SECOND YEAR: ELECTRICAL & ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION

(RC 2016-17)

SEMESTER - III

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P#	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.1	Applied Mathematics	3	1	--	3	100	25	--	--	--	**125**
EE 3.2	Electronic Devices and Circuits	3	1	2	3	100	25	--	25	--	**150**
EE 3.3	Electrical Machines-I	3	1	2	3	100	25	--	25	--	**150**
EE 3.4	Electrical Measurements and Measuring Instruments	3	1	2	3	100	25	25	--	--	**150**
EE 3.5	Economics and Management	3	--	--	3	100	25	--	--	--	**125**
EE 3.6	Analog and Digital Communication	3	--	2	3	100	25	--	--	25	**150**
TOTAL		**18**	**4**	**8**	**--**	**600**	**150**	**25**	**50**	**25**	**850**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

SECOND YEAR: ELECTRICAL & ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION

(RC 2016-17)

SEMESTER - IV

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P#	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.1	Numerical Techniques and Probability	3	1	2	3	100	25	--	--	--	**125**
EE 4.2	Electrical Machines-II	3	1	2	3	100	25	--	25	--	**150**
EE 4.3	Linear Integrated Circuits	3	1	2	3	100	25	--	25	--	**150**
EE 4.4	Digital Integrated Circuits	4	--	2	3	100	25	25	--	--	**150**
EE 4.5	Electrical Circuit Analysis and Synthesis	3	1	--	3	100	25	--	--	--	**125**
EE 4.6	Electrical Power	4	--	--	3	100	25	--	--	25	**150**
TOTAL		**20**	**4**	**8**	**--**	**600**	**150**	**25**	**50**	**25**	**850**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

FE 1.1 ENGINEERING MATHEMATICS-I

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
FE 1.1	Engineering Mathematics-I	4	--	--	3	100	25	--	--	--	**125**

Course Objectives: To enhance their knowledge of Mathematics specifically in the field of function of more than one variable and their analytic properties, expansion of function as a power series, complex functions and its analytic properties.

Course Outcomes: After successful completion of this course the student will

1. Have knowledge of an infinite series.
2. Evaluate integrals using Beta and Gamma functions.
3. Express a function in the form of a power series.
4. Understand various operations on complex numbers & analytic properties of functions of complex variables.
5. Have knowledge of indeterminate forms.
6. Understand partial differentiation & its applications.
7. Solve first order partial differential equations.

UNIT - 1 (16 Hours)

Beta and Gamma Functions: Various forms and properties, relation between Beta and Gamma functions, Legendre's duplication formula, Error function.

Infinite Sequence and Infinite Series: Convergence and Divergence of sequences and series, tests for Convergence and Divergence of infinite series such as Integral test, Comparison test, D'Alembert's ratio test, Cauchy's root test and Leibnitz test for Alternating series, Power series and Radius of Convergence.

UNIT - 2 (16 Hours)

Complex Variables: Complex numbers and their properties, Modulus and Argument of a Complex number, Polar and Exponential form of Complex number, Geometric interpretation of Complex numbers, De Moivre's theorem and its applications, Exponential, Trigonometric, Hyperbolic and Logarithmic functions, Inverse Trigonometric and Hyperbolic functions, Continuity, Differentiability and Analytic functions. Cauchy-Riemann equations, Harmonic functions.

UNIT - 3 (16 Hours)

Differential Calculus: Leibnitz theorem, Taylor's theorem (without proof), Taylor's and Maclaurin's series expansion. Indeterminate forms, Partial Differentiation, Total Differentiation.

UNIT - 4 (16 Hours)

Partial Differential Equations and Extreme Values of Functions: Formation of first order Partial Differential Equations, Methods to solve first order Partial Differential Equations, Euler's theorem on Homogenous functions, Extreme values of functions of two and three variables, Lagrange's method of Undetermined Multipliers.

Recommended Readings:

1. G.V. Kumbhojkar; Applied Mathematics-I for F.E. Semester-1; C Jamnadas & Company.
2. Erwin Kreysig; Advanced Engineering Mathematics; Wiley International Edition.
3. Ch. V. Ramana Murthy and N. C. Srinivas; Applied Mathematics; S. Chand Publishing.
4. Dr. B. S. Grewal; Higher Engineering Mathematics; Khanna Publishers.
5. Srimanta Pal, Subodh C. Bhunia; Engineering Mathematics; Oxford University Press.
6. Thomas/Finney; Calculus and Analytic Geometry; Addison Wesley.

FE 1.4 FUNDAMENTALS OF ELECTRICAL ENGINEERING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
FE 1.4	Fundamentals of Electrical Engineering	3	--	2	3	100	25	--	--	--	**125**

Course Objectives:

1. To develop an understanding of important concepts of Electricity & Magnetism.
2. To be able to analyze AC & DC circuits
3. To understand concept of DC and AC power, Reactive power and power factor
4. To develop conceptual understanding of three phase AC circuits.
5. To understand basics of Transformer.

Course Outcomes:

On completion of this course, the students will have a thorough understanding of various electrical and magnetism concepts. They will have an ability to work on DC and AC circuits. They will have knowledge of Transformers.

UNIT - 1 (12 Hours)

Introduction to Generation of Electrical Energy: Different sources of generation of electrical energy - conventional sources of energy- Thermal, hydro & nuclear. Non conventional sources - solar & wind. Single line representation of a power system indicating generation, transmission & distribution of electrical power.

Magnetism: Concept of magnetic field. Definitions of terms related to magnetic field- flux density, permeability, reluctance, m.m.f, Ampere law, Faraday's laws , Lenz's Law . Fleming's rules - their significance & application. Electromagnetic induction, induced emf and its types, magnetic circuits, analogy between electric circuit & magnetic circuit. Energy stored in magnetic circuit.

UNIT - 2 (12 Hours)

Electrical Circuits & Analysis of DC circuits: Introduction to Electric circuit, circuit elements- passive & active – their definition from circuit & energy view point, ohm's law, Kirchhoff's laws- KCL & KVL, series & parallel connection, star & delta transformation . Basic principles of voltage divider & current divider. Concept of voltage & current sources. Analysis of D.C. circuits involving independent sources: Loop analysis/mesh analysis & nodal analysis. Superposition Theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's Theorem.

UNIT - 3 (12 Hours)

A.C. Fundamentals, AC Circuit Analysis: Generation of sinusoidal voltage - frequency, time period, average value, r.m.s. value, maximum value , form factor, peak factor, phase, concept of phasor diagram, phase angle. Active, reactive & apparent power. Power factor. Analysis of R, L, C, series and parallel circuits, phasor diagram.

UNIT - 4 (12 Hours)

Three phase A.C Circuits : Representation of three phase system, concept of phase sequence & its significance. Balanced & unbalanced three phase supply system. Relationship between line and phase quantities for star & delta connections. Three phase power. Three phase power measurement.
Introduction to Single Phase Transformer: Working principle, construction, equivalent circuit, phasor diagram, voltage regulation, losses in transformer and their measurements using O.C. & S.C. test & efficiency.

