SCHEME OF INSTRUCTION AND EVALUATION
I SEMESTER OF II YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course No.	Course	Hours of instructions per week			Scheme of evaluation			Total marks
		Lectures	Tutorials	Drawing / Practicals	External Evaluation		Sessionals	
					Duration of Exam.	Max Marks	Max Marks	
MH 211	Mathematics-II	3	1		3 Hrs	100	50	150
EE 212	Network Theory	3	1		3 Hrs	100	50	150
EE 213	Basic Electrical Engineering	3	1		3 Hrs	100	50	150
EE 214	Electrical Engineering Materials	3	1		3 Hrs	100	50	150
EI 215	Electronic Devices and circuits-I	3	1		3 Hrs	100	50	150
CE 218	Fluid Mechanics & Hydraulic Machines	3	1		3 Hrs	100	50	150
EE 215	Basic Electrical Engineering Lab	-		3	3 Hrs	50	25	75
EE 217	Networks Laboratory	-		3	3 Hrs	50	25	75
	Total	**18**	**6**	**6**				**1050**

MH-211 MATHEMATICS-II

Class: **II/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorial:***1**
Branch: **Mech, Civil, E&I, EEE,CSE,IT,ECE** *University Examination:***100** marks
Duration of University Examination: **3 hours** *Sessionals:***50 marks**

UNIT - I

1. **Complex Integration:** Line integration in complex plane, Cauchy's integral Theorem, Cauchy's integral formula. Series expansion of complex functions: Taylor's series and Laurent's series, Zeros and singularities. Residues- Residue Theorem- evaluation of real integrals using Residue Theorem (contours of the type semi circle and circle only) **8+3**

UNIT- II

2. **Laplace Transforms:** Laplace transform-Inverse Transform-Properties of Laplace Transforms- Laplace Transform of unit step function, impulse function, and periodic functions- Convolution theorem, Solution of ordinary differential equations with constant coefficients and system of ordinary differential equations with constant coefficients using Laplace Transforms. **8+3**

UNIT - III

3. **Fourier Series:** Expansion of a function as Fourier series for a given range- Fourier series of even and odd functions- Half range cosine and sine series expansions. **8+3**

UNIT - IV

4. **Partial Differential Equations:** Solution of wave equation, Heat flow equation, and Laplace equation by the method of separation of variables and problems of vibrating string, One dimensional unsteady heat flow, two dimensional steady state heat flow(Problems based on Fourier-Trigonometric series only) **12+3**

TEXT BOOK:

1. B.S.Grewal, *Higher Engineering Mathematics,* Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. R.V.Churchill, *Complex Variables and its Applications,* McGraw-Hill, New York.
2. M.K.Venkatraman, *Engineering Mathematics, Vol.III,* National Publishing Co., Madras.
3. E.Kreyszig, *Advanced Engineering Mathematics,* Wiley Eastern Ltd., New Delhi.

EE - 212 NETWORK THEORY

Class: **II/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorial:***1**
Branch: **EEE,** *University Examination:***100** marks
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT - I

Network Topology : Topological description of networks - Lumped Vs Distributed circuits - Network graph theory - Tress, Co-Tress and loops - Incidence matrix - Tie-set and cut-set Matrices - Kirchoff's Laws and analysis of Networks.
Network Theorems and applications for A.C. Circuits : Thevenin's - Norton's - Reciprosity - Millmen's - Maximum power-Telligen's –Compensation and Substitution Theorems. **(9 + 3)**

UNIT - II

Time response analysis of networks: Transient analysis of R-L,R-C,R-L-C series and parallel networks with step , impulse , sinusoidal and pulse excitation-initial conditions-Special signal waveforms-Ramp ,Triangular , Train of pulses, delayed input.
P-SPICE : Introduction to P-SPICE - representation of circuit elements - Analysis of circuits using P-SPICE - Simple problems **(9+3)**

UNIT - III

Two port networks : Characterisation of linear time invariant two port networks - Open circuit impedance Parameters - Short circuit admittance parameters - transmission parameters – Inverse transmission parameters - Hybrid parameters -Inverse Hybrid parameters - Inter relationship between parameters - Inter connections of two port networks –Ladder network-Bridged-T, Parallel-T and Lattice-T network-Network representation of element devices - Network transmission criteria. **(9+3)**

UNIT - IV

Network Functions : Network functions for 1-port and 2-port networks and their relationships - Ladder Networks - General Networks - Poles and Zeros of Network functions - Restrictions of pole-zero locations for driving point functions.
Network Synthesis : Positive real function properties - Hurwitz Polynomials - Even and odd functions - Test for positive Real functions - Elementary synthesis operation - Properties and Foster and Cauer forms of RL, RC and LC networks. **(9+3)**

TEXT BOOKS:

1. M.E.Van Valkenberg, "Network Analysis" PHI
2. W.H.Hayt and Jr.Kemmerly, "Engineering Circuit Analysis" TMH
3. Muhammed H.Rasheed., "SPICE for Circuits and Electronics Using P-Spice".
4. James.W.Nilson, "Electric Circuits" PearsonEducation

REFERENCES:

1. J.Edminister & M.Nahvi, "Electric Circuits" Schaum's Outlines,TMH
2. D.Roy Choudhary, "Network analysis and Synthesis"New age Publishers
3. K.A.Gangadhar, "Circuit Theory" Khanna Publishers

EE – 213 BASIC ELECTRICAL ENGINEERING

Class: II Year B.Tech. I Semester
Branch: EEE,CSE &IT
Duration of University Examination: 3Hrs
Lectures: 3; ***Tutorial***: 1
University Examination: 100 Marks
Sessionals: 50 Marks

UNIT – I

D.C. Circuits : Ohm's Law , Network Elements ,Kirchhoff's Laws , Source Transformation , Mesh and Nodal Analysis ,Power in D.C.Circuits,Series, Parallel and Series Parallel combination of Resistances ,network reduction by Star – Delta Transformation , Superposition, Thevenin's , Norton's, and Maximum power transfer theorems for D.C Circuits. **(9+3)**

UNIT – II

1-ϕ A.C. Circuits : Phasor representation of sinusoidal quantities ,Average , R.M.S. values and Form factor, A.C. through Resistor, Inductor and Capacitor, Analysis of R-L-C series and parallel circuits , Power factor , Power triangle , Series Resonance.
Measurements : Working principle of Moving coil , Moving Iron Ammeters and Voltmeters Dynamometer type Wattmeter and 1 -ϕ Induction type Energy meter.
3-ϕ A.C. Circuits: Production of 3 -ϕVoltages, Voltage& Current relationships of Line and Phase values for Star and Delta connections , 3-ϕ Power Measurement by two-wattmeter method. **(9+3)**

UNIT – III

Magnetic circuits: Self and Mutual Inductance, Dot Convention, Coefficient of Coupling.
D.C.Machines: Constructional features, Methods of Excitation, E.M.F.Equation, Characteristics of Series, Shunt and Compound Generators and Applications, Torque development in D.C motor, Characteristics of Series, Shunt and Compound motors and Applications.
Single Phase Transformers: Construction and operation principle, Development of No Load &On Load Phasor diagrams, Equivalent circuit, O.C.and S.C.tests, Losses and Efficiency, Voltage regulation. **(9+3)**

UNIT – IV

3-Phase Induction Motor: Constructional features, Principle of Operation, Production of Rotating Magnetic Field, Torque – Slip Characteristics, Applications.
1-Phase Induction Motors: Production of Rotating Field in various type of 1 – Phase Motors Split Phase, Capacitor Start, Capacitor run, Shaded Pole motors and Applications.
Synchronous Generators and Motors: Principal of Operation and its Applications. **(9+3)**

TEXT BOOKS:

