) Operations Management
Principles and Types of Plant Layout-Methods of production (Job, batch and Mass production), Work Study - Basic procedure involved in Method Study and Work measurement- Statistical Quality Control - X chart, R chart, C chart, P chart, (simple problems), Acceptance Sampling, Deming's contribution to quality.
B) Materials Management: Objectives, Need for inventory control, EOQ, ABC Analysis, Purchase procedure, Stores management and Stores records, Supply chain management.

Unit –III: A) Human Resources Management (HRM)
Evolution of HRM, Concepts of HRM, Basic functions of HR Manager - Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.
B) Marketing: Functions of Marketing, Marketing Mix, Marketing strategies based on Product Life cycle, Channels of distribution.

Unit –IV: Project Management (PERT/CPM)
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method(CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing.(Simple problems)

Unit –V: Strategic &Contemporary Management Practices

Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of corporate planning process, Environmental Scanning, SWOT analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Basic concepts of Just-In-Time(JIT) system, Total Quality Management(TQM), Six Sigma and Capability Maturity Model(CMM) levels, Value Chain Analysis.

Text Books:

1. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, 2012.
2. Aryasri, Management Science, TMH, New Delhi, 2009

References Books:

1. Koontz and Weihrich, Essentials of Management, McGraw Hill, 2012.
2. Thomas N. Duening and John M. Ivancevich Management, Principles and Guidelines, Biztantra, 2012.
3. KanishkaBedi, Production and Operations Management, Oxford University Press, 2012.
4. Samuel C. Certo, Modern Management, 2012.
5. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, 2012.
6. Parnell, Strategic Management, Cengage, 2012.
7. Lawrence R Jauch, R. Gupta and William F. Glueck, Business Policy and Strategic Management Science, McGraw Hill, 2012.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Evaluate the concepts of business management and approaches.
2. Understand interconnections between the developments of key functional areas of management.
3. Analyze ethically conscious and socially responsible managers, capable of contributing to the development of nation and quality of life.
4. Develop PERT/CPM charts for project and estimate time and cost of a project.
5. Understand management contemporary concepts and practices to handle the various activities.

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PROJECT MANAGEMENT
(Open Elective – II)

Course Objectives:

1. To understand the concept of Project Management.
2. To know about the different approaches to project screening and planning.
3. To explain about the factors of risk involved in project execution.
4. To understand about team leading and functional cooperation.
5. To know about the project performance and future trends in the project management.

Unit-I: Introduction
Meaning, Need, Principles Project Lifecycle and itsPhases, Project Management Research in brief, Project Management today, Organization strategy and structure and culture, Format of organization structure, Stake holder Management, Organization Culture, creating a culture for Project Management.

Unit-II: Project Identification and Planning
Defining the project, Project Identification Process, Approaches to Project Screening and Selection, Project Planning, Work Breakdown Structure, Financial Module, Getting Approval and Compiling a Project Charter, setting up a Monitoring and Controlling Process.

Unit-III: Project Execution
Initiating the Project, Controlling and Reporting Project Objectives, Conducting project evaluation, Risk, Risk Management Factors, Project Management, Four Stage Process, Risk Management an Integrated Approach, Cost Management, Creating a Project Budget.

Unit-IV: Leading Project Teams
Building a Project Team, Characteristics of an effective Project Team, achievingCross-Functional Co-operation, Virtual Project Teams, Conflicts Management, Negotiations.

Unit-V: Performance Measurement and Evaluation
Monitoring Project Performances, Project Control Cycles,Earned Value Management, Human factors in Project Evaluation and Control, Project Termination, Typesof Project Terminations, Project Follow-up. Current and Future Trends in Project Management.

Text Books:

1. Gray, Larson, Project Management, Tata McGraw Hill,2015
2. Jeffery K.Pinto, Project Management,Pearson Education,2015

References Books:

1. EnzoFrigenti, Project Management, Kogan, 2015
2. R. Panneerselvam& P. Senthil Kumar, Project Management, PHI, 2015
3. Thomas M. Cappels, Financially Focused Project Management, SPD, 2008.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain about the life cycle and other concepts of Project Management.
2. Apply different approaches to project screening and planning
3. Analyze different risk factors in project execution
4. Estimate how to lead a team, to get functional cooperation
5. Build performance evaluation reports and future trends in project management.

