COURSE DESCRIPTION

BACHELOR OF TECHNOLOGY

(ELECTRICAL ENGINEERING)

COLLEGE OF TECHNOLOGY AND ENGINEERING

MAHARANA PRATAP UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

UDAIPUR (RAJASTHAN)

DEPARTMENT OF ELECTRICAL ENGINEERING

COLLEGE OF TECHNOLOGY AND ENGINEERING

Maharana Pratap University of Agriculture and Technology, Udaipur (Raj.)

VISION

The Electrical Engineering Department was established with a vision of making it a centre for imparting technical education of high standards and conducting research at the cutting edge technology to meet the current and future challenges of technological development.

MISSION

- *To offer high quality graduate and post graduate programmes in Electrical Engineering.*
- *To prepare students for professional career or higher studies.*
- *The department promotes excellence in teaching, research, collaborative activities and positive contributions to society*

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
DEPARTMENT OF ELECTRICAL ENGINEERING

PEO I :

Our graduates will be productive in the professional practice of electrical engineering, related fields and higher education. They will obtain employment appropriate to their background, interests, and education and will advance in their career.

PEO II :

Have the mathematical and scientific knowledge to analyze and solve emerging real world problems related to power system, control systems, power electronics, measurement and instrumentation system, signal processing and communication systems, and are demonstrating that they possess the necessary communication, organization and teamwork skills for bridge the divide between advanced technology and end users in the practice of electrical engineering.

PEO III :

Exhibit professionalism, ethical attitude, sense of responsibility in their profession and adapt to current trends by engaging in lifelong learning or in service to society.

PROGRAMME OUTCOMES (POs)

DEPARTMENT OF ELECTRICAL ENGINEERING

a. Graduates will demonstrate an ability to apply knowledge of computer science and engineering, mathematics, probability and statistics as it applies to the field of computer engineering including software and hardware.

b. Graduates will demonstrate in depth knowledge of topics which are critical to system level design, including both hardware and software design and hardware/software tradeoffs such as 1) Computational Programming and Software Design: Ability in Simulating Softwares like MATLAB, PSCAD, PSIM, PLC, and computer programming, including data structures and algorithms using representative programming languages; 2) Systems Components and Design: Proficiency in the topics necessary to design combined hardware/software systems, including power system plants design and architecture, HVDC, Power electronics control of electric motors, FACTS devices, operating system kernels, measurements and instrumentations, and the interdependencies among these topics; 3) Digital Logic and Technologies: Proficiency in digital logic design, including logic families, DSP, PSPICE, PLCS, SCADAs and contemporary digital technology; etc.

c. Graduates will demonstrate the ability to function as a member of engineering and science laboratory teams, as well as on multidisciplinary design teams.

d. Graduates will demonstrate the ability to learn and work independently to identify and solve Computer Science and engineering related problems.

e. Graduates will demonstrate an understanding of professional and ethical responsibilities.

f. Graduates will posses effective communication skills both orally and in writing.

g. Graduates will have the confidence and potential to apply engineering solutions in global and social contexts.

h. Graduates will be disciplined and will show the capabilities of independent problem solving, self learning and innovation.

i. Graduates will be truly educated and will have a point of view regarding global scenario of the impact of electrical engineering on society and will demonstrate awareness of contemporary issues at large.

SECOND YEAR (SEMESTER-I)

BS 211 (All Branches) MATHEMATICS – III

Cr. Hrs. 3 (3 + 0)

L T P

Credit 3 0 0

Hours 3 0 0

COURSE OUTCOME - CO1: Understand the need of numerical method for solving mathematical equations of various engineering problems., CO2: Provide interpolation techniques which are useful in analyzing the data that is in the form of unknown functionCO3: Discuss numerical integration and differentiation and solving problems which cannot be solved by conventional methods.CO4: Discuss the need of Laplace transform to convert systems from time to frequency domains and to understand application and working of Laplace transformations.

UNIT-I

Interpolation: Finite differences, various difference operators and theirrelationships, factorial notation. Interpolation with equal intervals;Newton's forward and backward interpolation formulae, Lagrange'sinterpolation formula for unequal intervals.

UNIT-II

Gauss forward and backward interpolation formulae, Stirling's andBessel's central difference interpolation formulae.

Numerical Differentiation: Numerical differentiation based on Newton'sforward and backward, Gauss forward and backward interpolation formulae.

UNIT-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.*Numerical Solutions of Ordinary Differential Equations:* Picard's method,Taylor's series method, Euler's method, modified Euler's method,Runge-Kutta methods.

UNIT-IV

Laplace Transform: Laplace transforms of elementary functions; Basicproperties of Laplace transform; Initial value theorem, final valuetheorem and convolution property of Laplace transform; Inverse Laplacetransforms. Applications of Laplace transform to solve ordinary differential equations.

EE 211 CIRCUIT THEORY – I

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 1 2

COURSE OUTCOME - CO1: Develop understanding for fundamental laws and elements of electrical networks.CO2: Understand waveforms, signals, transients and steady state response of various RLC circuits.CO3:.Develop an ability to solve any DC or AC electrical circuit using various network theorems.CO4: Understand the advanced mathematical tools like Laplace and Fourier transforms to solve electrical circuits.

UNIT-I

Basic circuit element and waveform: circuit component, ideal andpractical voltage and current sources and their inter conversion,independent and dependent sources, unilateral and bilateral, active andpassive, linear and non linear, distributed and lumped parameters.
Network theorem for AC network: Mesh and Nodal analysis, thevenin,Norton, superposition, maximum power transfer, milliman, telegen,compensation, reciprocity theorem.

UNIT-II

Resonance in series and parallel circuit, Q factor, selectivity, Transientand steady state response, solution of differential equation, Effect anddetermination of initial conditions and time constants, analysis of coupledcircuit under sinusoidal excitation, coefficient of coupling, analysis of 3phase balanced and unbalanced circuit, measurement of 3 phase active
and reactive power.