1.Vinvent Del Toro " PRINCIPLES OF ELECTRICAL ENGINEERING " PHI
2.Edward Hughes, " ELECTRICAL TECHNOLOGY ", Pearson Publisher

REFERENCE BOOKS:

1.M.S. Naidu & S.Kamakshaiah, " INTRODUCTION TO ELECTRICAL ENGINEERING
2.B.L.Thereja, A.K.Thereja, " ELECTRICAL TECHNOLOGY " S.Chand & Company Ltd.
3.Sudhakar and Shyam Mohan "NET WORK ANYLYSIS AND SYNTHESIS" TMH
4.Nagrath and kothari "BASIC ELECTRICAL ENGINEERING " TMH

EE-214 ELECTRICAL ENGINEERING MATERIALS

Class: II Year B.Tech. I Semester ***Lectures*** : 3 ***Tutorial***: 1
Branch: EEE ***University Examination***: 100 Marks
Duration of University Examination: 3 Hrs ***Sessionals***: 50 Marks

UNIT-I

1. **Classification of Materials:** Introduction, Atomic Theory, Inter Atomic Bonds
2. **Conducting Materials:** Introduction,Resistivity and factors affecting resistivity, Classification of Conducting materials into low-resistivity and high resistivity materials, Low Resistivity Materials and their Applications ,Resistivity Materials and their applications,Superconductiong Materials.

UNIT-II

3. **Semiconducting Materials:** Introduction ,The Atom, Conductors and Insulators, Semiconductors, Electron Energy and Energy Band Theory, Excitation of atoms, Insulators, Semiconductors and Conductors, Semiconductor Materials,Convalent Bonds, Intrinsic Semiconductors-Type Materials, P-Type Materials,Manority and Minority Carriers, Semi-Conductors Materials, Applications of Semiconductor Materials.

4. **Dielectric Materials:** Introduction, Dielectric constant of Permittivity, Polarisation, Dieletric Losses, Electric Conductivity of Dielectrics and their Break Down, Properties of Dielectrics, Applications of Dielectrics.

UNIT-III

5. **Insulating Materials:** Introduction, General properties of Insulating materials, Classification, Properties, Insulating Gasses.
6. **Magnetic Materials:** Introduction, Classification, Magnetization curve, Hysteresis, Eddy Currents, Curie point, Magnetostriction, Soft and Hard Magnetic materials,

UNIT-IV

7. **Materials for special purposes:** Introduction, Structural materials, Protective materials, Other Materials.
8. **Electronic Components:** Resistors, Capacitors, Inductors, Transformers.

TEXT BOOKS:

1 S.K.BHATTACHARYA “ELECTRICAL ENGINEERING MATERIALS” S.K.Kataria & Sons.

REFERENCE BOOKS:

1. A.J.Dekker “ELECTRICAL ENGINEERING MATERIALS” PHI

EI-215 ELECTRONIC DEVICES AND CIRCUITS – I

Class: II/IV B.Tech. I –Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours

Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT – I

Review of semiconductor diodes. Continuity equation. Junction capacitance. Temperature dependence of p-n junction. Halfwave rectifier – and fullwave rectifier, Bridge rectifier – with and without filters. Ripple, Regulation. Series and shunt regulators. Introduction to SMPS.

UNIT – II

Transistors, current components in NPN and PNP transistors, Ebers-Moll model. Small Signal LF h-parameter model, Determination of h-parameters – Analysis of transistor amplifier using h-parameters in CE, CB and CC configuration –simplified analysis for these configurations,BJT as a switch.

UNIT – III

FETs : JFET-V-I characteristics, MOSFET – Enhancement and Depletion type MOSFETs. Small signal model – Analysis of CS, CD amplifier.
Principles, characteristics and applications of SCR, UJT, Tunnel diode, Varactor diode. Diac Triac LED, Photo diode and Photo Transistor.

UNIT – IV

Transistor biasing Thermal runway and thermal stabilization. The operating point stability Collector –to-base, self Bias. Stabilization against variations in V_{BE} and Beta for self bias circuits, FET biasing, Source self bias. Zero current drift biasing. Biasing against device variation. Biasing of enhancement type MOSFET.

TEXT BOOKS:

1. Jocob Millman & Christos C.Halkias, Electronic Devices and Circuit, McGraw Hill, 1991.
2. Robert Boylestad & Lowis Nashelsky, electronic Devices and Circuit theory, Prentice Hall of India, 5th Ed., 1993.
3. Donald L Schilling & Charles Belove, Electronic Circuits: Discrete & Integrated, McGraw Hill International Edition, 3rd Edition., 1989.

CE-218 FLUID MECHANICS AND HYDRAULIC MACHINES

Class: II Year B.Tech. I Semester
Branch: EEE
Duration of University Examination: 3 Hrs
Lectures: 3; ***Tutorials***: 1
University Examination: 100 Marks
Sessionals: 50 Marks

UNIT - I

1 **Introductory concepts and Definitions**: Properties of fluids; Fluid statics; pressure at a point; Hydrostatic pressure; Manometry; Hydrostatic forces on plane and curved Surfaces; Buoyancy; Stability of floating bodies Metacentric height: **(5+3)**

Fluid Kinematics; Description of fluid flow; Velocity field; Acceleration of fluid element in general 3-D flow; Streamlines; Rotation of fluid Element and Conditions for irrotational flow; in 3-D flow and along a stream tube.

UNIT - II

2. **Fluid Dynamics**; Euler's equation in 3-D flow and along a stream tube; Its integration to yield Bernoulli Equation and underlying assumptions; Energy equation; Linear-Momentum equations; Applications through orifices; Mouthpieces; Liquid Jets etc; Time of emptying of Vessels; Measurement of velocity and flow with pitot tube, prandtl tube, venturimeter, orificemeter, flow nozzle, Rotameter, sharp,crested,weirs: **(9+3)**

UNIT - III

3. Dimensional analysis and Dimensionless numbers; Formation of equations by Buckingham's II – method, model Analysis. **(3+1)**

Viscous Flow; Laminar flow through pipes and parallel plates by one-dimensional approach; Turbulent flow through pipe; velocity distribution; smooth and rough pipes; friction factor; moody's chart; Local losses in pipes; problems of flow through pipes; plotting of energy gradient and hydraulic lines: **(5+1)**

UNIT - IV

4. Hydraulic machinery; Angular Momentum equation for a fluid machine; Hydraulic turbines – Main energy transfer types and their features; Application of basic tube functions and types; Main and Operational characteristics; cavitation and Methods to avoid it; Centrifugal and reciprocating pumps; construction and function of various components; simple calculations; characteristics. **(10+2)**

TEXT BOOKS AND REFERENCES:

1. V.L. streeter ; Fluid Mechanics, Mc Graw Hill Book Co.
2. A.K. Mohanty : Fluid Mechanics, Prentice – Hall India.
3. K.L. Kumar : Engineering Fluid Mechanics.
4. Jagadish lal: Hydraulic and Fluid Mechanics, Metropolitan Book Co.
5. P.N. Modi and S.M. Seth: Fluid Mechanics, Standard publishers.
6. A.K. jain : Fluid Mechanics, Khanna publishers.
7. Jagdish Lal: Hydraulic Machines, Metropolitan Book Co.