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Technical and Business Communication Skills
(Open Elective – II)

Introduction

The course is intended to expose the students to learn and practice the five communication skills thinking, listening, speaking reading, and writing in English, the global language of communication. It reflects some of the approaches in English language teaching and learning currently in practice around the world.

Objective:

To help the students to develop effective communication skills in all communicative contexts for professional advancement

UNIT-I:
E-World & E-Communication
E-language - E-governance - E-commerce/E-business - E-banking - E-waste

UNIT-II:
Business Establishment & Infrastructure Development
Power Supply - Industrial Park - Business Correspondence: Follow-up letters - Acceptance & Rejections -Persuasive letters - Resignation letters

UNIT-III:
Technology and Society
Robot Soldiers - For a Snapshot of a Web - Placing an order - Proposal Writing - Patents & Rights (National & International) - Intellectual Property - Nanotechnology

UNIT-IV:
Ethics in Business Communication
Ethical issues involved in Business Communication - Ethical dilemmas facing managers - Ethical Code & Communication - Standards in Daily Life - Total Quality Management - World University Ranking

UNIT-V:
Management Information System
Corporate Governance - Business Process Outsourcing - Project Management Communication - Marketing Communication

Textbooks:

English and Communication Skills for Students of Science and Engineering by S P Dhanavel. Orient Black Swan. 2009.

Reference Books:

1. **Business Communication** (Second Edition) by Meenakshi Raman & Prakash Singh by Oxford University Press. 2012.
2. **Language and Communication skills for Engineers** by Sanjay Kumar & Pushp Lata by Oxford University Press. 2018.
3. **Business Communication** by Anjali Kalkar, et.al. Orient BlackSwan. 2010.
4. **Technical Communication** by Paul V. Anderson. Cengage. 2014.
5. **Engineering Communication** by Charles W. Knisely & Karin I. Knisely. Cengage. 2015.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. communicate technical and business correspondence
2. reflect on the themes discussed
3. recognize ethical implications of technical communication in professional contexts
4. identify the contemporary issues in engineering from environmental, societal, economic, and global perspectives
5. demonstrate ethical decisions in complex situations

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Intellectual Property Rights
(Open Elective – III)

Course Objectives:

1. To understand the concepts of Intellectual Property Rights and related agencies.
2. To know about the purpose and functions of Trademarks in competitive environment
3. To explain the process of Patent and Copyrights and related procedures
4. To know the Trade Secret Law and its protection from Unfair practices.
5. To get knowledge on the overview of International Intellectual Property Scenario.

Unit -I: Introduction to Intellectual Property

Introduction, Types of Intellectual Property, International Organization, Agencies and Treaties, Importance of Intellectual Property Rights.

Unit -II: Trademarks

Purpose and Function of Trademarks, Acquisition of Trademarks Rights, Protectable Matter, Selecting and Evaluating Trade Mark, Trade Mark Registration Processes.

Unit-III: Law of Copy Rights & Patents

Fundamental of Copy Rights Law, Originality of Material, Rights of Reproduction, Rights to Perform the Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice of Copy Right, International Copy Right law. Foundation of Patent Law, Patent Searching Process, Ownership Rights & Transfer.

Unit- IV: Trade Secrets & Unfair Competition

Trade Secret Law, Determination of Trade Secret Status, Liability for Misappropriation Right of Trade Secrets, Protection for Submission, Trade Secret Litigation.Misappropriation Right of Publicity, False Advertising.

Unit- V: New Development & International Overview on Intellectual Property

New Developments in Trade Mark Law, Copy Right Law, Patent Law, and Intellectual Property Audits.International Trade Mark Law, Copy Right Law, International Patent Law, International Development in Trade Secrets Law.

Text Books:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage learning
2. PrabuddhaGangulli,Intellectual Property Rights Unleashing the knowledge economy, Tata McGraw Hill Publishing Company Ltd.