UNIT-III

Two port Network: open circuit, Short circuit, transmission, Hybridparameters, their inter-relationship and interconnection, Two portsymmetry, Input Impedance, output impedance, Image Impedance,Brune's test

UNIT –IV

Fourier series: Periodic function, Trigonometric Fourier series,Evaluation of Fourier coefficient, waveform symmetry Analysis of simplecircuit with non sinusoidal excitation

EE 212 (EE, CS) ELECTRICAL MEASUREMENTS & INSTRUMENTS

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 0 2

COURSE OUTCOME - CO1: The measurement of circuit quantities. CO2: Minimization of errors in measurement. CO3: Understanding of most useful technique in a particular case of measurement.

UNIT-I

Measuring Instruments: Principle of operation, construction detail,torque equation, scale shape, uses and error in Moving iron,Electrodynamics and induction instruments for the measurement ofvoltage, current, power and energy.*Galvanometers:* D'Arsonval, Vibration and Ballistic galvanometers,Dynamic equation of motion and its solution for various conditions,Relative damping, logarithmic decrement and galvanometer sensitivities.

UNIT-II

Potentiometers: Theory of operation and construction of D.C. and A.C.potentiometers (polar and coordinate type), Their standardizationand applications.*Measurements of Resistance*: Methods of measurement of medium, lowand high resistances, three and four terminal type resistance, Kelvin'sdouble bridge, Price's guard wire and Loss of charge method.

UNIT-III

A.C. Bridges-Four arm A.C. Bridge for the measurement of inductance,capacitance, quality and dissipation factor. Screening, Wagner earthing.
Instrument Transformers: Theory and construction of current andpotential transformers, Ratio and phase angle errors and theirminimization, effects of variation of power factor, secondary burden andfrequency on errors, Testing of CTs and PTs.

UNIT-IV

Magnetic Measurements-Determination of B-H curve and hysteresis loopof ring and bar specimens, Measurement and separation of iron losses.*Electronic Instruments*-Transistor voltmeter, TVM using FET in inputstage, Digital voltmeters: Ramp type, integrated type, Measurement oftime, phase and frequency using digital counters, Principle and working
of cathode ray oscilloscope.
Wave analyzers: Frequency selective and heterodyne wave analyzersand its applications.

EE 213 ELECTRICAL WORKSHOP

Cr. Hrs. 1 (0 + 1)

L T P

Credit 0 0 1

Hours 0 1 2

COURSE OUTCOME - CO1: Understand the working of electrical appliances used in daily life.CO2: Discuss the various problems in working of electrical appliances and to solve them properly.CO3: Discuss the need of PCB in modern electrical appliances and understanding the procedure to make a printed circuit board. CO4: Perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting afluorescent tube, Series wiring, Go down wiring.

Accessories & ratings of the wiring materials, wiring circuits: stair case,fluorescent tube lighting circuit, flasher for moving lights circuits,connection of sodium vapors and mercury vapor lamp, wiring layout ofsimple domestic and commercial buildings; Preparation of detailedestimation in the standard format for installation of surfaceconduit/casing and capping wiring in a small house/office, *Study thevarious types of electrical appliances*: electric iron, Geyser,mixer/systems, table fan & ceiling fan, principles of thermostats,
regulators; Practice of earthing; Study of U.P.S, Battery Charger;Design small single -phase transformer of given rating;
Printed Circuitboard: Design guideline General components, layout scheme, PCB
size, design rules for digital circuit and analog circuit PCB's single andmultiplayer boards, Automation and Computer in PCB design, CADpackages and tools, Electronic circuit and minimum system design byusing PCB design software packages.

EC 212 (EE) ELECTRONICS – I

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 1 2

COURSE OUTCOME - CO1: understand the theory of operation of solid-state devices. CO2: Discuss the functioning of various solid-state devices, including several types of diodes (conventional, Zener, and light-emitting), bi-polar junction transistors.CO3: Develop ability to acquire hands-on laboratory experience, utilizing oscilloscopes and other modern test equipment.

UNIT-I

Semiconductors: Intrinsic and extrinsic semiconductors, Mobility andconductivity, types of doping and its effect on properties ofsemiconductor, Diffusion, Mass-action Law, Graded semiconductors.*Theory of PN Junction Diodes:* The open circuited junction, spacecharge region. The biased p-n junction, the volt-ampere characteristicsand volt-ampere equation and effect of temperature on V-Icharacteristic, junction diode switching times, diode capacitance.

UNIT-II

Diode circuits: Half wave and full wave single-phase rectifiers and theiranalysis, peak inverse voltage, various types of filters their analysis andapplications. Voltage multipliers, Clipping and clamping circuit.*Other Types of Diodes:* Zener and avalanche breakdown phenomenonin zener diodes, photo-diodes, light emitting diodes, solar cells,varactor diodes.

Bipolar Junction Transistors: The ideal current controlled source, Thejunction transistor, Ebermoll representation of the BJT, The commonbase (CB) and common emitter (CE) configuration and their input andoutput characteristics, current gains alpha & beta, common collector,the forward active, reverse active, cut off and saturation, Modes of BJT.

UNIT-III

BJT biasing and d.c. models, stabilization techniques. BJT as a switch andas an amplifier, The BJT small signal models, h-parameter and hybrid pimodel, BJT as a diode, Transistor ratings.

Field effect Transistors: Ideal voltage controlled current source, junctionfield effect transistor and its VI characteristics and its construction. TheJFET transfer characteristics. MOSFET: Enhancement and depletiontype. Brief idea about construction of MOSFETs, V-I characteristic.

UNIT-IV

Small signal Amplifiers at Low Frequency: Analysis of BJT and FET invarious modes; input and output resistance, voltage and current gain,Miller theorem and its dual. Cascaded BJT amplifiers, Differentialamplifiers and its analysis, composite transistor stages: Darlington pairand others, Boot strapping.

EC 216 (EC, EE) DIGITAL ELECTRONICS

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 1 2

COURSE OUTCOME - CO1: Discuss the need and applications of digital circuitsin present scenario.CO2: Understand number systems and codes basic postulates of Boolean algebra and shows the correlation between Boolean expressions, logical gates.CO3: Understand the formal procedures for the analysis and design of combinational circuits and sequential circuits. CO4: Discuss the various memory devices like latches, flip fops and their applications.

UNIT-I

Number System & Codes: Radix and Radix conversion, Sign,magnitude and complement notation, Arithmetic shift weightedcodes,Excess-3 code, Gray code, ASCII & EBCDIC codes, Fixed andfloating point arithmetic, BCD addition and subtraction.