EE - 215 BASIC ELECTRICAL ENGINEERING LABORATORY

Class: II Year B.Tech. I - Semester
Branch: EEE,CSE,IT

Practicals: 3
Sessionals: 50 marks

LIST OF EXPERIMENTS

1. Verification of Superposition Theorem
2. Verification of Thevenin's Theorem
3. Verification of Maximum Power Tranfer Theorem
4. Measurment of 3-Phase Power By Two Watt Meter Method
5. Frequency Response of R-L-C Series Circuit
6. Determination of Parameters of a Choke Coil
7. O.C And S.C Tests on 1-Phase Transformer
8. Efficiency And Voltage Regulation of a 1-Phase Transformer By Direct Load Test
9. Speed Control of A D.C Shunt Motor
10. Load Test on 3-Phase Induction Motor

EE - 217 NETWORK LABORATORY EXPERIMENTS

Class: II Year B.Tech. I - Semester
Branch: EEE

Practicals: 3
Sessionals: 50 marks

LIST OF EXPERIMENTS

1. Verification of Superposition Theorem for AC circuits.
2. Verification of Thevenin's Theorem for AC circuits.
3. Verification of Maximum Power Transfer Theorem for AC circuits.
4. Verification of Reciprocity Theorem for AC circuits.
5. Determination of Z - Y parameters of Two-port network
6. Determination of ABCD Parameters & Inverse ABCD Parameters of Two-port network.
7. Determination of Hybrid Parameters & Inverse Hybrid Parameters of Two-port network.
8. Determination of Self and Mutual inductance and coefficient of coupling for coupled circuits.
9. 9. Time response of second order R - L - C Series circuit.
10. 10.Analysis of circuits using P-SPICE

SCHEME OF INSTRUCTION AND EVALUATION
II SEMESTER OF II YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course number	Course	Hours of instructions per week			Scheme of evaluation			Total marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing / Practicals	Duration of Exam.	Max Marks	Max Marks	
MH 221	Mathematics –III	3	1		3 Hrs	100	50	150
EE 222	Electrical Machines-I	3	1		3 Hrs	100	50	150
EE 223	Electrical Measurements	3	1		3 Hrs	100	50	150
EE 224	Electromagnetic fields	3	1		3 Hrs	100	50	150
EI 224	Electronic devices and circuits –II	3	1		3 Hrs	100	50	150
EC 225	Signals & Systems	3	1		3 Hrs	100	50	150
EE 225	Electrical Measurements Lab	-		3	2 Hrs	50	25	75
EI 2210	Electronic circuits Laboratory	-		3	2 Hrs	50	25	75
Total		**18**	**6**	**6**				**1050**

MH- 221 MATHEMATICS-III

Class: II Year B.Tech. II Semester ***Lectures***: 3 ***Tutorial***: 1
Branch: **Mech, Civil, E&I, EEE, CSE, IT, ECE** ***University Examination***: 100 Marks
Duration of University Examination: 3 Hrs ***Sessionals***: 50 Marks

UNIT I

1. **MATRICES:** Rank of matrix-Solution of system of linear equations-linear dependence and independence of vectors-Characteristic roots and characteristic vectors of a matrix-Caley Hamilton 's Theorem (without proof)-Reduction of a matrix to diagonal form and normal form-Reduction of a quadratic form to canonical form. **8+3**

UNIT II

2. **PROBABILITY & STATISTICS:** Curve fitting-Method of least squares- Straight line and parabolic curves-correlation coefficient – rank correlation- regression-linear regression equations. Random variables-Discrete land continuous distributions-Density and distribution functions- Illustration through Binomial, Poisson and normal distributions **12+4**

UNIT III

3. **NUMERICAL ANALYSIS:** Interpolation-Forward and Backward differences interpolation-Newton's and Lagrange's formulae.
4. **NUMERICAL DFFERENTIATION AND INTEGRATION:** First and Second derivatives using forward and backward interpolation- Numerical integration-Trapezoidal and Simpson's rule. **8+3**

UNIT IV

5. **SOLUTION TO SYSTEM OF LINEAR EQUATIONS:** Jacobi, Gauss Siedel iteration method-Solution of algebraic and transcendental equations – Bisection method, Regula- Falsi method and Newton Raphson's method.
6. **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:** Taylor's method, Picard's method, Euler's method and Runge-Kutta methods of second and fourth orders. **8+3**

TEXT BOOK:

1. B.S.Grewal, *Higher Engineering Mathematics,* Khanna Publishers, New Delhi.

REFERENCES BOOKS:

1. S.S.Sastry, *Introduction to Numerical Analysis,* Prentice Hall of India, New Delhi.
2. E.Kreyszig *Advanced Engineering Mathematics,* Wiley Eastern Ltd., New Delhi.
3. Gupta and Kapoor, *Fundamentals of Mathematical Statistics*, S.Chand and Co., New Delhi.

EE 222 ELECTRICAL MACHINES – I

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **1.Basic Principles of Rotating Electrical machines**: Principles of Electromechanical Energy Conversion, singly and doubly excited systems – Basic constructional features of rotating Electrical machines.
2. **DC Generators**: Principle of operation, Armature windings, Simplex and Multiplex lap and wave windings, Types of DC Generators, emf equation. **(9+3)**

UNIT – II

3. Armature reaction: Demagnetizing and cross magnetizing Ampere Turns – Interpoles - compensating windings, Commutation –Reactance voltage-Methods of improving commutation. Methods of excitation-separately and self excited generators-voltage buildup in shunt generators, critical field resistance and critical speed- Parallel operation of DC Generators-Use of equalizer bars- Load sharing- characteristics and Applications of Shunt , Series & compound Generators. **(9+3)**

UNIT – III

4. **4.D.C. Motors**: Principle of operation-Back emf- Torque Equation- Classification of DC motors-Speed Control- Starters- Losses and Efficiency - Testing of DC machines,Brake Test-Swinburne's Test - Hopkinsan's Test- Retardation Test- Field's Test -separation of Stray losses- characteristics and applications of DC motors. **(9+3)**

UNIT – IV

5. **5.Transformers, Single Phase Transformers**: Constructional features, principle of operation, emf equation, operation on no load and on load, Development of equivalent circuit, Determination of equivalent circuit parameters, phasor diagram, losses, ordinary efficiency and All day efficiency, Separation of circuit losses, regulation, approximation and rigorous expressions, predetermination of performance by OC and SC tests, Suppress test, Parallel operation, Load sharing,
6. **Auto Transformer**: principle of working, saving of copper as compared to two winding Transformer.
7. **7.Three Phase Transformers**: Types of connections, Relation between line and phase voltages and currents, Three winding Transformer,Use of tertiary winding, Scott connection of Transformers for phase conversion, Tap changing, Off load and On load, Induction Regulator. **(9+3)**

TEXT BOOK:

1. P.S. Bimbhra, "ELECTRICAL MACHINARY" 5/e, Khanna Publishers.

REFERENCE BOOKS:

1. R.D. Begamudre, "ELECTROMECHANICAL ENERGY CONVERSIONS WITH DYNAMICS OF MACHINES" 2/e Wiley Eastern Edition.
2. Claytons Hancock "PERFORMANCE of DC MACHINES"
3. M.G. Say , " PERFORMANCE of AC MACHINES"
4. Nagrath and Kotari "ELECTRICAL MACHINES" TMH

EE-223 ELECTRICAL MEASUREMENTS

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT –I

ELECTRICAL MEASURING INSTRUMENTS: Significance of Measurement, static characteristics of measuring system- linearity-sensitivity- Precision-Accuracy. Permanent magnet moving coil - Moving Iron - dynamometer - Induction - Thermal - Electrostatic indicating instruments for measuring current, voltage and power. Q-meter and Synchroscope - Errors and methods of reducing them in these meters – Measurement of three phase power using two watt meter method, Measurement of three phase reactive power using single wattmeter method. Extension of Ranges of Voltmeters and ammeters. loading effect on measuring instruments, Phantom loading. **(9+3)**

UNIT – II

INSTRUMENT TRANSFORMERS: Introduction-Advantages- Burden of instrument transformer-Current transformer-errors in current transformer-effect of secondary open circuit-Potential transformer-errors in potential transformers. Testing of current Transformers with silsbee's method.