Recommended Readings:

1. Vincent Del Tero; Principles of Electrical Engineeringby; PHI Publication.
2. Joseph Administer; Electrical Circuits; Schaum Series Publication.
3. Hayt, Kemmerly, Durbin ;Engineering Circuit Analysis; Tata McGraw Hill Publication.
4. G. D. Rai; Non conventional Energy Sources; Khanna Publications.
5. J B Gupta; Electrical power; Khanna Publication.
6. Rajendra Prasad; Fundamentals of Electrical Engineering; PHI Publication.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Ohm's law and its application
2. Verification of Kirchhoff's laws
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Verification of Superposition theorem
6. Verification of Maximum power transfer theorem
7. Study of single phase domestic wiring system

8. Brightness control of 2 bulbs using series and parallel connection
9. Measurement of power in single phase circuit
10. Open circuit and short circuit test on single phase transformer
11. Load test on single phase transformer.

FE 2.1 ENGINEERING MATHEMATICS-II

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
FE 2.1	Engineering Mathematics-II	4	--	--	3	100	25	--	--	--	**125**

Course Objectives:

Primary objective of this subject is to familiarize students with multiple integrals, vector calculus, solve ordinary differential equations.

Course Outcomes:

After successful completion of this course the student will

1. Evaluate double & triple integrals & learn its various Engineering applications.
2. Understand analytic properties of vector valued functions & the associated results used in engineering.
3. Solve first order differential equation & higher order linear differential equations.

UNIT - 1 (16 Hours)

Differentiation under the Integral Sign: Integral with its limit as constant and as a function of the parameter.

Curve Tracing and Rectification of Plane Curves: Tracing of Plane Curves in two dimensions, Polar and Parametric forms of Plane Curves such as Cardiod, Asteroid, Cycloid, Leminiscate etc., Rectification of Plane Curves in Polar, Cartesian and Parametric form, Vector Differentiation, Curves in space, Tangent, Normal and Binormal vectors, Torsion and Curvature, Serret- Frenet formulas.

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UNIT - 2 (16 Hours)

Multiple Integrals: Double Integration in Polar and Cartesian co-ordinates, change of order in Double Integration, application of Double Integration to computation of Centre of Gravity; Triple Integration in Cartesian , Spherical and Cylindrical co-ordinate systems, Geometrical interpretation of Triple Integration and applications to surface area and volume.

UNIT - 3 (16 Hours)

Vector Calculus: Scalar and Vector fields, Directional Derivatives, Divergence and Curl of Vector fields, Gradient of a Scalar field, Line Integrals and their applications, Greens theorem in a Plane, Surface and Volume Integrals, Divergence theorem and Stroke's theorem(both without proof) and their applications.

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UNIT - 4 (16 Hours)

Ordinary Differential Equations: First order and first degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous differential equations, Equations reducible to Homogeneous form, Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non- Exact Differential Equations; Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax}, sin ax, cos ax, e^{ax} f(x), x^n f(x) etc., Linear equations with variable coefficients such as Cauchy's Equation and Lagrange's Equation, D- operator and Inverse D- operators, method of Variation of Parameters.

Recommended Readings:

1. G. Shanker Rao; Engineering Mathematics Volume I; I.K. International Publishing House.
2. A textbook of Vector Calculus; Shanti Narayan; S. Chand Publishing.
3. Ch. V. Ramana Murthy and N. C. Srinivas; Applied Mathematics; S. Chand Publishing.
4. Dr. B. S. Grewal; Higher Engineering Mathematics; Khanna Publishers.
5. Erwin Kreysig; Advanced Engineering Mathematics; Wiley International Edition.
6. Thomas/Finney; Calculus and Analytic Geometry; Addison Wesley.

EE 3.1 APPLIED MATHEMATICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.1	Applied Mathematics	3	1	--	3	100	25	--	--	--	**125**

Course Objectives:

1. To equip students with adequate knowledge of mathematics that will enable them in formulating problems and solving problems analytically.
2. Study Laplace transform, Fourier series and Z transform and use them in Solving Engineering Problems..

Course Outcomes:

On completion of this course, the students will be able to formulate and solve problems analytically. They will be able to apply the mathematical concepts for engineering analysis

UNIT - 1 (12 Hours)

Matrices:

Types of matrices, Determinants, Adjoint & Inverse of a matrix, Elementary transformations and elementary matrices, Rank of a matrix, Reduction to normal and canonical form, Rank using elementary transformation, Linear dependence & Independence of vectors, System of equations of the form AX=0 & AX=B.

Eigen values & Eigen vectors, Cayley-Hamilton theorem, Diagonalisation of matrices, Minimal polynomials

UNIT - 2 (12 Hours)

Laplace Transforms:

Definition, existence conditions, Laplace exponential, trigonometric, algebraic, hyperbolic, Dirac delta and Heaviside functions. First and second shifting theorem, change of scale, Laplace transform of periodic function.

Laplace transform of derivatives & integral, Convolution of two function and its Laplace transform. Inverse Laplace transforms. Application of Laplace transform in solving linear differential equations, integral-differential equation and system of differential equations with initial conditions.

UNIT - 3 (12 Hours)

Fourier Series:

Periodic functions, set of orthogonal functions, Trigonometric series, Euler's formula, Dirichlet's condition, Fourier series, Half range series, Parseval's identity.

Fourier Transforms:

Fourier transform, Inverse Fourier transform, Fourier Sine and Cosine transform, convolution and application.

UNIT - 4 (12 Hours)

Partial Differential Equations:

Solution of partial differential equations: Solution by direct integration, Linear partial differential equation of first order. Derivation of equation governing transverse vibration of an elastic string (one dimension). Solution using Fourier series by variable separable method. Derivation of heat flow equation in one dimension and solution using variable separable method

Z-Transform:

Definition, region of convergence, properties, Z-transforms of impulse function, Convolution Theorem, Application to difference equations.

Recommended Readings:

1. Grewal B. S.; Higher Engineering Mathematics; Khanna Publications, New Delhi.
2. Veerarajan; Engineering Mathematics; Tata McGraw Hill Publications.
3. Erwin Kreyzing; Advanced Engineering Mathematic; New International Limited.
4. Kandasamy P.; Engineering Mathematics; Chand & Co., New Delhi.
5. Srimanta Pal, Subodh C. Bhunia; Engineering Mathematics; Oxford University Press
6. Dr. D. S. C; Engineering Mathematics- Part III ; Prism Books Pvt. Ltd.