UNIT-II

Boolean Algebra And Digital Logic Gates: Features of logic algebra,postulates of Boolean algebra, Theorems of Boolean algebra, Booleanfunction drive logic gates, Exclusive- OR, NAND, NOR gates, their blockdiagrams and truth tables, logic diagrams from Boolean expressionsand vice –versa, converting logic diagrams to universal logic, positive,negative and mixed logic, logic gate conversion.

Minimizing Techniques: Minterm, Maxterm, Karnaugh Map, K map up to 4 variables, simplification of logic function with K map, conversion oftruth table of POS and SOP form, Incomplete specified functions,Variable mapping, Quinn-Mc Klusky minimization techniques.

UNIT-III

Combinational Systems: Combinational logic circuit design, half and fulladder, subtractor, Binary serial and parallel adders, BCD adder, BCD to7-segment decoder, multiplexer, De-multiplexer, encoder, octal tobinary, BCD to excess-3 encoder, Diode switching matrix, Design oflogic circuits by multiplexers, encoder, decoders, and de-multiplexer.

UNIT-IV

Sequential Systems: Latches, flip flops, R-S, D, J-K, Master Slave flipflops, Conversion of flip-flops, Asynchronous (ripple), Synchronousdecade counter, Modulus counter, skipping stateb counter, counterdesign, Ring counter, Counter applications, Registers, buffer registers,shift register.

CE 211 (AE, EE, MI) STRENGTH OF MATERIALS

Cr. Hrs. 3 (2 + 1)

L T P

Credit 2 0 1

Hours 2 1 2

COURSE OUTCOME - CO1: Understand the basic mechanical properties of materials.CO2: Discuss the behaviors of various engineering structural materials under various forces and stresses. CO3: Discuss various types of engineering structures and study of types of beams.CO1: Understand the concepts of Fourier series to solve problems in electrical networks.CO2: Understand the concepts of nonlinear equation and various numerical methods to solve this.CO3: Discuss the application of statistics and probability in engineering problems.CO4: Study various types of probability distributions like Binomial, Poisson and Normal distribution.

UNIT-I

Fundamentals : Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagram's, mechanical properties ofmaterials, elasticity and plasticity. Shear stress. and strain, pure shear.Complementary shear. Linear elasticity and Hooke's law. poison's ratio,volumetric strain, bulk modulus of elasticity. Elastic constants andrelation between elastic modulic. Stress and strain in axially loadedmembers. Temperature stresses and effects.

UNIT-II

Analysis of stress and strain : Stress at a point, stress components.Stresses on inclined planes. Plane stress and strain. Mohr's circlerepresentation of plain stress and strain. Principle stresses and strains,maximum shear stresses. Hooke's law for plain stress.Stresses in thin cylinder and special shells subjected to internal &external pressures.

UNIT-III

Beam under Flexural Loads : Bending moment and shear force, relationbetween load,. Shear force and bending moment. Bending moment andshear force diagrams for simply supported, Cantilever and overhangbeams under static loading of different types viz. point loads, Uniformlydistributed loads, linearly varying loads, Pure bending. Theory of simplebending of initially straight beams. Flexural stresses in beams. Built up andcomposite beams. Shear stresses in beams of rectangular, Circular and Isection.Shear formula, effect of shear strain.

UNIT-IV

Torsion : Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns : Buckling and stability, critical load. Euler's theory for initiallystraight column with different end conditions, equivalent length,Limitation of Eulor's formula. Rankine's formula. column underconcentric loading. Secant, Perry's and Indian standard Formulae.

SECOND YEAR (SEMESTER-II)

EE 221 CIRCUIT THEORY – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Understand the advanced mathematical methods such as Laplace and Fourier transforms to solve. CO2: Understand pole zero concepts and network synthesis. CO3: Understand the types of filters and their application.CO4: Understand the concepts of network synthesis and its application.

UNIT-I

Laplace transform and its application to network analysis, transform networks and sources, initial and final value, and inverse transform, Unit impulse response, unit step response, the time shift theorem, convolution.

UNIT-II

Network functions and complex frequency plane- transfer functions, concepts of complex frequency, poles and zero and restrictions on their location in s-plane, relation between natural transient frequencies and resonance. Time domain behavior from pole-zero configuration ,frequency response , magnitude and phase of network functions ,a relation between time domain and frequency domain analysis .

UNIT-III

Filters –two port reactance networks, image impedance, attenuation, phase shift and insertion loss, characteristics and design of constant –k and m-derived filters

UNIT-IV

Fourier integral and continous spectra – the Fourier Integral spectrum analysis for recurring pulse, relationship between fourier and laplace transform, analysis of circuit using fourier transforms ,sinusoidal transfer function. Network synthesis – the positive real concept , brune ‘s positive realness , properties of function , Hurwitz polynomials , synthesis of two elements networks LC ,RC and networks, cauer and foster networks .

EE 222 POWER SYSTEM – I

Cr. Hrs. 4 (3 + 1)
L T P
Credit 3 0 1
Hours 3 0 2

COURSE OUTCOME - CO1: Understand the basic overview of electrical power systems and distribution supplies. CO2: Discuss the parameters of transmission lines and their performance. CO3: Understand various types of distribution system configurations, equipment and loads. CO4: Understand various types of transmission effects like Ferranti effect, proximity effect etc. CO5: Understand concepts of travelling waves and their applications.

UNIT-I

Basics of power system; Insulators: Type of insulators, bushings, voltage distribution over an insulator string, grading and methods of improving string efficiency, pollution flashover; Corona: Electric stress between parallel conductor's, Disruptive critical voltage and visual critical voltage, calculation for three phase overhead lines for corona power loss, factors effecting corona, effect of corona.

UNIT-II

Parameters of transmission lines: Resistance, inductance and capacitance of overhead lines, effect of earth on capacitance, line transposition, geometric mean radius and distance, calculation of inductance and capacitance of single phase transmission line, Skin and Proximity effect.

UNIT-III

Performance of transmission lines: Steady state analysis of short, medium and long transmission lines, Generalized ABCD line constants, receiving end and sending end power circle diagrams, Ferranti effect, interference with communication circuits.