POTENTIO METERS : D.C. Potentiometer and A.C. Potentiometers of Polar and Co-ordinate type - Relative merits - Applications - Measurements of resistance - Calibration of Voltmeter, Ammeter and Wattmeter. **(9+3)**

UNIT – III

BRIDGES: Principle of working - Types: Wheatstone, Kelvin, Maxwell, Owen, Schearing, Wien, Kelvin's double bridge - - Megger.

MAGNETIC INSTRUMENTS: Measurement of Magnetic field - Types of instruments and their principle of working – Ballistic Galvanometer, Flux meter - B-H loop plotting **(9+3)**

UNIT-IV

ELECTRONIC INSTRUMENTS: Cathode Ray Oscilloscopes (CRO) - Block diagram representation - Cathode Ray Tube (CRT) - Electrostatic Deflection, Post Deflection - Acceleration of Electron Beam - Expression for Deflection - Sensitivity - Screens for CRTs - Time base generators - Free running and Triggered Sweeps - Attenuators - Probes - Applications of CRO, Lissajous patterns - Measurement of frequency and phase. .

TRANSDUCERS: Transducers for measurement of non-electrical quantities – Types and their principle of working – measurement of Linear displacement – Acceleration – Flow rate – Liquid level –strain-Force-Pressure -Temperature. **(9+3)**

TEXT BOOKS:

1. Electrical Measurement in Measuring Instruments. Goldwing E.W. and Widdies
2. Electrical and Electronics Measurement and Instrumentation Sahwany A.K.

REFERENCE BOOKS :

1. "Modern Electronics Instrumentation Techniques" Alfred D. Helthic & Willem D.Cooperr.

EE-224 ELECTRO MAGNETIC FIELDS

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Introduction: Review of vector Algebra, Cartesian, -Cylindrical and Spherical Co-ordinate Systems.Introduction to Electromagnetic Fields, Field theory Vs Circuit theory.

Static Electric Fields: Coulomb's law - Electric field intensity - Field due to different charge configurations - Electric flux- Electric flux density - Gauss law and its Applications- Divergence theorem - Relation between D and E - Work done in moving a unit positive charge - Electric potential-Absolute potential-Potential difference between two points and it is independent of path of integration- Potentials caused by different types of charge configurations - Relation between E and V- Potential and electric field at a point due to electric dipole - Torque on electric dipole when placed in Electric field - Electro static energy-Energy density. **(9+3)**

UNIT – II

Electricfield in materials Conductors in Electrostatic Fields-Polarization in Dielectrics_-Dielectric strength&constant. Boundary conditions between dielectrics

Boudary value problems: Laplace and Poisson's equations - Uniqueness theorem –simple examples –method of images. **Capacitance:**Definition of capacitance - Parallel plate, Cylindrical and Spherical capacitors –Capacitance of multi conductor systems –Conduction and Convection currents.-Current density &Ohm's Law-Electromotive force&KVL-Equation of Continuty&KCL-Boundary conditions for current density.

(9+3)

UNIT – III

Static Magnetic fields : Concept of Magnetic field- Biot Savart's law- Ampere's law and its applications - Magnetic flux and flux density - Magnetic field caused by different types of current configurations - Scalar and Vector magnetic potentials-Calculation of Vector Magnetic Potentials for simple cases-Vector Poisson's equation.

Magnetic Forces: Force on a moving charge - Force on a differential current element - Force between differential current elements. **Field in dielectrics**: Magnetic boundary conditions – Magnetic Dipole-Magnetisation in materials. **Inductance:** Concept of self inductance mutual inductance, Calculation of Inductance of Solenoid, over headlines. **(9+3)**

UNIT – IV

Maxwell's equations & Electromagnetic Waves: Maxwell's equations for Static Fields – Faraday's law- displacement current - Maxwell's equations for time varying fields – Wave Equation for free space, conducting medium-field –Relation between E&H in plane waves - Wave Propagation in good conductors and dielectrics - Poynting Vector and flow of power - Power loss in a plane conductor. **(9+3)**

TEXT BOOKS:

1. W.H. Hayt (Jr.) " ENGINEERING ELECTROMAGNETICS" TMH
2. Matthew.n.o.Sadiku "ELEMENTS OF ELECTROMAGNETICS" Oxford University Press.
3. Edward.C.Jordan&Keith.G.Balmain"ELECTROMAGNETICWAVES& RADIAING SYSTEMS" PHI.

REFERENCES:

1. 1.David.K.Cheng "FIELD&WAVE ELECTROMAGNETICS" Adison wesely Longman.
2. 2.K.A.Gangadhar "FIELD THEORY" Khanna publishers
3. John. D. Kraus and K.R. Carver "ELECTROMAGNETICS" TMH

EI- 224 ELECTRONIC DEVICES & CIRCUITS – II

Class: **II/IV B.Tech. II Semester**. Lectures:**3,**Tutorials:**1**
Branch: **ECE , EIE, EEE** University Examination: **100 marks**
Duration of University Examination: **3 hours** Sessionals: **50 marks**

UNIT-I

SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER CIRCUITS:

Analysis of Single Stage transistor amplifier circuits using h-parameters, RC coupled amplifier – Frequency response analysis, cascaded amplifiers.

HIGH FREQUENCY TRANSISTOR AMPLIFIER CIRCUITS:

High frequency model of a transistor α and β cut-off frequencies, single Stage and Multistage amplifiers at High frequencies Calculation of Band Width of single and multistage amplifiers.

UNIT-II

DC AMPLIFIERS:

DC amplifiers, drift compensation techniques, differential amplifiers.

FET AMPLIFIERS:

FET Low frequency and High Frequency models; Low and High frequency response of amplifier circuits, Analysis of Single and Multistage amplifier circuits.

UNIT-III

FEED BACK AMPLIFIERS:

Concept of feedback, Classification of feedback amplifiers, general characteristics of negative feedback amplifiers, effect of feedback on amplifier characteristics.

OSCILLATORS:

Condition for Oscillations, RC and LC type oscillators, crystal oscillators, frequency and amplitude stability of Oscillations.

UNIT-IV

POWER AMPLIFIERS:

Class A,B and AB power amplifiers: Push-Pull and Complementary push-pull amplifiers, design of heat sinks, power o/p efficiency, cross – over and Harmonic Distortion.

TUNED AMPLIFIERS:

Single tuned and Double tuned voltage amplifiers, Inter stage design, stability considerations, class B and Class C tuned Power amplifiers.

TEXT BOOKS:

1. Milman & halkas, “Integrated Electronics” TMH, New Delhi.
2. Robart Boylestad & Lowis Nashelsky, “Electronic Devices & Circuits”

REFERENCE BOOKS:

M.S.Gausi, “Electronic Circuits”, John Wiley & Sons, New york.

EC -225 SIGNALS & SYSTEMS

Class: **II/IV B.Tech. II Semester**. *Lectures:***3,***Tutorials:***1**
Branch: **ECE, EIE, EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Signals – Signals and their representation, classification of signals, singularity functions – Impulse, step, ramp functions, representation of signals withsingularity functions, exponential functions.

Systems: Definition, Classification of Systems, Convolution integral, graphical convolution.

Signal Approximation – Approximation of a function by a set of mutually orthogonal functions, mean square error, complete set of orthogonal functions orthogonality in complex functions, Trigonometirc and exponential Fourier series, representation of periodic functions by Fourier series, complex Fourier spectrum.

UNIT – II

Fourier Transforms and their applications to systems – Fourier transform definition, properties of F.Ts , energy spectral density, parsevals theorem, power spectral density, Hilbert transforms and properties.

Linear Systems – impulse response, response of a linear system, linear time invariant system, linear time variant system, transfer function of LTI system.