EE 3.2 ELECTRONIC DEVICES AND CIRCUITS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.2	Electronic Devices and Circuits	3	1	2	3	100	25	--	25	--	**150**

Course Objectives:

1. To familiarize with basic construction and operation of various Electronic devices.
2. To study the analysis of BJT and FET configurations under different operating conditions.
3. Design /assemble/ and test Power supply circuit, Oscillator circuit Amplifier and Voltage Regulator circuits
4. To be familiar with the application of transistorized circuits

Course Outcomes:

On completion of this course, the students will have a thorough understanding of various electronic devices and its application circuits.

UNIT - 1 (12 Hours)

Electronic Devices: PN junction diode, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics. Design of Half wave and Full wave Rectifier circuits with Filter circuits**.**

Power Devices: Device Construction and VI characteristics of BJT, FET, Photo-transistor, Opto coupler and UJT, Transistor as a switch, Transistor as an amplifier, Darlington connection.

UNIT - 2 (12 Hours)

Transistor Configurations: Common base, Common Emitter, Common Collector, Common Drain and Common Source Configuration. Transistor biasing circuits types and design, AC and DC load line.

Transistor AC Equivalent Circuits: H-parameter model, r-e model, ac equivalent circuit of small signal BJT and FET amplifiers. Design of a single stage voltage amplifier using BJT and FET. Different types of coupling (RC, transformer and direct) and their frequency response. Lag-Lead networks.

UNIT - 3 (12 Hours)

Feedback Concept Negative Feedback: Negative Feedback Types (Voltage series, Voltage shunt, Current series and current shunt) and its effects. Positive Feedback: Barkhausen criteria, Concept of Damped and undamped oscillations.
Oscillators: Construction, operation and design of oscillator: RC: Wien Bridge, RC phase shift oscillator; LC: Tuned base, Tuned collector, Tuned Drain, Hartley, Colpitts, Clapp Crystal oscillators, UJT Relaxation Oscillator. Sweep Circuits: Miller Sweep circuit, Bootstrap circuit.

UNIT - 4 (12 Hours)

Voltage Regulators: Performance - Line and Load regulation: Voltage regulators: working principle and design of Zener diode regulator, BJT shunt and series regulator, IC Voltage regulators.
Power Amplifiers: Introduction, Classification, analysis and design of Power Amplifier (class A – Series fed and transformer coupled, class B - Push pull, complimentary symmetry), Clippers, Clampers and voltage multipliers.
Multivibrators: Operation, analysis and design of Bistable, Schmitt trigger, Monostable and Astable Multivibrator.

Recommended Readings:

1. Donald A Neaman; Semiconductor Physics and Devices; Third Edition, Tata Mc Graw Hill Inc.; 2007.
2. Robert Boylestad and Louis Nashelsky; Electron Devices and Circuit Theory; Pearson Prentice Hall; 10th edition; July 2008.
3. Khetan and Goyal; A Monograph of Electronic Design Principles; Khanna Publication.
4. S. Salivahanan; Electronic devices & circuits; Vikas Publication.
5. Y.N. Bapat; Electronic devices and circuits; Tata McGraw Hill.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Design of Half Wave Rectifier.
2. Design of Full Wave Rectifier.
3. Input-Output characteristics of transistor biasing circuits.
4. FET Characteristics.
5. RC coupled amplifier.
6. Class A, B power amplifier.
7. Design of a single stage RC phase shift oscillator.

8. UJT relaxation oscillator.
9. Bootstrap sweep circuit.
10. Zener diode Characteristics & Regulator using Zener diode.
11. Series, shunt and IC voltage regulators.
12. Wein bridge oscillators
13. Design and fabrication of any one circuit mentioned in the syllabus

EE 3.3 ELECTRICAL MACHINES - I

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.3	Electrical Machines – I	3	1	2	3	100	25	--	25	--	**150**

Course Objectives:

1. To introduce concepts of various types of Electrical machines, Mathematical analysis and understand application of electrical machines.
2. To study the working principles of DC machines as Generator, determination of their no load/load characteristics, testing, starting and analyzing methods of speed control of motors, performance characteristics
3. To impart Industry oriented learning

Course Outcomes:

On completion of this course, the students will know the working principle, performance characteristics, mathematical analysis, control and application of DC Generators and DC motors. They will have an ability to design and conduct experiments as well as identify, formulate and solve machine related problems.

UNIT – 1 (12 Hours)

Electromechanical Energy Conversion: Flow of Energy in Electromechanical Devices, Energy in magnetic systems- concepts of field energy, co-energy and mechanical force, Torque equation, singly and multiply excited systems, Energy stored in Magnetic field , Dynamic equation of Electromechanical systems. Elementary machines, generated emf in Machines, Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding, MMF waveform of commutator machines, torque in round rotor machines.

UNIT – 2 (12 Hours)

DC Generators: Construction features, emf equation of dc generator, methods of excitation, voltage build up process, critical resistance and speed, no load characteristics, load characteristics, losses, condition for maximum efficiency. Armature reaction, interpoles and compensating winding, commutation, methods of improving commutation, performance characteristics of separately excited and self-excited dc generator.

UNIT – 3 (12 Hours)

DC Motors: Type of motors, significance of the Back EMF, torque equation, losses and efficiency, Necessity of starter, Three point & four point starter. Introduction to soft starter. Torque-speed characteristics of shunt, series & compound motors, Speed control methods, Load Test (DC Shunt, Series - Compound Motors). Application of DC motors.

UNIT – 4 (12 Hours)

Armature Windings: AC windings - single layer, double layer, DC windings, symmetry requirement, Equalizer rings.
Testing and Maintenance of DC Machines: Swinburne's Test, Hopkinson test, Brake test, Testing of DC machines as per IS, Causes of Sparking in Commutators , Defects in Commutator and Remedies , Resurfacing of Commutators and Brushes, Function & Requirements - Brush Holder , Brush Pressure , Defects in DC Armature Winding – Growler. General guidelines of DC machine maintenance.

Recommended Readings:

1) I.J. Nagrath & D.P.Kothari; Electrical Machines; Tata McGraw Hill
2) P.S.Bimbhra; Electrical Machinery; Khanna Publisher
3) J.B.Gupta; Theory & Performance of Electrical Machines; Kataria & Sons
4) Clayton & Hancock; Performance & Design of DC machines; ELBS publishers
5) P.S. Bimbhra; Generalized Theory of Electrical Machines; Khanna Publishers
6) A.E. Fitzgerald, C.Kingsley Jr and Umans; Electric Machinery; McGraw Hill, International Student Edition

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. OCC of separately excited DC generator.
2. Performance characteristics of DC machine
3. Speed Control of DC motors
4. Swinburne's Test
5. Hopkinson's test
6. Load test on DC series motor
7. To obtain Magnetizing Characteristics, Internal & External Characteristic of Self Excited DC Shunt Generator
8. To determine the various losses in a D.C. machine and separation of its core losses
9. To obtain Speed-Torque characteristics of DC Series Motor and DC Shunt Motor
10. To perform direct load test on a D.C. shunt motor and plot variation of (a) Input current (b) Speed(c) Torque (d) Efficiency versus output power.