UNIT-IV

Underground cables: Type of cables, insulation resistance and capacitance calculation, reduction of maximum stresses, causes of breakdown, idea about oil and gas filled cables, thermal rating of cables. Traveling waves: Traveling waves on transmission lines, wave equation, specification of traveling waves, reflection and refraction of traveling waves, typical cases of line terminations .

EE 223 ELECTRICAL MACHINES – I

Cr. Hrs.	**4 (3 + 1)**		
	L	**T**	**P**
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Understand the basic overview of various kinds of electrical machines and their applications.CO2: Discussconstructional details, principle of operation of Transformers.CO3 : Understand constructional details, principle of operation, Performance, starters and speed control Of DC Machines.CO4: Discuss the basic phenomenon of cross fields machinery and their applications

UNIT-I

Transformers: Constructional features, emf equation, phasor diagram, equivalent circuits, open circuit and short circuit test, Sumpner's test, efficiency, voltage regulation, all-day efficiency, separation of losses, parallel operation, autotransformers.

UNIT-II

Polyphase Transformers: standard connections for three-phase operation, single phasing and unbalanced load conditions on a threephase transformer, Scott connection and six-phase transformation. Electromechanical Energy Conversion: Basic principles of electromechanical energy conversion, energy balance, basic principles of operation of electric generators and motors. DC Machines: Fundamentals of DC machine, construction, armature windings, simple lap and wave windings, chording, equalizing connections.

UNIT-III

DC Generators: EMF equation, Types of DC generators, no load and load characteristics, parallel operation. Armature Reaction: Distribution of armature and field mmfs, crossmagnetizing and demagnetizing mmfs and their approximate estimation. Commutation: Introduction to commutation, reactance voltage, resistance commutation and interpoles.

UNIT-IV

DC Motors: Principle of operation, production of torque, back emf, torque-current and torque-speed characteristics, starting of motors, speed control by variation of armature voltage, field current and Ward Leonard method, electric braking, losses and efficiency, direct and indirect tests, Swinburne's test, Hopkinson's test, field test and retardation test, Rosenberg generator. Cross-Field Machines: Basic principles of operation of metadyne and amplidyne and their applications.

EE 224 ELECTRICAL COMPUTATION

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**1**	**2**

COURSE OUTCOME - CO1: Understand basic programming of C for various electrical problems.CO2:Discuss MATLAB as a versatile tool in electrical engineering and study basic programming in it CO3: Understand application of PSCAD, PSIM in modeling, computation and simulation of electrical circuits.

Review of C fundamentals: Data Structure in C: manipulating strings of character, input & output of strings. Using structures in arrays & arrays in structures, Pointer data type, pointers and arrays, pointer and functions. Enumerated data type, creating new data type names, simulation & application of stack,. List data structure, manipulation of linked list, Files-sequential & unformatted files, Projection preparing & running complete 'C' Program; Introduction to MATLAB and Simulink: To design and simulate various of electrical circuits and system.

Introduction to PSIM: To design and simulate various of electrical circuits and system; Introduction to PSCAD: Modelling, Simulating and Designing HVDC & AC transmission system using CB, Relays, faults, with no. of buses.

THIRD YEAR (SEMESTER-I)

BS 311 (EE) MATHEMATICS – V

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**1**	**0**

COURSE OUTCOME - CO1: Provide the Knowledge of Differences equations and their use in engineering applications. CO2: Analyze general Z-transformation and their applications to solve Differences equations. CO3 :Apply the numerical methods for solution of simultaneous linear equations. CO4 : Provide knowledge use of Fourier transform and to solve engineering specific partial differential equation problems.

UNIT-I

Difference Equations: Homogeneous linear difference equations with constant coefficients; Non-homogeneous linear difference equations with constant coefficients, method of undetermined coefficients, method of operators; Homogeneous\ Non-homogeneous linear difference equations of first order with variable coefficients.

UNIT-II

Z-Transforms: Basic properties of Z-transforms; Initial value theorem, final value theorem and convolution theorem of Z-transforms; Inverse Ztransforms; Applications of Z-transforms to solve difference equations.

UNIT-III

Solutions of Simultaneous Linear Equations: Gaussian elimination method, pivoting; Gauss-Jordan method; Gauss-Seidal method; Cholesky's method. Eigen values and Eigen vectors**:** Power and inverse power method.

UNIT-IV

Fourier Transforms: Complex Fourier transforms, Fourier sine and cosine transforms; Inverse Fourier transforms; Simple properties of Fourier transforms; Applications of Fourier transforms to solve partial differential equations.

EE 311 POWER SYSTEM – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Understand the principle of protective schemes and various faults in the Power System Scenario. CO2: Evaluate switchgear equipment in the context of international standards and specify appropriate equipment for a range of installation types. CO3:Examine protection of power system with various protection relays CO4: To study the various types of the circuit breakers, the arc quenching phenomena and the Protection against over voltages.

UNIT-I

Per Unit System: Percent and per unit quantities, single line diagram & impedance diagram for a balance system; Symmetrical Fault Analysis: Transient in R-L Circuit, symmetrical and asymmetrical short-circuit current in synchronous generation, equivalent circuit of synchronous machine in different conditions, analysis of three phase fault.

UNIT-II

Symmetrical Component: Fortesque theorem and symmetrical component transformation, phase shift in star delta transformer, sequence impedance and sequence circuit for synchronous machine, transformer and transmission line, sequence network of a power system. Unsymmetrical fault analysis: Single line to ground fault, Line to line
fault, Double line to ground fault.

UNIT-III

Switchgear & Protection: Fuses, Selectivity, Discrimination, Sensitivity, Reliability, Fastness, Time grading & current grading, Primary & back up protection.
Construction & operation of relays: Electro magnetic over current relays, Reverse Power Directional relay, Instantaneous Earth Fault Relay, Buchholtz Relay. Distance protection of transmission lines, C. T. & P. T. connection for distance relays.

UNIT-IV

Unit Protection: Protection of Transformer, stator winding of alternator, Protection against Excitation failure, Prime mover failure, Frame Leakage, Differential protection of: Generator-Transformer unit, 3-phase transformer, Buchholz protection. *Circuit Breakers:* Theorem of current interruption, Recovery theory, Construction and operation of Bulk oil, Air blast, MOCB, SF6, Vacuum circuit breaker, Advantages & disadvantages of static relay.