UNIT – III

Random Variables & Processes – Probability, Joint Probability, Statistical independence, Random Variables, cumulative distribution function, probability density function, relation between probability & probability density, joint commutative distribution, average valve of random variables, variance of a random variable, tchebycheffs inequality, the Gaussian probability density, the error function, Rayleigh probability density, mean & variance of the sum of random variables, correlation between random variables, central limit theorem.

UNIT – IV

Discrete Time Signals & Systems: Discrete time signals, representation, operations on sequences, Discrete time systems and classification, LTI systems, Linear Convolution, Difference equations.

Z-Transforms: ROC, properties of Z-Transforms Inverse Z-Transforms, Causality and stability.

Realization of Discrete Systems: Structural realization of discrete systems – Direct form – I, Direct form-II, Cascade and parallel forms.

TEXT BOOKS:

1. Simon & Haykins, Signals & Systems, Wiley Eastern Ltd.,
2. Zeimer, Signals & Systems, PHI.
3. Proakis, Digital Signal Processing: Principles, Algorithms and Applications.(PHI)
4. Simon & Haykin – " Signals & Circuits" – John Willey

REFERENCE BOOKS:

1. Oppenheim, Willsky & Young; Signals and Systems PHI, EEE, New Delhi.
2. P-Z Peebles – Probabilities, Random Variables and Random Signal Principles – TMH.
3. B.P. Lathi, Signals & Systems and Communication – BSP.

EE-225 ELECTRICAL MEASUREMENTS LABORATORY

Class: II Year B.Tech. II Semester ***Practicals***: 3
Branch: EEE ***Sessionals***: 50

LIST OF EXPERIMENTS

1. Measurement of resistance using Kelvin's double bridge.
2. Measurement of Inductance using Maxwell's bridge.
3. Measurement of Capacitance using schering bridge.
4. Calibration of Ammeter and voltmeter with Potentiometer.
5. Measurement of EMF using A.C. Potentiometer.
6. Measurement of displacement using LVDT.
7. Measurement of strain using strain guage.
8. Measurement of magnetic flux using fluxmeter.
9. Measurement of frequency using CRO.
10. Measurement of temperature using Thermocouple.
11. Measurement of Hysterisis loss with B-H loop plotting .
12.. Measurement of Ratio and Phase angle error of a Current Transformer.
13. Measurement of frequency and Phase angle using Lissajous figures.
14. Calibration of Energy meter.
15. Extension of meter ranges.

EI- 2210 ELECTRONIC CIRCUITS- LAB

Class: **II/IV B.Tech. II Semester** *Practicals* **: 2 Hrs**
Branch : **EEE** University *Examination:* **50 Marks**
Duration of University Examination: **2 Hrs** *Sessionals :* **25 Marks**

LIST OF EXPERIMENTS

1. **Characteristics of:** PN Diode, Zener Diode, SCR, UJT
2. **Static Characteristics of :** BJT(CE), FET(CS)
3. **Half wave & Full wave Rectifiers :**Without & with Filters .
4. Zener Diode Voltage Regulator.
5. **BJT Biasing Circuits :** Fixed Bias, Collector to Base Bias, Self Bias
6. BJT Switch , Amplifier .
7. Emitter Follower.
8. Cascade Amplifier (Two Stage).
9. FET Amplifier.
10. **Feedback Amplifiers:** Voltage series/shunt; Current series/shunt.
11. **Oscillators:** RC, LC & Crystal.
12. Differential Amplifier.
13. Class –B Power Amplifier.
14. Single Tuned Amplifier.

SCHEME OF INSTRUCTION AND EVALUATION
I SEMESTER OF III YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			EVALUATION SCHEME			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Practical	Duration of Exam	Max. Marks	Max. Marks	
HS 311	Management Economics and Accountancy	4	-	-	3	100	50	150
EE 313	Electrical Machines -II	3	1	-	3	100	50	150
EE 314	Power systems-I	3	1	-	3	100	50	150
EE 319	Control systems Engg..	3	1	-	3	100	50	150
EC 314	Linear Integrated Circuits	3	1	-	3	100	50	150
EC 318	Digital Electronics	3	1	-	3	100	50	150
EE 316	Electrical Machines Lab-I	-	-	3	3	50	25	75
EC 317	Integrated Circuits Lab	-	-	3	3	50	25	75
	Total	**19**	**5**	**6**				**1050**

HS 311 MANAGEMENT ECONOMICS AND ACCOUNTANCY

Class: **III/IV B.Tech. I Semester** *Lectures:* **3**
Branch: **Common to All Branches.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

ECONOMICS **UNIT – I**

Economics: Meaning, Definition, Scope: Micro and Macro, Assumptions and Methods, Usefulness**.** **(2 Periods)**
Factors of Production: Meaning and Definition. Characteristics of Land Labour, Capital and Enterpreneurship. Division of Labour : Advantages and Disadvantages. Formation of Capital Forms of Business Organization: Sole Proprietaryship, Partnership Concern, Cooperative Societies Joint Stock Company. Types of Partners, Types of Joint Stock Companies. Merits and Demerits **(6 Periods)**

MANAGEMENT **UNIT – II**

Management: Meaning and Definition. Scope of Management- Principles of Management. Scientific Management: Definition, Characteristics and Criticism**.** **(4 Periods)**
Functions Of Management: Planning: Definition and Process. Organizing Definition of Organization: Characteristics andTypes. Principles of Organization. Departmentation: Meaning and Fundamentals of Departmentation, Centralisation And Decentralization: Definition: Features Merits and Demerits. Communication: Process of Communication, Channels, Media, and Barriers. **(10 Periods)**

UNIT – III

Staffing: Meaning and Functions of Personnel Management. Coordination: Definition, how to Achieve Effective Coordination. Controlling: Definition and Process. **(4 Periods)**

ACCOUNTANCY **UNIT – IV**

Double Entry Book-Keeping : Definition. Journalization of Transactions. Ledger Posting and Balancing. Preparation of Trial Balance. **(10periods)**
Preparation of Final Accounts: Trading Account, Profit And Loss Account and Balance sheet(With Simple Adjustments) **(7 Periods)**

REFERENCE BOOKS:

1. Modern Economics Theory By K.K.Dewett.
2. Principles and Practice of Management By LM.Prasad.
3. Introduction To Accountancy BY T.S. Grewal.
4. Business Organization and Management Y.K.Bhushan.

EE 313 ELECTRICAL MACHINES – II

Class: **III/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **3-Phase Induction Motors**: Construction details, Types, Production of rotating magnetic field, Principle of operation, Equivalent circuit, Phasor diagram, torque equation, Slip torque characteristics, Effects & Change in supply voltage and supply frequency on torque and speed , Losses and efficiency, Testing, No load and Blocked Rotor test, Determination of equivalent circuit parameters, Pre determination of performance from equivalent circuit and circle diagrams
2. Methods of Starting, Direct on line, Star Delta, Autotransformer, Rotor resistance starters.
3. **Methods of speed control:** Pole changing , Cascading, Variable frequency Variable voltage, Rotor resistance , Rotor injected emf technique.
4. **Double cage induction motor**: Construction. Principle & operation, equivalent circuit characteristics and applications. **(9+3)**

UNIT – II

5. **Synchronous Generators**: Construction, Types, Winding factors, Production of emf – Harmonics, Armature reaction – Synchronous reactance – Phasor diagrams, Load characteristics OC and SC tests, Methods of predetermination of regulation by synchronous Impedance(EMF). MMF method, Potier(ZPF) and ASA methods, Simple theory of two reaction analysis and its application for the pre determination of regulation of alternator, Slip test, power angle characteristics, Synchronization and synchronizing power, parallel operation, Load sharing, operation on infinite bus bar, High frequency generation, Typical applications, short circuit transients in synchronous machines. **(9+3)**

UNIT – III

6. **Synchronous Motors**: Principle of operation, Phasor diagrams, variables of current and power factor with excitation, Hunting and its application, Determination and pre determination V and $\wedge$ curves, excitation circles and pane circles, methods of starting Synchro condenser, Applications. **(9+3)**

UNIT – IV

7. **Single phase Induction Motors**: Principle & operation, Starting methods, Double revolved fixed theory, Equivalent circuit, Determination equivalent circuit parameters
8. **Special purpose machines :**Constructional features, principle & working characteristics and applications of Stepper motor,Brushless DC motor, Scharage motor, Reluctance motor, Hystersis motor and Linear Induction motor. **(9+3)**

TEXT BOOKS:

1. P.S. Bhimbhra, "ELECTRICAL MACHINARY" 5/e, Khanna Publishers.
2. P.S. Bhimbhra, "GENERALIZED THEORY OF ELECTRICAL MACHINES" , Khanna Publishers.
3. Mukhopadyaya , "ELECTRICAL MACHINES".