EE 3.4 ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.4	Electrical Measurements and Measuring Instruments	3	1	2	3	100	25	25	--	--	**150**

Course Objectives:

1. To introduce classification of various instruments used in measuring electrical Quantity.
2. To measure the quantities with accuracy & precision.
3. To calibrate an instrument with minimized error.
4. To introduce the method of measuring non electrical Quantity.

Course Outcomes:

On completion of this course, the students will gain knowledge of the working principle various instruments used for electrical measurements. They will be able to practically use the instruments for measurements.

UNIT - 1 (12 Hours)

Introduction to Measurement and Instruments:

Methods of Measurement, terms related to measurements, errors, Broad classification of Instruments, Classifiction of Analog Instruments, principle of operation. Operating forces, Control system and damping system in the instruments.

Principle, Construction and working of PMMC, Moving Iron and Electrodynamometer Instruments

Galvanometers: DC permanent magnet moving coil type, current and voltage sensitivity. Ballistic Galvanometer and Flux meter, AC vibration Galvanometer of moving coil and moving magnet type

UNIT - 2 (12 Hours)

Measurement of Resistance, Inductance and Capacitance:

Measurement of resistance: Measurement of low, medium and high resistance, Wheatstone and Kelvin's bridge methods, ammeter -voltmeter method, Mega ohm bridge, Megger**,** Earth tester.

AC Bridge Methods: Principles of AC bridge circuits for measurements of inductance and capacitance, dielectric loss angle and Q-factor.

Potentiometers: Principles of DC Potentiometer, Slide wire type potentiometer, Crompton's potentiometer, and applications. AC Drysdale potentiometer – construction and operation.

UNIT - 3 (12 Hours)

Measurement of Power and Energy:

Current and potential transformers – Principle of operation, construction, Ratio and Phase angle errors, applications. Testing of CT's and PT's.

Measurement of Power: Electrodynamometer Wattmeter – construction and operation, three phase wattmeter, measurement of power using instrument transformer, measurement of reactive power.

Measurement of Energy: Induction type energy meters - Construction, theory and operation. Testing of energy meters. Polyphase ergy meter.

UNIT - 4 (12 Hours)

Measurements of other Electrical Quantities and Magnetic Measurements:

Construction and operation of power factor meter, frequency meters and Synchro-scopes**.** Principles of LVDT and RVDT

Transducers: classification of transducers, measurement of temperature, torque and pressure.

Magnetic Measurements: DC Hysteresis loop and BH curve determination, AC magnetization curve, AC power loss measurements in sheet steel by wattmeter method.

Recommended Readings:

1. A K Sawhney; Electrical Measurements and Measuring instruments; Dhanpat Rai & Sons.
2. Rajendra Prasad; Electrical Measurements and Measuring instruments; Khanna Publication
3. Baldwin; Fundamentals of Electrical measurements; Kalyani Publisher
4. Stou; Basic Electrical Measurements; PHI
5. Golding and Widdis; Electrical Measurements and Measuring instruments; English language Book society.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments. The Term Work Marks to be awarded based on the assessment of the experiments conducted.)

1. Measurements of reactive power & active power in 3 phase circuit by using one wattmeter method
2. Measurement of active power in a 3 phase circuit by using two wattmeters
3. Measurement of low resistance by kelvin's double bridge method
4. Measurement of medium resistance by Wheatstone bridge method
5. Extension of range of wattmeter using CT & PT
6. Measurement of energy consumed & energy recorded by using single phase & three phase energy meter
7. Measurement of insulation resistance of motor winding using megger
8. Extension of range of single phase energy meter & three phase energy meter by using CT & PT
9. Measurement of inductance of circuit by using Maxwell's inductance bridge
10. Measurement of capacitance by using Schering bridge
11. Measurement of ratio & phase angle error in CT
12. Measurement of ratio & phase angle error in PT

EE 3.6 ANALOG AND DIGITAL COMMUNICATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.6	Analog and Digital Communication	3	--	2	3	100	25	--	--	25	**150**

Course Objectives:

This course will develop Communication Engineering basic theory and methods with the following objectives:

1. Present an introduction to information representation and processing.
2. To introduce students to the fundamentals of communication engineering by familiarizing students with the basics of classical communication systems.
3. Introduction to hardware and software communication devices.
4. Introduction to modern communication systems.

Course Outcomes:

On completion of this course, the students will have indepth knowledge of the fundamentals of communication engineering. They will understand the classical and modern communication systems.

UNIT - 1 (12 Hours)

Modulation: Need for modulation, Basic principles of amplitude modulation (AM), frequency spectrum of AM wave, Power and current relationships in AM, generation of AM wave using collector/emitter modulation, Detection of AM using Diode/Envelope detector.
SSB techniques: Suppression of carrier using FET, Suppression of sideband using Phase shift method/Third Method.
Basic theory of frequency Modulation and phase modulation, spectrum of FM, Generation and detection of FM. Comparison between AM, FM and PM.

UNIT - 2 (12 Hours)

Sampling Theory: Sampling theorem, recovery of signal from samples. Basic principles of PAM, PWM and PPM, their generation and detection circuits.
Quantization, Quantization noise & companding principles of PCM transmission & Reception, Delta modulation and Adaptive delta modulation. (4 Hours)
Digital Modulation techniques: ASK, FSK and PSK. Modulator/demodulator circuits of BPSK, QPSK and DPSK.

UNIT - 3 (12 Hours)

Data Communication: Components, basic concepts – line configuration point to point, multipoint Topologies - Mesh, star, tree, Bus, Ring, hybrid. Line Encoding and error detection and correction (LRC/CRC, Hamming and CRC codes).
Fiber Optic Communication: Types of fibre such as step and graded index, Principle of Optical Transmission, Optical sources (LED's and ILD's only) optical detectors (PIN diode and APD) Applications in Telecommunication.
Satellite Communication: Synchronous orbit, geostationary orbit, Satellite Subsystem (block diagram) Earth station (Block diagram), Telemetry tracking and command.

UNIT - 4 (12 Hours)

Wireless Transmission: Antennas, Signal Propagation, Multiplexing, Cellular Systems.
Telecommunication System: GSM, mobile services, system Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, HSCSD & GPRS.
Wireless LAN: Advantages & disadvantages of WLAN, Infrared vs. radio transmission, Infrastructure and ad hoc networks, IEEE 802.11 - System architecture, Protocol Architecture.
Bluetooth: User scenarios, Physical layers, MAC layer, Networking, Security & link Management.