EE 312 POWER ELECTRONICS – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO 1: Describe the role of Power Electronics as an enabling technology in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc.CO 2: Provide knowledge for basic power electrical devices like Thyristor, MOSFETS, IGBT, and UJT.CO3: Learn the basic concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies. CO 4: Understand, simulate and design single-phase and three-phase thyristor converters.

UNIT-I

Semiconductor Power Devices: Characteristics of power Diodes, power Transistors like BJT, MOSFET& IGBT, Diac, SCR and UJT

UNIT-II

Thyristor: Principle of operation, Construction and characteristics, specification and ratings, pulse transformer, optical isolators, methods of turn on, Protection of SCR protection against over voltage, over current, dv/dt, di/dt, switching surges, over heating. Gate protection,
SCR mounting, Heat transfer process in SCR, *Thyristor firing circuit*- Principle features of a typical gate triggering circuit R & R-C, UJTrelaxation oscillator

UNIT-III

Converters: Half wave converters for single, two, three, six phase; Single phase and three-phase full wave converrtor with R, R-L and RLE loads; Performance factors for line commutated converters; Inversion operation semi converters, dual converter; Effect of source impedance; Microprocessor based firing scheme for three phase fully controlled
bridge converter.

UNIT-IV

Power supplies: Basic series and shunt voltage regulators, Integrated circuit regulators. Switch mode d.c. Power supplies, Fly back converter, forward converter, push-pull converter, half and full bridge converters, A.C. power supplies; UPS configurations, On-line and Off-line UPS.

EE 313 ELECTRICAL MACHINES – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Understand the two basic principles (generation of force and emf) that govern electromechanical energy conversion. CO2: Discussconstructional details, principle of operation of induction motor. C03: Discussconstructional details, principle of operation of synchronous motor.

UNIT-I

Induction Motors: Rotating magnetic fields, construction, basic principal of induction motor, induction motor as a generalized transformer, phasor diagram, equivalent circuits, no-load and blocked rotor tests, circle diagram, calculation of performance, Torque-slip characteristic, effect of rotor resistance, operating characteristics of induction motor, speed control, starting and braking, cogging, crawling.

UNIT-II

Single Phase Induction Motor: Basic Principle, revolving field theory, methods of starting, equivalent circuit. Induction generator, Induction regulators.

Synchronous Generators- Constructional features, general equation of induced emf, effect of distribution, chording, armature reaction, theory of cylindrical rotor machine, saturation effects, phasor diagram, open circuit, short circuit and zero power factor characteristic, Potier triangle, regulation by synchronous impedance, M.M.F. & A.S.A. methods and their relative comparison. Theory of Salient pole machines Blondel's two reaction theory, phasor diagram, direct and quadrature-axis reactance their determination; parallel operation of alternators, synchronizing operation of infinite bus, synchronizing power, power-angle characteristics, stability.

UNIT-III

Synchronous Motor: Construction, principle of operation, equivalent circuit, phasor diagram, power flow equation, V curves, starting, hunting & damping. *Commutator Motors*-Effects of injected EMF, commutator as frequency changer, single phase series motor and schrage motor.

UNIT-IV

Fractional Horse Power Motors: Construction, principle of operation, elementary analysis, characteristics and applications of universal motors, repulsion motors, hysteresis motor, brush less motors, linear induction and stepper motors.

EE 314 CONTROL SYSTEM – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1:Make measurements of a system and determine a transfer function CO2:Implement a proportional control system and make performance predictions, including SSE, response speed and relative stability. CO3:Understanding of stability, transient, and steady-state behavior of linear dynamic systems. CO4: Demonstrate the ability to identify a dynamic system from its time or frequency response. CO5: Use software tools to model, analyze, and simulate control system performance.

UNIT-I

Representation of simple open loop and closed loop system, electrical analogs, Laplace transforms, Mathematical modeling, transfer functions, block diagram reduction techniques, signal flow graphs, mason's gain formula, control system components – error detectors, potentiometers, synchros, d.c. and a.c techogenerator , d.c .and a.c. servo motors.

UNIT-II

Time Response analysis and Design specifications: Transient and steady state response, standard test signals, Time response of a first order and second order system to standard signals, steady state error, error coefficients, generalized error series sensitivity, control actions (proportional, derivative and integral controls)

UNIT-III

Concept of stability, Absolute stability, relative stability, Routh Hurwitz criteria, Characteristic equation, Root Locus Technique

UNIT-IV

Frequency Response Analysis: Frequency Domain Specification, correlation between time and Frequency Response, Polar plot, Bode Plot, Gain Margin, Phase Margin Nquist stability criteria, Compensation: Lag, Lead and Lag-Lead Network

EE 315 COMPUTER ARCHITECTURE & INDUSTRIAL CONTROL

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1:Develop ability to explain how the various parts of a modern computer function and cooperate CO2: Describe the architecture of microprocessor and its peripheral devices. CO3: Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices. CO4: Apply the programming techniques in developing the assembly language program for microprocessor application. CO5: Understand the PLC and Industrial control for various engineering problems.

UNIT-I

Microprocessor Architecture: Inter 8085 Architecture, Buses, Registers, status flag, Opcode & operands, Word size, Pin configuration, Instruction cycle, Fetch operation, Machine cycle & state, Instruction & data flow. Timing diagram for-opcode fetch, Memory read & write, I/O read and write, Instruction & data formats, Addressing modes, Instruction set, Stack & subroutines, Data Transfer Schemes, *Programming the 8085*, Programming techniques-looping, counting, indexing, counters and time delays, subroutines.

UNIT-II

Programming the 8085: Programming techniques looping, counting, indexing, counters and time delays, subroutines. Interrupts of 8085, Debugging of programs. Modular & structured programming, Macro, Micro programming. *Micro controllers*-Introduction & applications, *Computermemories*-Tape, disk and floppy disk storage, semiconductor memories systems, bubble memories- CCD memory. Input –output devices- VDU, graphic display, magnetic tape unit, printers, mouse, plotters & digitiser.

UNIT-III

Programmable logic controller: Principles of operation, architecture of Programmable controller, programming the programmable controller, software, configurations, applications, conclusions.