EE 314 POWER SYSTEMS – I

Class: **III/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch: **EEE.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Conventional Energy Sources: Hydroelectric Stations: Introduction, arrangement and location of hydroelectric station – Types of hydroelectric plant – Principle of working – power developed – layout of hydro power station: Steam power plant, Introduction – Selection of site – coal handling plant – Ash handling Plant – Steam generating Plant – Steam turbine & Generator – Cooling water systems: Nuclear Power Plant: Introduction to Nuclear reactors – Types of reactors – Location of Nuclear power plant; Gas turbine power plant: Introduction lay out of Gas turbine plant – Advantages, Combined cycle plants. **(9+3)**

UNIT – II

Non Conventional Energy Sources: Tidal Power, Wind Power, Geo Thermal Power, Magento Hydro Dynamic Power, Solar Power. **Economics of Power Generation**: Definitions, Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Load duration curve, Number and size of generating units, Base load and peak load plants, cost of Electrical energy, Fixed cost, Running cost, Tariffs. **(9+3)**

UNIT – III

Insulators: Types, Potential distribution over a string of suspension insulators, Factors affecting the distribution of voltage along the string insulators, Methods of equalizing potential string efficiency, Stringing charts, Testing of insulators. **Corona**: Critical disruptive voltage, Corona loss, Line design based on corona, Disadvantage of corona, Radio interference, and Inductive interference between power and communication lines. **(9+3)**

UNIT – IV

Distribution Lines: Distribution Systems, D.C. two wire and three wire systems. Single phase and three phase 3 wire and 4 wire AC systems – Comparison of efficiency, Kelvin's Law – Economic size of conductor. **Transmission Lines**: Electrical Power system components – Elementary ideas of layout – Resistance and capacitance of transmission lines, single phase; and 3 phase lines with symmetrical and asymmetrical spacing, composite conductors – Transposition, bundled conductors, Effect of earth on capacitance, Mechanical design of transmission lines. **Under Ground cables:** Electric stress in a cable-core cable-Grading of cables-cable capacitance-cable inductance-Dielectric loss and Heating. **(9+3)**

TEXT BOOKS:

1. C.L.Wadhwa, "Electrical Power Systems". 3/e. New Age International Publishers.
2. C.L.Wadhwa, "Generation, Distribution & Utilization Of Electrical Energy". New Age International Publishers.
3. W.D. Stevenson, "Elements Of Power System Analysis". 4/e McGraw Hill International Publishers.
4. A.T. Starr, "Generation, Transmission and Distribution".
5. Syed A Nasar" Electric Power Systems" McGRAW-HILL

REFERENCE BOOKS:

1. Soni, Gupta, Bhatnagar, "ELECTRICAL POWER".Dhanpat rai & sons
2. MV.Deshpande, "ELEMENTS OF POWER STATION DESIGN", 3/e Wheelers Publishers.

EE 319 CONTROL SYSTEM ENGINEERING

Class: **III/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:**1*
Branch: **EEE, E&I,ECE** *University Examination: **100 marks***
Duration of University Examination: **3 hours** *Sessionals: **50 marks***

UNIT – I

1. **Introduction: (9+3)**
   Types of systems, Properties of systems, Linearity, Time-inverience, Stability, Causality. Open loop control system, Closed loop control system, Effect of Feedback on over all gain, Stability and Sensitivity.
2. **MATHEMATICAL MODES OF PHYSICAL SYSTEMS:**
   Electrical, Mechanical and Electromechanical systems, Transfer function of physical systems by Block diagram reduction techniques and signal flow graphs, Drawing a signal flow graph from a block diagram.

UNIT – II

3. **CONTROL SYSTEM COMPONENTS: (9+3)**
   AC and DC servomotors, Synchros, Tacho generator and Potentiometer.
4. **TIME DOMAIN ANALYSIS:**
   Design specifications, Typical test signals, Time response of first order and of 2^{nd} order systems, Time domain specifications, Basic control actions like P, PI, PD, PID and derivative feedback, Steady State error and error constants, Routh Hurwitz Criterion, Concept of root locus and construction of root loci, Effects of adding poles and zeros.

UNIT – III

5. **FREQUENCY DOMAIN ANALYSIS: (9+3)**
   Frequency response of closed loop systems, Specifications, Correlation between frequency and time domain specifications, Polar plots, Gain Margin and Phase Margin, Bode plots, Nyquist stability criterion, Relative stability using Nyquist stability criterion.

UNIT – IV

6. **STATE VARIABLE ANALYSIS OF CONTINUOUS SYSTEMS: (9+3)**
   Concepts of state, State variables and state model, Derivation of state model from transfer function, Diagonolization, Derivation of transfer function from state model, Solution of state equations, State transition matrix, Concept of Controllability and Observability.
7. **COMPENSATION:** Elementary treatment of Compensation.

TEXT BOOKS:

1. M. Gopal, *"Modern Control System Theory",* Wiley Eastern Publishers, New Delhi.
2. B.C. Kuo, *"Automatic Control Systems"* 7/e Prentice Hall of India. New Delhi.
3. K.Ogata, *" Modern Control Engineering"* Prentice Hall of India, New Delhi.

REFERENCES:

1. I.J. Nagarth & M. Gopal, *"Control System Engineering",* New Age International Publishers, New Delhi.

EC 314 LINEAR INTEGRATED CIRCUITS

Class: III/IV B.Tech. I –Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours
Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT-I

Integrated circuits: Introduction, classification of Ics, Fabrication Techniques of Ics. Introduction to OPAMP: Introduction, Internal blocks of Op-Amps, Ideal & Practical characteristics of Op-Amps, Measurement of Op-Amp parameters, Analysis of Basic Inverting & Non-Inverting Amplifiers and voltage follower.

D.C. Characteristics of OPAMP: Open loop and closed loop frequency response, Op-Amp stability, Frequency compensation techniques. Ideal & Practical characteristics of IC-741.

UNIT-II

Applications of Operational Amplifiers: Summing and difference amplifiers, Integrator and differentiator, current to voltage and voltage to current converters, Instrumentation amplifier, sample and Hold circuit.

Non-Linear Applications: Precision Rectifiers – Half wave and full wave, log and antilog amplifiers.

Comparators and wave form generators: OPAMP comparators, Regenerative (Schmitt Trigger), R.C. phase shift and wiens bridge oscillators, Astable Mulitivibrator (Square wave generator) and Monostable Multivibrator.

UNIT-III

Active Filters: Introduction of filters, Ideal and Realistic frequency responses of various filters, Second Order filters: Analysis and design of I.G.M.F., V.C.V.S configuration of L.P.F, H.P.F., B.P.F. and notch filters.

Monolithic Timers and their applications: Introduction to IC 555 Timer, Functional Diagram, Design of Astable and Monostable multivibrators using 555timer.