Recommended Readings:

1. George kennedy; Electronic communication System; Tata McGraw Hill
2. ThyagrajanVishwanathan; Telecommunication Switching Systems and Networks; PHI
3. W Tomasi; Electronics Communication Systems;PHI
4. Forouzan; Data communication & Networking;Tata McGraw Hill
5. D C Agarwal; Satellite Communication; Khanna Publishers
6. Keiser;Optical fiber communication; McGraw Hill
7. Jochen Schiller; Mobile Communication; Education Asia.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)
1. AM transmitter and receiver
2. FM transmitter and receiver
3. PM transmitter and receiver
4. PAM, PWM and PPM transmitter and receiver
5. Delta modulation and Adaptive delta modulation
6. ASK, FSK and PSK. Modulator/demodulator
7. Satellite Subsystem trainers
8. Antenna radiation patterns
9. WLAN demonstration
10. Bluetooth demonstration

EE 4.5 ELECTRICAL CIRCUIT ANALYSIS AND SYNTHESIS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.5	Electrical Circuit Analysis and Synthesis	3	1	--	3	100	25	--	--	--	**125**

Course Objectives:

To understand the concept of various circuit elements ,their interpretation from physical and circuital viewpoint concept of physical system as circuit

1. To study the basic laws governing the circuit theory different methods of analysis choice of selection of method.
2. To study various theorems applied in circuit theory, practical application of these theorems in electrical system
3. To study the basis for computer method of analysis

Course Outcomes:

On completion of this course, the students will be able to interpret various circuit elements in circuital viewpoint. They will know the basic laws governing the circuit theory. They will understand the various theorems related to circuit theory.

UNIT – 1 (12 Hours)

Circuit Concepts: Development of circuit concept, circuit elements R L C their circuital and field interpretation, approximation of a physical system as circuit ,linear and nonlinear, lateral and bilateral ,time variant and time invariant networks.

Network equations, reference directions for current and voltage; dependent and independent current and voltage source; coupled coils; dot convention for coupled coils, Kirchhoff's laws, loop basis and nodal basis of analysis of networks; concept of super node and super mesh, factors governing the choice of method of analysis; source transformations, formulation of network equations. Concept of Network Graph, Terminology used. Incidence matrix, tie-set matrix, cut set matrix, KCL, KVL using N/W topology. Network equilibrium equations, Principle of duality.

UNIT – 2 (12 Hours)

Thevenin's, Norton's, Maximum Power transfer, reciprocity and Millman's theorem for A.C circuits involving all types of sources and network connections.

Laplace Transforms: Introduction to Laplace Transform, Application of Laplace Transform in circuit analysis, Step, Impulse response of series RL,RC,RLC circuit using Laplace Transform method .

Complete response of a network; causes of transients, initial conditions in circuit elements calculation of initial conditions.

Steady state and transient response. Response of series RL, RC, RLC with DC excitation, Solution of network differential equation using classical method

UNIT – 3 (12 Hours)

Resonance: Series resonance, parallel resonance, Analysis of series and parallel resonance circuits for Selectivity Bandwidth and Quality factor.

Network elements, Classification of network functions. Driving Point and Transfer functions of two port networks, Network parameters Z, Y, ABCD, Hybrid parameters of two port network. Interconnection of two port networks. Inter relation between various parameters

UNIT – 4 (12 Hours)

Network Realization and Synthesis. Concept of Poles and zeros in a network function, Introduction to network stability of a system from pole-zero plot, Concept of Hurwitz polynomials, and positive real functions. Strum's theorem, Introduction to network Synthesis LC, RL and RC network synthesis using Foster and Cauer forms.

Introduction to state-space representation of networks and their analysis. Concept of filtering, filter types and characteristics. Introduction to passive filters, design of first and second order passive filters.

Recommended Readings:

1. A.Chakrabarthi; Circuit Theory (Analysis and Synthesis); Dhanpat Rai & sons
2. M.E Van Valkenburg; Network Analysis; PHI publications
3. CL Wadhwa; Network Analysis and synthesis; New age publishers
4. G K Mithal; Network Analysis and synthesis; Khanna Publishers
5. F.M.Reza & S.Seely; Modern Network Analysis; Hohn Wiley& sons
6. F F Kuo; Network Analysis and synthesis; John Wiley & sons
7. M E Van Valkenberg; Introduction to Modern Network Synthesis; John Wiley

EE 4.1 NUMERICAL TECHNIQUES AND PROBABILITY

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.1	Numerical Techniques and Probability	3	1	2	3	100	25	--	--	--	**125**

Course Objectives:

1. Enable to solve Problems based on different methods
2. Study computer programming to solve differential equation problems using various methods
3. To understand the solutions of linear algebraic equations

Course Outcomes:

On completion of this course, the students will be able to solve different Engineering problems using Numerical Techniques. They will be able to solve linear algebraic and differential equations.

UNIT - 1 (12 Hours)

Finite Difference and Interpolation:

Operators: Forward Difference operator-Δ, backward difference operator-∇, Taylor's operator-D, shift operator-E, averaging operator –μ, Central Difference operator-δ

Differences: Forward and backward difference, Central differences, Divided differences, Difference tables, Interpolating polynomials, factorial polynomials , Newton Forward & Backward difference interpolation formula. Newton's Divided difference interpolation formulae: Lagrange's interpolation formula: Derivation, Problem Solving, Algorithm and computer programming.

Central Difference interpolation formula: Stirling's and Bessel's interpolation formula

UNIT - 2 (12 Hours)

Solutions of Equations:

Solutions of non-linear equations of single variables using Bisection method, Regula-Falsi method, Secant method and Newton- Raphson method (Problem Solving, Algorithm and computer programming). Order of convergence of these methods, comparison of these methods.

Solution of Linear Algebraic Equations:
Direct methods: Gauss Elimination method, Partial & Complete pivoting, Gauss- Jordan method. Iterative methods: Jacobi's method, Gauss-Siedel method.
Condition for convergence of above methods, Ill conditioned & well-conditioned systems.

UNIT - 3 (12 Hours)

Numerical Integration:
Newton-Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule, Romberg's integration Richardson extrapolation), Truncation errors for these rules, Problem Solving, Algorithm and computer programming.
Numerical Solution of Differential Equations:
Picard's method & Taylor series method, Euler's method & Modified Euler's method, Second order Runge- Kutta method, Fourth order Runge- Kutta method (Problem Solving, Algorithm and computer programming), Milne's Predictor-Corrector method.

UNIT - 4 (12 Hours)

Probability:
Definition, properties ,Axioms of probability, conditional probability, theorem on total probability, Baye's theorem; Random variables-discrete & continuous; Expectation, Variance, Standard deviation, Moment Generating Function & properties, Standard distributions: discrete-Binomial, Geometric & Poisson; continuous- Uniform, Normal, exponential, Gamma, Weibull

Recommended Readings:

1. B. S. Grewal ;Numerical Methods; Khanna Publications.
2. Douglas C. Montgomery, George C. Runger; Applies Statistics & Probability for Engineers; Wiley
3. P. Kandasamy ; Numerical Methods ; S. Chand & Co., New Delhi.
4. E. Balagurusamy ; Numerical Methods ; Tata McGraw, PHI.
5. Srimanta Pal, Subodh C. Bhunia; Engineering Mathematics; Oxford University Press

List of Experimrnts:
(At least 8 experiments should be conducted from the list of experiments.)