UNIT-IV

Distributed Digital Control: Fundamental requirements of distributed process control system, system architecture, distributed control system, configuration, and some popular distributed control system *Industrial Control Applications:* Introduction, cement, thermal power, water treatment, steel plant.

THIRD YEAR (SEMESTER-II)

EE 321 ELECTROMAGNETIC & FIELD THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1:Transformation from one co-ordinate system to other. CO2:Knowledge of gradients and variation of different physical quantities. CO3:Connection between electric & magnetic field.

UNIT-I

Vector relation in rectangular, cylindrical, spherical and general curvilinear coordinate system, line, surface & volume integral; Concept and physical interpretation of: Gradient, Divergence, Curl, Stokes Theorem, Helmholtz Theorem**.**

UNIT-II

Electrostatics: Introduction to Electric field vectors, Electric field due to charge configuration, Potential function and displacement ratio; Gauss law, Poison's and Laplace's equation's, Uniqueness theorem, continuity equation, Capacitance & electrostatic energy, Field determination by method of image, Boundary condition, Field mapping and concept of field cell.

UNIT-III

Magnetostatics: Introduction to magnetic field vectors, Bio-Savart and Ampere's law, Magnetic scalar and vector potential Self and mutual inductance energy stored in magnetic field, Boundary condition, Analogy between electric and magnetic field, Field mapping and concept of field cell.

UNIT-IV

Time-Varying Fields: Faraday's law, Displacement current & equation of continuity, Maxwell's equation, UPW: Free space, dielectrics and conductors, Skin effect and sinusoidal time variation, Reflection, refraction and polarization of UPW, standing wave ratio, Poynting vector and power consideration .Radiation and Transmission, Retarded potential and concepts of radiation, radiation from small current elements, Transmission line parameters, Introduction to EMI & EMC. EMI coupling nodes, methods of eliminting interference, shielding, grounding, conducted EMI.EMI testing, emission testing, susceptibility testing.

EE 322 POWER ELECTRONICS – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Understand the advanced power electronic devices.CO2: Discuss the cyclo converters and their types, applications.CO3: Discuss the choppers and their types, applications.

UNIT-I

Converters: Performance measures of single and three-phase converters, discontinuous conduction in two quadrant converters, power factor improvements: Extinction angle control, symmetrical angle control, pulse width modulation control, and sinusoidal pulse width modulation control; Thyristor commutation scheme- Line commutation, load commutation, forced and external pulse commutation

UNIT-II

Cycloconverter: Basic principle of operation, single phase to single phase, three phase to three phase and three phase to single phase cycloconverters, Output equation.

UNIT-III

Choppers: Principle of chopper operation, control strategies, step-up chopper, reversible chopper, Steady state time domain analysis of type-A chopper, Chopper configuration, and chopper commutation. AC Chopper, Multiphase chopper.

UNIT-IV

Inverters: Inverter classification, Voltage source thyristor inverters, single phase half and full bridge inverters with auxiliary communication and with complementary communication, Three phase bridge inverters with 180 mode & 120 mode, Pulse width modulation inverters, Current source inverters, single phase capacitor-commutated CSI with restive load, single phase auto-sequential commutated inverter, three phase auto-sequential commutated inverter, single phase series inverters & parallel or push pull inverters, Voltage control of inverters.

EE 323 INSTRUMENTATION

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1 : Application and handling of transducers in real system. CO2: Signal filtering and modulation. CO3: Utility and handling of amplifiers, converters and choppers.

UNIT-I

Theory of errors: Accuracy and precision, systematic and random errors, limits of errors, probable errors and standard deviation, Gaussian error curves, Combinational errors.

UNIT-II

Transducers: Constructional features, operating characteristics and selection. Criteria of active, passive and digital transducers, block diagram representation for the instrumentation of strain, displacement, velocity, acceleration, force, torque, flow, pressure and temperature.

UNIT-III

Signal conditioning: a.c. & d.c. Bridges, analysis of unbalanced bridges, Instrumentation amplifier, operational amplifiers, choppers, established and carrier amplifiers, charge amplifiers, A/D & D/A converters. Phase sensitive detectors, shielding and grounding.

UNIT-IV

Signal recovery: Signal filtering, averaging, correlation and coding. Signal transmission and telemetry: Modulation and encoding methods, transmission media, Time division and frequency multiplexing. Signal recording and display- Analog and digital display, Recorders, storage oscilloscopes, printers and plotters, Data acquisition system (analog and digital).

EE 324 CONTROL SYSTEM – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Discuss Application and handling of transducers in real system. CO2 :Understanding Signal filtering and modulation. CO3: Utility and handling of amplifiers, converters and choppers.

UNIT-I

State Space Analysis: Concept of state, state space representation of systems, phase variable form, canonical variable form, physical variable form, Diagonalization, relationship between state equation and transfer function, solution of state equation, concept of controllability and observability, eigen values and eigen vector.

UNIT-II

Sampled Data System: importance of sampling, mathematical analysis of sampling, spectrum analysis of sampling process, Shanon's Theorem, signal reconstruction, hold circuit, Z transform, inverse Z transform, difference equation, pulse transfer function, state variable representation of sampled data system, solution of discrete state equation.

UNIT-III

Non linear system- characteristic of non linear system, type of Non linearity, jump resonance, limit cycle, describing function method of analysis.

UNIT-IV

Liapunov stability criteria- introduction, stability definitions and theorems, Liapunov function for linear system.

EE 325ELECTRICAL ENGINEERING MATERIALS

Cr. Hrs.	**3(3+ 0)**		
	L	**T**	**P**
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1:Analysis of different kinds of materials and finding its utility. CO2:Understanding of magnetic material and their properties. CO3:Understanding of semi-conductors and their utility.

UNIT-I

Conductor Materials: Electrical, thermal and mechanical properties of conductive and resistive materials. Important characteristics and applications of specific conductor materials like copper, aluminium, AAC, ACSR, silver, gold, platinum and tungsten, study of important resistance materials, carbon and nicrome, standard resistance materials. Soldering alloys.

UNIT-II

Super-conducting Materials: Introduction, critical field and critical current density, type I and type II superconductors, intermediate state, penetration depth and thin films, Superconductivity at high frequencies, application of superconductivity. Advancements in super conducting materials. Dielectric materials: Dielectric behavior of materials under static and dynamic field, Polarisation, induced and permanent dipole moments, Surface resistivity. Breakdown processes. Thermal properties Electrical properties of important dielectric materials including plastics and ceramics, ferroelectric and piezo-electric materials.