References Books:

1. KhushdeepDharni and NeerajPandey, Intellectual Property Rights, PHI Learning Pvt. Ltd.
2. Vivien Irish, Intellectual Property Rights for Engineers, 2nd edn, IET, 2005
3. Carlos Alberto Primo Braga, Carsten Fink, Claudia Paz Sepulveda, Intellectual Property Rights and Economic Development, World Bank Publications, 2000

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Explain the concepts of Intellectual Property Rights and related agencies.
2. Describe the purpose and functions of Trademarks in Competitive Environment
3. Analyze the process of Patent and Copyrights and related procedures
4. Explore the Trade secret law and its protection from Unfair practices
5. Explain the overview of International Intellectual Property Scenario

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Internet of Things
(Open Elective – III)

Course Objectives:

1. To understand the basics of Internet of Things
2. To get an idea of some of the application areas where Internet of Things can be applied
3. To understand the middleware for Internet of Things
4. To understand the concepts of Web of Things
5. To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing

Unit I: Introduction to Internet of Things (IoT)

Definition and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates.

Unit II: Domain Specific IoTs

Introduction, Home Automation, cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

IoT and M2M

Introduction to M2M, Difference between IoT and M2M, SDN and NFV to IoT. Basics of IoT System Management with NETCOZF

YANG NETCONF, YANG, SNMP NETOPEER

Unit III: Developing Internet of Things:

IoT Platform Design Methodology, Introduction, IoT Design Methodology, Case Study on the IoT System for Whether Monitoring, Motivation for using Python.

Unit IV : IoT Systems

Logical Design using Python, Introduction, Installing Python, Python Data Types and Data Structures, Control Flow and Functions, Modules , Packages, File Handling, Date/Time Operations, Classes, Python packages of Internet of Things,JSON,XML,HTTP,Lib and URL lib, SMTP lib.

Unit V : IoT Physical Device and Endpoints

What is an IoT Device, Exemplary Device: Raspberry P_i About Raspberry Board, Linux on Raspberry P_i ,Raspberry P_i Interfaces, Serial, SPI, I2C. Programming Raspberry $P_{i\ with}$ Python, Other IoT Devices.

Text Books:

1. ArshdeepBahga and Vijay Madisetti,Internet of Things A Hands –on approach, Universities Press, 2015.

Reference Books:

1. HonboZhou,The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer – 2011
3. David Easley and Jon Kleinberg,Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010
4. Olivier Hersent, Omar Elloumi and David Boswarthick,The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, 2012

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Identify and design the new models for market strategic interaction
2. Design business intelligence and information security for WoB
3. Analyze various protocols for IoT
4. Design a middleware for IoT
5. Analyze and design different models for network dynamics

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Nano Science and Nano Technology
(Open Elective – III)

Course Objectives:

1. To provide the most exciting and novelproperties at nanoscale regime
2. To explain the interdisciplinary issues in nanoscale science and technology.
3. To discuss about the basics of nanotechnology
4. To classify and explain the various properties of nanomaterials
5. To describe the various methods for synthesis of nanomaterials and their applications

Unit I: Introduction:
History and Scope, Can Small Things Make a Big Difference?
Quantum confinement, Surface area to Volume ratio,Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit II: Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials:
Dislocations, Twins ,stacking faults and voids, Grain Boundaries, triple and disclinations. **Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility.
MagneticProperties: Soft magnetic nano crystalline alloy, Permanent magnetic nanocrystalline materials,Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit III: Synthesis Routes: Bottom up approaches:
Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method,Self-assembly,
Top down approaches: Mechanical alloying, Nano-lithography.
Consolidation of Nano powders: Shock wave consolidation, Hot isostatic pressing and Coldisostatic pressing Spark plasma sintering.

Unit IV: Tools to Characterize nanomaterials:
X-Ray Diffraction (XRD), Small Angle X-rayscattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nano indentation.

Unit V: Applications of Nanomaterials:
Nano-electronics, Micro- and Nano-electrome chanical systems (MEMS/NEMS), Nano sensors, Nano catalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water-Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications, Concerns and challenges of Nanotechnology.

Text Books:

Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

References Books:

1. Nano: The Essentials by T.Pradeep, McGraw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact– Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

Course Outcomes:
At the end of this course, students must have knowledge and ability to

1. Explain the concepts and applications of nanotechnology and the growth techniques of nanomaterials.
2. Apply the materials in the nanoscale.
3. Discuss about Synthesis Techniques of nanomaterials.
4. Classify the different characterization techniques of nanomaterials
5. Explain the applications in the fields of automobiles, textiles and energy.