UNIT-IV

Voltage regulators: Basic voltage regulator using Op-Amps, General purpose IC Regulator, uA723, Functional diagram, specifications, Design consideration of 723 as low & high voltage regulators. Current limit protection, current feed back, current bossting. Three terminal voltage (fixed) Regulators: Introduction and general features of three terminal regulators, Ic series of three terminal Regulators, their Design, current boosting.

Phase Locked Loops: Voltage controlled oscillator, Basic PLL operation, definitions related to PLL, Monolithic PLL and design considerations, transient response of PLL, typical PLL applications (FSK, AM detectors)

Analog multiplexers, DAC types (R-2R ladder weighted ladder and Inverted ladder), ADCs types (Successive Approximation, Dual-Slop, Flash types).

TEXT BOOKS:

1. Roy Choudhary, Shail Jain, Linear Integrated Circuits, New Age International, New Delhi.
2. Ramakant Gayakwad, Opamp and Linear Integrated Circuits, Pearson Education.
3. G.B. Clayton, Integrated Circuits & Applications, ELBS, Lodon.
4. Rodert F.Coughlin, Frederick F.Driscoll, Operational Amplifiers and Linear Integrated Circuits, Pearson Education, New Delhi.

REFERENCE BOOKS:

1. R.Botkar, Integrated Circuits, Khanna Publishers, New Delhi.
2. Franco, Integrated Circuits & Applications, McGraw Hill, New York.

EC 318 DIGITAL ELECTRONICS

Class: III/IV B.Tech. I –Semester
Branch: **Common to CSE, IT, EEE)**
Duration of University Examination: 3 Hours
Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT – I

Number Systems and Codes : Introduction to Number systems, Base conversion among different Number Systems, Signed number representation, Binary arithmetic, Use of 1's and 2's complement representation in Binary Number system Introduction to Codes, Weighted and Non weighted codes, self complementing and reflecting codes, code conversion, Error detection and correction, Hamming codes.
Switching functions and minimization: Basic laws of Boolean algebra, logical gates (block diagram representation), Boolean expressions, SOP and POS forms, realization of Boolean expressions with logic gates, simplification of Boolean expressions, Karnaugh map methods, Tabulation method. **(9+3)**

UNIT – II

Half Adder, Full Adder, Serial Adder, Parallel Adder, Carry look ahead Adder, BCD Adder, Subtractor, 1's and 2's complement Adder / subtractor.
Decoders, Seven segment LED displays, Encoders, Multiplexers, De MUX's realization of Boolean expression using MUX's and De MUX's. **(9+3)**

UNIT – III

Sequential circuits : RS, JK, D and T Flip Flops, use of direct inputs, shift registers, applications of shift registers, Ring counter, Johnson counter.
Ripple counters – Design of Mod-N ripple counters.
Synchronous sequential machines – state diagrams, state tables, design of synchronous sequential machines, design of Mod-N synchronous counters, Design of sequence detectors.
(9+3)

UNIT – IV

Logic Families : Introduction to logic families. Description of the terms – Fan in, Fan out, Noise margin, Propagation delay, current sourcing, current sinking. Study of RTL, DCTL, DTL, HTL, TTL, ECL, MOS, CMOS families. **(9+3)**

TEXT BOOKS:

1. Zvi. Kohavi, *Switching and Finite Automata Theory* , Tata McGraw-Hill, New Delhi.
2. Taub & Schilling, *Digital Integrated Circuits,* Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Moris Mano, *Digital Logic Design,* Prentice Hall of India, New Delhi.
2. Samuel.C.Lee & B.S.Sonde, *Digital Circuits & Logic Design,* Prentice Hall of India, New Delhi.
3. R.P. JAIN***, Modern Digital Electronics,*** Prentice Hall of India, New Delhi

EE 316 ELECTRICAL MACHINES – I LABORATORY

Class: **III/IV B.Tech. I Semester** Practicals:**3**
Branch: **EEE** *University Examination:* **50 marks**
Duration of University Examination: 3 **hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Determination of the magnetization characteristics and speed versus voltage curve separately excited D.C. generators.
2. Determination of the load characteristics of a separately excited D.C. Generator.
3. Determination of the load characteristics of a D.C. shunt generator.
4. Determination of torque speed characteristics of a D.C. shunt motor.
5. Retardation test on a D.C. shunt machine.
6. Determination of the torque speed characteristics of a D.C. Series Motor.
7. Performance characteristics of two identical transformers by conducting back to back test. (Sumpners test).
8. Performance test on a scot connected transformer.
9. Performance test on a V-connected transformer.
10. Parallel Operation of Transformers.

EC 317 INTEGRATED CIRCUITS LAB

Class: **III/IV B.Tech. I Semester** *Practicals:***3Hrs.**
Branch: **E&I, EEE, ECE.** *Sessionals :* **25 Marks**
Duration of University Examination: **3 hours.** *University Examination :* **50 Marks**

LIST OF EXPERIMENTS

PART A

1. Realization of Boolean functions, HALF Adder using NAND/NOR gates.
2. Bit ripple counter using JK/TFFS.
3. 4 BIT shift register using DFFS
4. 4 Bit Ring and Johnson Counters
5. Verification of function table of Decade counter IC7490 And displaying O/P using decaders and D 7 Segment display.
6. (a) design of 4:1 MUX using lo gic gates and verification of its function table
7. (b) Realization of Boolean expressions using 8:1 MUX.

PART B

1. Measurement of OP Amp parameters
   - (i) Open Loop gain
   - (ii) I/P bias and offset currents
   - (iii) I/P offset voltage
   - (iv) Slew Rate and
   - (v) CMRR

2. Design and testing of OP Amp Integrator and Differentiator
3. Design and testing of precision rectifier
4. Design and testing of Astable multivibiator and monostable multivibrator using IC 555 timer
5. Design and testing of wien's Bridge oscillatox for required frequency using IC74

SCHEME OF INSTRUCTION AND EVALUATION
II SEMESTER OF III YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			EVALUATION SCHEME			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Practicals	Duration of Exam–hours	Max. Marks	Max. Marks	
HS 311	Management Economics and Accountancy	4	-	-	3	100	50	150
EE 313	Electrical Machines -II	3	1	-	3	100	50	150
EE 314	Power systems-I	3	1	-	3	100	50	150
EE 319	Control systems Engg..	3	1	-	3	100	50	150
EC 314	Linear Integrated Circuits	3	1	-	3	100	50	150
EC 318	Digital Electronics	3	1	-	3	100	50	150
EE 316	Electrical Machines Lab-I	-	-	3	3	50	25	75
EC 317	Integrated Circuits Lab	-	-	3	3	50	25	75
		19	5	6				1050

HS 311 MANAGEMENT ECONOMICS AND ACCOUNTANCY

Class: **III/IV B.Tech. I Semester** *Lectures:* **3**
Branch: **Common to All Branches.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

ECONOMICS

UNIT:I

Economics: Meaning, Definition, Scope: Micro and Macro. Assumptions and Methods. Usefulness**.** **(2Periods)**

Factors of Production: Meaning and Definition. Characteristics of Land Labour, Capital and Enterpreneurship. Division of Labour : Advantages and Disadvantages. Formation of Capital Forms of Business Organization: Sole Proprietaryship, Partnership Concern, Cooperative Societies Joint Stock Company. Types of Partners, Types of Joint Stock Companies. Merits and Demerits **(6Periods)**

MANAGEMENT

UNIT:II

Management: Meaning and Definition. Scope of Management- Principles of Management. Scientific Management: Definition, Characteristics and Criticism**.** **(4 Periods)**

Functions Of Management: Planning: Definition and Process. Organizing Definition of Organization: Characteristics andTypes. Principles of Organization. Departmentation: Meaning and Fundamentals of Departmentation, Centralisation And Decentralization: Definition: Features Merits and Demerits. Communication: Process of Communication, Channels, Media, and Barriers. **(10 Periods)**