UNIT-III

Magnetic Materials: characteristics of diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic and anti-ferromagnetic materials, Properties and applications of common nonretentive and retentive magnetic materials including various alloys, ferrites and powder cores. Eddy current and hysteresis losses, Curie point.

UNIT-IV

Semiconductor materials: Electric properties of semiconducting elements and compounds and their application. Zone refining and crystal growth. Miscellaneous materials: important electronic properties of electron emitting materials, photosensitive materials and luminescent materials.

EE 326 SYSTEM DESIGN & SIMULATION LAB

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**1**	**2**

COURSE OUTCOME - CO1: Analysis of Design & Simulation of rudimentary electrical system using MATLAB. CO2: Understanding of emerging trends in Design and control of different electrical system. CO3:Understanding of Vector and DTC controlled system, Non –linear system designing.

Design & Simulation of rudimentary electrical system using MATLAB, PSIM, PSCAD, software packages; Study of emerging trends in Design and control of different electrical system: HVDC, HVAC systems design, harmonic analysis, Interfacing problems & design of fuel cell, solar and wind based system; Design & Simulation of recent trends in drive control technology: Vector and DTC controlled system, Non –linear system designing, design and simulation of ALFC and AVR, Simulation of power flow and stabilities problems.

FINAL YEAR (SEMESTER-I)

EE 411 ELECTRICAL MACHINE DESIGN

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO 1:Understand the need of designing and designing limitations. CO 2 :Providing knowledge of heating and cooling of electrical machines. CO 3 :Study various aspects of design of transformers, DC machine and Ac machines. CO 4 : Study various types of winding and their characteristics.

UNIT-I

Principle of electrical machine design- Design factors, limitations in design, magnetic circuit calculations, magnetic leakage calculations, magnetising current calculations, unbalanced magnetic pull. Heat dissipation, Heating, cooling curve, Estimation of minimum temperature rise, cooling media, quantity of cooling media, design of fan, Ratings.

UNIT-II

General features of armature winding, single layer, Double layer & commutator winding, integral & fractional slot winding, winding factors, harmonics, Eddy current losses in conductors. Design of D.C. Machines, output equation, main dimensions, staggering of buses, selection of no. of poles, airgap, specific magnetic & electric loading.

UNIT-III

Design of transformers,. General consideration, output equation, EMF per turn, main dimension conductor size, window yoke & over all dimension, tank design, choice of electric & magnetic loading.

UNIT-IV

Design of Induction motors, output equation, selection of frame size, selection of no. of stator slots, calculation of air gap length & conductor size. Design of squirrel cage motor, Rotor bar, elimination of harmonic torque. Design of synchronous machine, output equation, selection of no. of slots, Runaway speed, main dimension, Effect of SCR on machine performance, airgap.

EE 412 ELECTRIC DRIVES AND CONTROL

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1:Electric Drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc., making Electric Drives an enabling technology. CO2:Understand basic requirements placed by mechanical systems on electric drives. CO3:Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives.

UNIT-1

Switching Mode Regulators: Buck, boost, buck-boost and Cuk regulators; Ac Voltage Controllers: Single-phase AC controllers with R and RL load, sequence control of AC controllers, three phase AC controllers.

UNIT-II

Dynamics Of Electric Drives: Fundamental Torque Equations, Speed- Torque conventions And Multi-quadrant Operation, Equivalent Values Of Drive Parameters, Components Of Load Torques, Nature And Classification Of Load Torques, Calculation Of Time And Energy Loss In Transient Operation, Steady State Stability, Load Equalization.

UNIT-III

D.C. Drives: Characteristics of separately exited D.C. Motor and its operating modes for motoring regenerating braking & dynamic braking. Types of Electrical braking, Phase control drives, chopper control drives. Block diagram and explanation for close loop control of d.c. drive. Soft start, acceleration control and current limiting, various industrial applications of drive

UNIT-IV

A.C. drive-Speed control of Induction motor, stator voltage control & soft start, variable frequency control from current sources, rotor resistance control, slip power recovery. Block diagrams & their explanation for closed loop control, stator voltage control, volts hertz control with current limiting, volts hertz control with slip regulation, static cramer drive. Synchronous motor drive-volts hertz control & brushless d.c. and a.c. motors. Sensor less control Electric drives.

EE 413 ELECTRICAL ENGINEERING ECONOMICS AND MANAGEMENT

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1: Knowledge of money, price, demand, production and their relation. CO2:Understanding worth for money and its changing trend. CO3:Use of economics in electrical system so as to make electricity production economical.

UNIT-I

Definition of Economics, Income, Investment, Assets, Liability, utility, Market and its types, Money, Price, value, wants, wealth, capital and its types, supply and demand , Law of Returns, Concept of physical and financial efficiency of electrical goods and services, Importance of Engineering economics, Annuities and its kind, Profit, supply & demand, elasticity, necessity & luxuries, free competition and monopoly, law of diminishing returns.

UNIT-II

Depreciation and its various method for calculating- Straight line, diminishing balance, Sinking fund, sum of the Year Digit method, Depreciation in utilizing electrical energy. Element of cost, Direct and Indirect expenses, component of cost, Depreciation and its various method for calculation-Straight line, diminishing balance, Sinking fund, sum of the Year Digit. Linear break-even analysis Comparison of alternatives- Annual cost, Present worth, Rate of return, payback & benefit to cost ratio methods.

UNIT-III

Economical choice of electrical apparatus, economic life of electrical machine. Economic choice of motors, Transformers, Electrical lamps, Economic choice of Transmission Line and Distribution substation, Kelvin Law for cables.

UNIT-IV

Management- Functions of Management, office management, Human Resource Management, store management.

EE 414 ELECTRIC ENERGY SYSTEMS THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1:Understanding of electrical system and its mathematical modeling. CO2:Controlling and analysis of loads. CO3:Optimization of power system.

UNIT-I

Fundamental concept of electric energy system theory; electric supply systems; economics of power transmission.

UNIT-II

Load flow analysis: Static load flow equation, system variable and its solution, Bus admittance matrix, Bus classification, Solution of load flow problem by gauss siedal, Newton Rephson and fast decoupled method, Comparison of above method.