1. Newton's forward difference interpolation formula
2. Newton's backward difference interpolation formula
3. Lagrange's interpolation formula
4. Newton's divided difference interpolation formula

5. Solution of non-linear equations using bisection method
6. Solution of non-linear equations using Regula-Falsi method
7. Solution of non-linear equations using Newton Raphson method
8. Solution of non-linear equations using Secant method
9. Solution of linear system of equations using Gauss- Elimination method
10. Solution of linear system of equations using Gauss Jordan method
11. Solution of linear system of equations using Gauss Jacobi's method
12. Solution of linear system of equations using Gauss Seidal method
13. Solution of differential equations using Euler's method
14. Solution of differential equations using Modified Euler's method
15. Solution of differential equations using Runge-Kutta second order method
16. Solution of differential equations using Runge-Kutta fourth order method
17. Numerical integration using Trapezoidal rule
18. Numerical integration using Simpson's 1/3 rule
19. Numerical integration using Simpson's 3/8 rule
20. Numerical integration using Weddle's rule

EE 4.2 ELECTRICAL MACHINES - II

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.2	Electrical Machines - II	3	1	2	3	100	25	--	25	--	**150**

Course Objectives:

1. To Introduce concepts of various types of Electrical machines, Mathematical analysis and understand application of electrical machines.
2. To study the working principles of Induction machines as Generator and motor, determination of their no load/load characteristics, testing, starting and analyzing methods of speed control of motors, performance characteristics
3. To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the Transformers
4. To impart Industry oriented learning.

Course Outcomes:

On completion of this course, the students will be knowing the working principle, performance characteristics, mathematical analysis, control and application of Transformers and Induction machines. They will have an ability to design and conduct experiments as well as identify, formulate and solve machine related problems.

UNIT – 1 (12 Hours)

Single Phase Transformers:

Constructional details of a single phase transformer, core, winding, insulation and cooling methods; circuit model of a practical transformer incorporating an ideal transformer. Analysis of a practical single phase transformer, exact and approximate equivalent circuits, phasor diagram, and relation between referred variables and parameters, per unit system of representation.

Open circuit and short circuit tests, polarity test, Sumpners test, Percentage regulation of a single phase transformer, per unit representation, Efficiency of a single phase transformer, maximum efficiency, all day efficiency.

UNIT – 2 (12 Hours)

Three Phase Transformers:
Three phase transformer as a single unit; constructional features, three limb,five limb, core type and shell type constructions; comparison with bank of three single phase transformers. Three phase transformer connections (star, delta etc), polarity and terminal convention, vector groups, per phase equivalent circuit based analysis.
Tap changing in transformer. Parallel operation of single and three phase transformers, conditions and connection diagrams, per phase equivalent circuit based analysis with equal and unequal no load voltages, load sharing. Single and three phase autotransformers, advantages, equivalent circuit and phasor diagram.
Transformer tank & Readiator, Conservator, Breather and Bucholtz Relay

UNIT – 3 (12 Hours)

Three Phase Induction Machines:
Concept of Rotating magnetic field, principle of operation, construction, Types: Squirrel cage and slip ring, No load and blocked rotor tests, Equivalent Circuit, losses and efficiency, slip torque equations, torque slip characteristics covering motoring, generating and braking regions, Phasor diagrams for different conditions, starting methods, and speed control methods. Circle diagram and performance evaluation of motor, Testing of Three phase Induction Machines.

UNIT – 4 (12 Hours)

Induction Generator:
Externally Excited, Self-Excited, Voltage build up, Application of Induction Generators in Wind mills.
Single Phase Induction Machines:
Constructional aspects, rotating field theory, performance analysis and circuit model for single winding machines, split phase motors- resistance, capacitance split phase motors, capacitor start and two value capacitor motors, shaded pole motors, comparison of single phase and three phase motors.
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Recommended Readings:

1. I.J. Nagrath & D.P.Kothari; Electrical Machines; Tata McGraw Hill
2. P.S.Bimbhra; Electrical Machinery; Khanna Publisher.
3. J.B.Gupta; Theory & Performance of Electrical Machines; Kataria & Sons
4. MG Say; Theory, Performance & Design of A.C. Machines; CBS Publishers.
5. Langsdorf A S, Theory of A C Machinery, Tata McGraw Hill
6. A.E. Fitggerald, C.Kingsley Jr and Umans; Electric Machinery; McGraw Hill, International Student Edition

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. OC and SC test on single phase transformer
2. Load test on single phase transformer
3. Sumpner's Test
4. Parallel operation of Single phase transformers
5. Vector groups in three phase transformer
6. No load and Blocked rotor Test on Three Phase Induction Machine.
7. Performance characteristics of Induction machine.
8. Speed Control of Induction motors.
9. Direct load test on three phase Induction Motor.
10. No Load and blocked rotor test on single phase Induction motor.

EE 4.3 LINEAR INTEGRATED CIRCUITS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.3	Linear Integrated Circuits	3	1	2	3	100	25	--	25	--	**150**

Course Objectives:

1. Introduce the basic building blocks of linear integrated circuits.
2. To learn the linear and non-linear applications of operational amplifiers.
3. Design of Filter, Oscillators, Clipper and Clamper circuits.
4. To be familiar with the operation of ADC and DAC, and
5. Introduce the working of a few special function integrated circuits.

Course Outcomes:

On completion of this course, the students will have a thorough understanding of operational amplifiers with linear integrated circuits. Also students will be able to design circuits using operational amplifiers for various applications.

UNIT – 1 (12 Hours)

Differential Amplifier:
Differential Amplifier: Configurations (Single input unbalanced output, Single input balanced output, Dual input unbalanced output, Dual input balanced output), D.C and A.C Analysis. Constant current bias, Current Mirror, Level translator.

Operational Amplifier:
Block diagram Representation of a Typical op amp; op amp characteristics:-Input Offset Voltage, Input Offset Current, Input Bias current, CMRR,SVRR, Input and output resistance. Op-amp with single power supply, Specifications of OP-AMP 741. Frequency compensation, stability, offset control, slew rate, inverting and non-inverting amplifier

UNIT – 2 (12 Hours)

Operational Amplifier Applications:
Linear Applications:- Amplifier circuit, Summing and Subtracting amplifier, Differentiator, Integrator, Instrumentation amplifier, V-I and I-V converters, voltage follower and inverter.

Non Linear Application: Log, antilog op amp, multiplier and divider circuits, Charge amplifiers, Peak detectors, Precision rectifiers, Sample and hold Circuits, Gyrators.
Comparators & Converters: Basic comparator & its characteristics types and applications: Zero crossing detector, Schmitt trigger, v/f & f/v converters, window detectors, clippers & clampers, phase detector.

UNIT – 3 (12 Hours)

Digital To analog converter: weighted resistor network, binary ladder circuit, Analog to Digital conversion methods. Simultaneous conversion successive approximation types of ADC.
Filters: Active filters, first order low pass & high pass Butterworth filter, Second order high pass butter worth filter, band pass & band reject filters, all pass filter, Notch filter design.
Oscillators: Principle of operation. Design of phase shift and Wien bridge oscillator. Wave generation and shaping using linear IC's: Square wave, triangular wave and saw tooth wave generator.

UNIT – 4 (12 Hours)

Multivibrators: Astable and Monostable Multivibrators using 555 Timer and its applications. Voltage Controlled Oscillator operation and its applications.
Phased Locked Loop: Operating principle, block diagram, applications of LM565.
Voltage regulator, adjustable voltage regulator, switching regulators. Functional block diagram and applications of IC 723 as high and low voltage regulator
.

Recommended Readings:

1. Ramakant Gayakwad ; Operational amplifier and Linear Integrated Circuits; Pearson
2. K R Botkar; Integrated Circuits; Khanna Publishers
3. B S Sonde; Introduction to system Design using Integrated Circuits; Wiley Eastern ltd.
4. J.Michael Jacob; Applications and Design with Analog Integrated Circuits; PHI
5. Jerald Graeme and Gene Tobey; Operation Amplifier-Design and Application; McGraw Hill
6. Coughlin, Driscoll; Operational Amplifiers and Linear Integrated Circuits; PHI

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)
1. Operational Amplifiers (IC741)-D.C and A.C Characteristics.
2. Opamp linear Application: Summing, Averaging
3. Opamp as differentiator and Integrator
4. Design of Active filters: Low and High pass Filter

5. Waveform generation using IC741: Square wave and Triangular wave, Sawtooth wave.
6. Clipper and Clamper design using IC741
7. Study and application of PLL IC's
8. Design of Clippers and Clampers circuit using IC 741
9. Design of Schmitt Trigger and Zero crossing Detector
10. Op-Amp voltage Regulator- IC 723
11. Instrumentation Amplifier
12. PSPICE/PSIM simulation Experiments

EE 4.4 DIGITAL INTEGRATED CIRCUITS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.4	Digital Integrated Circuits	4	--	2	3	100	25	25	--	--	**150**

Course Objectives:

At the end of this course students will be able to attain the following skills pertaining to the competency "Maintain different types of Digital Electronic Circuits"

1. Interpret specifications of digital IC's, analyze given circuit, connect the circuit and test it for proper functionality by selecting proper test and measuring instruments.
2. Design / assemble / modify a digital circuit for different applications.
3. Follow correct test procedures and safety measures.
4. Diagnose and correct the faults / bugs in given / assembled / modified digital circuits

Course Outcomes:

On completion of this course, the students will have a thorough understanding of the Digital integrated circuits. Also students will be able to design circuits using logic gates. They will be able to diagnose and correct the faults in digital circuits

UNIT – 1 (16 Hours)

Introduction to Digital Systems: Binary, Octal, Decimal, Hexadecimal systems and conversion between systems.
Codes: Excess 3 code, Gray code, ASCII code, Error detection and correction codes. Compliments, Representation of signed numbers, Binary arithmetic – addition, subtraction (1's and 2's compliment), multiplication and division. Fixed and floating point numbers, BCD numbers and BCD arithmetic.
Logic Families: Direct Coupled Transistor Logic(DCTL), Resistor Transistor Logic(RTL), Resistor-Capacitor Transistor Logic(RCTL), Diode Transistor Logic(DTL), Emitter Coupled Logic(ECL), Transistor logic (TTL), Complimentary MOS (CMOS) and advantages and disadvantages of each type. TTL gates, TTL NAND and NOR gates, Active pull up TTL gate, open collector TTL, wired AND TTL, Schottky clamped TTL, High speed TTL, Low power TTL ,Tri state TTL.

Basic logic operations and Theorems: (AND, OR, NOT, NAND, NOR, XOR, XNOR)- truth tables, symbols and logic expressions. De Morgan's theorems, Fundamental theorems of Boolean algebra.

UNIT – 2 (16 Hours)

Simplification of Boolean Functions: Canonical and standard forms, minterm and maxterm representation, SOP and POS forms, Karnaugh Map representation(2,3 and 4 variable), simplification of logic functions using K-Maps, don't care conditions, NAND and NOR implementation of logic functions, plotting K-map using Quine-Mc Clusky tabular method.

Combinational Logic Design: Design of Half/Full adder, Half/full subtractor, binary parallel adder, look ahead carry generator, Two's complement circuit, BCD adder / subtractor, Magnitude comparator, parity generator/checker. Code converters: Binary to Gray, Gray to Binary, combined Binary to Gray- Gray to Binary converter, Excess-3 to BCD converter, BCD to Excess 3 converter

UNIT – 3 (16 Hours)

Encoders: Priority encoder, decimal to BCD encoder, Octal to Binary encoder.

Decoders: 2 to 4 decoder, 3 to 8 decoder. Design of BCD to decimal decoder with or without false data rejection, BCD to seven segment decoder.

Multiplexers and demultiplexers: Internal logic diagram of multiplexer and demultiplexer, Combinational logic design using multiplexer, demultiplexer and decoder.

PLA and PAL: Block diagram, logic diagram, PLA program table and PLA implementation of logic function. Differences between PALs and PLAs.

Sequential Logic circuits: Flip Flops: RS (NAND and NOR latch, clocked), D, T, JK flip flops: their schematic symbols, logic diagram, truth table, excitation table, characteristic equation. Triggering of Flip Flops, Master-Slave configuration. Detailed timing issues of flip-flop setup time, clock slew, hold time

UNIT – 4 (16 Hours)

Memory: Memory organization, Operation, characteristics and addressing, Types of memories: ROM, PROM, EPROM, EEPROM, RAM-SRAM, Flash Memory. Dram operation modes- Single bit read, page mode read, Extended data out mode, Burst read, serial mode read, DRAM refresh operation modes- ROR refresh, CBR refresh, self refresh. ROM: Logic construction of 32x4 ROM, ROM implementation of logic function.

Counters: Synchronous and asynchronous counters, Binary counter, Binary up-down counter, binary ripple counter, mod 3 counter, mod 5 counter, decade counter.

Shift Registers: SISO, SIPO, PISO, PIPO, bi-directional shift register, universal shift register, ring counter.

Sequential Logic Design: State diagram, state table, state assignment, state minimization methods, design of counters using state table (with RS, JK, T flip-flops).