UNIT-III

The energy system in steady state-Basic generator control loops, Mathematical modeling and description of various components of automatic voltage regulator, steady state and dynamic performance of AVR.

UNIT-IV

Automatic load-frequency control of single area system, Mathematical modeling and description of various components of ALFC, steady state and dynamic performance of ALFC, steady state, dynamic and transient stabilities, Equal Area criterion, step by step method of solving swing equation.

EE 415 GENERATION OF ELECTRICAL POWER

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - Co1: Different types of lightening systems and their design. CO2: Provide knowledge of Traction System. CO3: Understanding the methods of heating.

UNIT-I

Method of Bulk Energy Generation: Introduction to thermal, hydel, nuclear and gas power plants with their layouts, Concept of co-generation, Impact of thermal, hydro and nuclear stations on environment.

New Energy Sources: Elementary ideas of electric energy generation by wind, solar, tidal and geothermal energy and fuel cell, Open and close cycle MHD power generation.

UNIT-II

Load And Load Curve: Types of load, chronological load curves, load duration curve, energy load curve, mass curve, maximum demand, demand factor, load factor, capacity factor, utilization factor, diversity factor.

Power Plant Economics: Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost, Role of load diversity in power system economics, off peak energy utilization. Energy cost reduction.

UNIT-III

Tariffs: Objectives of tariffs. General tariff form, flat demand rate, straight meter rate, block meter rate, two part tariffs, power factor dependent tariffs, three part tariff, spot (time differentiated) pricing.

Power Factor Improvement: Causes and effects of low power factor, advantages of power factor improvement, power factor improvement using shunt capacitors and synchronous condensers. Calculation of most economical power factor when kW demand is constant and kVA demand is constant.

UNIT-IV

Selection Of Power Plant: Comparative study of thermal, hydel, nuclear and gas power plants. Base load and peak load plants, Size of generating units, types of reserve and size of plant, Selection and location of power plants.

EC 413 (EE) COMMUNICATION ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1: To convert between time and frequency domain representations of signals. CO2:To compute the energy in an energy signal in the time or frequency domain. CO3: To compute a modulated analog signal from an analog message signal (modulation). CO4: To compute the autocorrelation function of a random process.

UNIT-I

Modulation techniques: Amplitude modulation, AM-DSB, AMDSB/SC.AM/SSB & their generation and detection. Angle (FM& Phase) modulation, modulation and demodulation techniques, PLL–applications in modulating and receiver circuits.

UNIT-II

Pulse modulations- PAM, PDM, PPM, PCM, delta modulations. Performance of analog modulation schemes under noise, non-linearity and their comparison. Radio Receiver systems.

UNIT-III

Digital communication system: Basic information theory-Units of information entropy, Uncertainty & information, rate of communication, redundancy relation between system capacity & information content of messages.

UNIT-IV

Introduction to satellite and optical fiber communication system. Noise-Atmospheric, thermal, shot & partition noise, white noise, Noise figure & experimental determination of noise figure, minimum noise figure networks.

FINAL YEAR (SEMESTER-II)

EE 421ADVANCED POWER SYSTEMS

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME - CO1: Implement stability concepts of power systems. CO2: Study HVDC and high voltage AC transmission.CO3:Study of concepts of FACTS and their applications.

UNIT-I

EHV AC Transmission: Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, bundled conductors geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise.

UNIT-II

HVDC Transmission: Types of D.C. links, advantages and disadvantages of HVDC transmission, Basic scheme and equipment of converter station. Analysis of HVDC Converters, twelve-pulse converter. Ground return. Basic principles of DC link control and basic converter control characteristics, system control hierarchy, various controls of HVDC like VDCOL, firing angle control, current and extinction angle control, gamma controller, power controller.

UNIT-III

Introduction to multi-terminal DC systems, application of MTDC Systems, types of MTDC systems, Control and protection of MTDC systems. Description of various converters and inverters circuits, HVDC circuit breakers, Harmonics and filters, Measurement of HVDC quantities, Reactive power requirements and sources of reactive power. Converter Faults and protection against over currents, over voltages.

UNIT-IV

FACTS: Problems of AC transmission lines. Phenomena of voltage collapse, basic theory of line compensation. Basic features of FACTS controllers, Basic schemes and operations of thyristor controlled series compensator phase angle regulator and dynamic brake, Introduction to static synchronous compensator (STATCOM) and unified power flow controller (UPFC).

EE 422 NEURAL AND FUZZY BASED CONTROL SYSTEM

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

COURSE OUTCOME - CO1: Solution of a system using neural network and Fuzzy logic. CO2: Provideoptimization techniques for solution of neural networks. CO3:Feedback Control of a system.

UNIT-I

Artificial neural systems : Preliminaries, fundamental concepts & models of artificicalsystem, neural networks learning rules, Hebbian, perceptron, delta Widrow-Hoff learning rules; Single layer percepton classification : Classification model, features & decision regions training & classification using discrete perception, algorithm & examples, single layer continuous perceptron networks for linear separable classification; Multilayer feedback work networks : Generalized delta learning rule, feedforword recall & error back propagation training, learning factors.

UNIT-II

Single layer feedback networks : basic concepts of dynamical systems mathematical modeling of discrete time & gradient type Hopfield networks, transient response of continuous time network solution optimization problems. Neural network in control system : Neuro-control approaches, training algorithm evaluation of training algorithms, through simulation, self tuning neuro-control scheme, self tuning PID neural controller, neurocontrol scheme feed water bath temperature control system.

UNIT-III

Mathematical of fuzzy control: fuzzy sets, fuzzy set theory, properties of fuzzy sets, Operations of fuzzy sets, fuzzy relations .Non linear fuzzy control: The control problem, FKBC as non linear transfer element PID & sliding mode type FKBC, some typical application of fuzzy based control systems.

UNIT-IV

Adaptive Fuzzy control: Introduction, design & performance evaluation, performance monitor, main approaches to design. Stability of fuzzy control system: state space approach, stability and robustness indices, input-output stability. FKBC design parameters: Structure of FKBC fuzzification and defuzzification module, rule based choice of variable and contents of rules, derivation of rule data based, choice of membership function and scaling factors.