Recommended Readings:

1. M. Morris Mano; Digital Logic and Computer Design; PHI
2. Donald P. Leach/ Albert Paul Malvino; Digital principles and Applications, Tata McGraw Hill.
3. Robert L Morris / John R. Miller; Designing with TTL integrated Circuits; McGraw Hill international
4. Sung Mo Kang; CMOS Digital Integrated circuits Analysis and Design; Tata McGraw Hill.
5. William Fletcher; An Engineering approach to digital design, Prentice Hall of India
6. Taub and Schilling; Digital Integrated Electronics; McGraw Hill International

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments. The Term Work Marks to be awarded based on the assessment of the experiments conducted)

1. Verification of De-Morgan's Theorems.
2. Logic Gates.
3. Design and Verification of Adder Circuits.
4. Design and Verification of Subtractor Circuits.
5. Design and Verification of 2's Complement Converter.
6. Design and Verification of Parity Generator and Checkers.
7. Design and Verification of Code Converters.
8. Verification of Encoders.
9. Verification of Seven Segment Decoder.
10. Design and Verification of 4digit Multiplexed seven segment display
11. Study of Multiplexers & Demultiplexers.
12. Design using Multiplexer
13. Design using Decoder
14. Verification of Flip-Flops.
15. Verification of Binary Ripple Counter.
16. Verification of Shift Registers.

EE 3.5 ECONOMICS AND MANAGEMENT

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 3.5	Economics and Management	3	-	-	3	100	25	--	--	--	**125**

Course Objectives:

1. To familiarize with the elementary principles of Economics.
2. To acquaint the students with standard concepts that they are likely to find useful in their profession when employed.
3. To study the organization structure.
4. To understand the principles of management.

Course Outcomes:

The student after undergoing this course will be able to:

1. Understand the basic principles of Economics.
2. Understand the concepts of capital budgeting & project evaluation.
3. Know the basic organization structure.
4. Understand the management concepts such as planning, organizing, staffing, leading and control.

UNIT - 1 (12 Hours)

Demand and Supply Analysis:
Main determinants, Demand and supply schedule, derivation of demand and supply curve, Law of demand and law of supply, Total Revenue and Marginal revenue, Market Equilibrium**.**
Price, Income and Cross elasticity, Applications of elasticity, Demand forecasting**.**
National Income Terms:
GDP, Real vs. Nominal GDP, NNP, GNP, Per Capita Income, Disposable income**.**

UNIT - 2 (12 Hours)

Price Index:
Construction of price index, Consumer, Wholesale and Labour Price index,
Inflation:
Causes, Theories, Measures to control inflation.

Break-even Analysis:

Break-even chart, Contribution margin, Break even volume, Break even revenue.

Capital Budgeting:

Importance and need, Steps in preparing a capital budget. Different approaches to drawing up a capital budget, Different methods of evaluation of projects – Payback period, Accounting rate of return, Net Present Value Index, Internal Rate of return.

Working Capital Management: Determinants of working capital, financing of working capital, dangers of excessive and shortage of working capital.

UNIT - 3 (12 Hours)

Science of Management:
Definition, Different schools of management; Scientific management, Modern Operational Management, Behavioral Management, Main functions of a manager**.**
Planning :
Importance of managerial planning, Types of plans. MBO , merits and demerits of MBO, span of management
Organisation:
Purpose, Structure of organisation, Types of organisation structures, Delegation and Decentralisation, Advantages, Limitations**.**

UNIT - 4 (12 Hours)

Motivation:
Theories of motivation :Maslow's theory of needs, Herzberg's theory, Vroom's Expectancy theory
Leadership:
Different styles, Theories of leadership
Communication:
Nature of communication, Basic communication process, Formal and informal Communication, Barriers in communication, Guidelines for improved communication, Principles of effective communication**.**
Controlling :
basic control process, types of control, requirements for effective control**..**

Recommended Readings:

1. Varshney and Maheshwari; Managerial Economics; Sultan Chand & Sons
2. Harold Koontz and Heinz Weihrich; Essentials of management ; Tata McGraw Hill
3. Tripathi and Reddy; Principles of management ; Tata McGraw Hill
4. Petersen and Lewis; Managerial Economics; PHI
5. Samuelson and Nordhaus; Economics; Tata McGraw Hill
6. James Stoner, Management; Edward Freeman and Daniel Gilbert;PHI

EE 4.6 ELECTRICAL POWER

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	P	O	Total
EE 4.6	Electrical Power	4	--	--	3	100	25	--	--	25	**150**

Course Objectives:

1. To understand the conventional and non-conventional sources of energy and economic aspects of the same.
2. To study the basic network and mechanical design of Electric Power System for Transmission.
3. To study the requirements of Distribution System
4. To understand the Utilisation of Electrical Power with special emphasis on Lighting schemes, Electric Heating and Electric Traction.

Course Outcomes:

On completion of this course, the students will gain knowledge of the Power generation, transmission, distribution and utilization systems. They will be able to apply the economic aspects of the power system**.**

UNIT – 1 (16 Hours)

Generation: Introduction to Thermal, Hydel, Nuclear and Gas power plants, choice of sites for power plants, cogeneration system, introduction to distributed generation systems.

Economic Aspects: Capital cost, annual fixed and operating costs of plants, depreciation, diversity factor, load factor, plant capacity factor, plant utilization factor, load curves.

Tariffs: Need , types, interconnection of power stations.

UNIT – 2 (16 Hours)

Transmission: Basic network of electric power system, Transmission line constants, Resistance, Inductance and Capacitance of single phase and three phase transmission lines, effect of earth, line transposition, steady state analysis of short, medium and long

transmission lines, ABCD constants, calculation of regulation and efficiency, sending end/receiving end circle diagrams.

Mechanical Design: Transmission line conductors, line supports, insulators, voltage distribution in insulator string, grading, string efficiency. Sag and tension calculations. Stringing charts and sag templates, conductor erection and stringing

UNIT – 3 (16 Hours)

Distribution: Feeders and distributors, criterion for selection of cross section of conductors in distributors and feeders, different types of DC and AC distribution systems, voltage drop calculation, Kelvin's law. Constructional features of LT and HT cables, dielectric stress and grading, thermal characteristics.

Substation: Layout, line diagrams, bus bar arrangement, current limiting reactors.

Grounding Systems: Neutral and equipment earthing, lightning and its effects.

UNIT – 4 (16 Hours)

Utilisation:

Illumination: Introduction to lighting schemes, types of lamps, efficiency, principles of lighting calculations, design of indoor and outdoor lighting schemes.

Electric Heating: Different methods Resistance, Induction and Dielectric. Operation of Arc furnace and induction furnace. Electric welding.

Electric Traction: Systems of electric traction, power supply system for track electrification, comparison and application of different systems, traction methods. .

Recommended Readings:

1. Dr. S.L.Uppal; Electrical Power; Khanna Publications
2. V.K.Mehta, Rohit Mehta; Principles of Power System; S.Chand & Company Ltd.
3. B.R.Gupta; Course in Electrical Power:; Kataria & Sons
4. C.L.Wadhwa; Electrical power systems; New Age International Ltd.
5. H Partab; Art and Science of Utilisation of Electrical Energy; Dhanpat Rai and Sons
6. H Cotton; Transmission and Distribution of Electric Energy; B.I Publishers