UNIT:III

Staffing: Meaning and Functions of Personnel Management. Coordination: Definition, how to Achieve Effective Coordination. Controlling: Definition and Process**.** **(4 Periods)**

ACCOUNTANCY

UNIT:IV

Double Entry Book-Keeping : Definition. Journalization of Transactions. Ledger Posting and Balancing. Preparation of Trial Balance. **(10periods)**

Preparation of Final Accounts: Trading Account, Profit And Loss Account and Balance sheet(With Simple Adjustments) **(7 Periods)**

Reference Books:

1. Modern Economics Theory By K.K.Dewett.
2. Principles and Practice of Management By LM.Prasad.

3. Introduction To Accountancy BY T.S. Grewal.
4. Business Organization and Management Y.K.Bhushan.

EE 313 ELECTRICAL MACHINES – II

Class: **III/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE .** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **3-Phase Induction Motors**: Construction details, Types, Production of rotating magnetic field, Principle of operation, Equivalent circuit, Phasor diagram, torque equation, Slip torque characteristics, Effects & Change in supply voltage and supply frequency on torque and speed , Losses and efficiency, Testing, No load and Blocked Rotor test, Determination of equivalent circuit parameters, Pre determination of performance from equivalent circuit and circle diagrams
2. Methods of Starting, Direct on line, Star Delta, Autotransformer, Rotor resistance starters.
3. **Methods of speed control:** Pole changing , Cascading, Variable frequency Variable voltage, Rotor resistance , Rotor injected emf technique.
4. **Double cage induction motor**: Construction. Principle & operation, equivalent circuit characteristics and applications. **(9+3)**

UNIT – II

5. **Synchronous Generators**: Construction, Types, Winding factors, Production of emf – Harmonics, Armature reaction – Synchronous reactance – Phasor diagrams, Load characteristics OC and SC tests, Methods of predetermination of regulation by synchronous Impedance(EMF). MMF method, Potier(ZPF) and ASA methods, Simple theory of two reaction analysis and its application for the pre determination of regulation of alternator, Slip test, power angle characteristics, Synchronization and synchronizing power, parallel operation, Load sharing, operation on infinite bus bar, High frequency generation, Typical applications, short circuit transients in synchronous machines.

(9+3)

UNIT – III

6. **Synchronous Motors**: Principle of operation, Phasor diagrams, variables of current and power factor with excitation, Hunting and its application, Determination and pre determination V and $\wedge$ curves, excitation circles and pane circles, methods of starting Synchro condenser, Applications. **(9+3)**

UNIT – IV

7. **Single phase Induction Motors**: Principle & operation, Starting methods, Double revolved fixed theory, Equivalent circuit, Determination equivalent circuit parameters
8. **Special purpose machines :**Constructional features, principle & working characteristics and applications of Stepper motor,Brushless DC motor,Scharage motor,Reluctance

motor,Hystersis motor and Linear Induction motor **(9+3)**

TEXT BOOKS:

1. P.S. Bhimbhra, "ELECTRICAL MACHINARY" 5/e, Khanna Publishers.
2. P.S. Bhimbhra, "GENERALIZED THEORY OF ELECTRICAL MACHINES" , Khanna Publishers.
3. Mukhopadyaya , "ELECTRICAL MACHINES".

EE 314 POWER SYSTEMS – I

Class: **III/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch: **EEE .** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Conventional Energy Sources**: Hydroelectric Stations: Introduction, arrangement and location of hydroelectric station – Types of hydroelectric plant – Principle of working – power developed – layout of hydro power station: Steam power plant, Introduction – Selection of site – coal handling plant – Ash handling Plant – Steam generating Plant – Steam turbine & Generator – Cooling water systems: Nuclear Power Plant: Introduction to Nuclear reactors – Types of reactors – Location of Nuclear power plant; Gas turbine power plant: Introduction lay out of Gas turbine plant – Advantages, Combined cycle plants.

(9+3)

UNIT – II

2. **Non Conventional Energy Sources**: Tidal Power, Wind Power, Geo Thermal Power, Magento Hydro Dynamic Power, Solar Power.

3. **Economics of Power Generation**: Definitions, Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Load duration curve, Number and size of generating units, Base load and peak load plants, cost of Electrical energy, Fixed cost, Running cost, Tariffs. …

(9+3)

UNIT – III

4. **Insulators**: Types, Potential distribution over a string of suspension insulators, Factors affecting the distribution of voltage along the string insulators, Methods of equalizing potential string efficiency, Stringing charts, Testing of insulators.

5. **Corona**: Critical disruptive voltage, Corona loss, Line design based on corona, Disadvantage of corona, Radio interference, and Inductive interference between power and communication lines.

(9+3)

UNIT – IV

6. **Distribution Lines**: Distribution Systems, D.C. two wire and three wire systems. Single phase and three phase 3 wire and 4 wire AC systems – Comparison of efficiency, Kelvin's Law – Economic size of conductor.

7. **Transmission Lines**: Electrical Power system components – Elementary ideas of layout – Resistance and capacitance of transmission lines, single phase; and 3 phase lines with symmetrical and asymmetrical spacing, composite conductors – Transposition, bundled conductors, Effect of earth on capacitance, Mechanical design of transmission lines.

8**. Under Ground cables:** Electric stress in a cable-core cable-Grading of cables-cable capacitance-cable inductance-Dielectric loss and Heating

(9+3)

TEXT BOOKS :

1. C.L.Wadhwa, "ELECTRICAL POWER SYSTEMS". 3/e. New Age International Publishers.
2. C.L.Wadhwa, "GENERATION, DISTRIBUTION & UTILIZATION OF ELECTRICAL ENERGY". New Age International Publishers.
3. W.D. Stevenson, "ELEMENTS OF POWER SYSTEM ANALYSIS". 4/e McGraw Hill International Publishers.
4. A.T. Starr, "GENERATION, TRANSMISSION and DISTRIBUTION".
5. SYED A NASAR" ELECTRIC POWER SYSTEMS" McGRAW-HILL

REFERENCE BOOKS:

1. Soni, Gupta, Bhatnagar, "ELECTRICAL POWER".Dhanpat rai & sons
2. MV.Deshpande, "ELEMENTS OF POWER STATION DESIGN", 3/e Wheelers Publishers.

EE 319 CONTROL SYSTEM ENGINEERING

Class: **III/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:**1***
Branch: **EEE, E&I,ECE** *University Examination: **100 marks***
Duration of University Examination: **3 hours** *Sessionals: **50 marks***

UNIT – I

1. INTRODUCTION: (9+3)

Types of systems, Properties of systems, Linearity, Time-inverience, Stability, Causality. Open loop control system, Closed loop control system, Effect of Feedback on over all gain, Stability and Sensitivity.

2. MATHEMATICAL MODES OF PHYSICAL SYSTEMS:

Electrical, Mechanical and Electromechanical systems, Transfer function of physical systems by Block diagram reduction techniques and signal flow graphs, Drawing a signal flow graph from a block diagram.

UNIT – II

3. CONTROL SYSTEM COMPONENTS: (9+3)

AC and DC servomotors, Synchros, Tacho generator and Potentiometer.

4. TIME DOMAIN ANALYSIS:

Design specifications, Typical test signals, Time response of first order and of 2^{nd} order systems, Time domain specifications, Basic control actions like P, PI, PD, PID and derivative feedback, Steady State error and error constants, Routh Hurwitz Criterion, Concept of root locus and construction of root loci, Effects of adding poles and zeros.

UNIT – III

5. FREQUENCY DOMAIN ANALYSIS: (9+3)

Frequency response of closed loop systems, Specifications, Correlation between frequency and time domain specifications, Polar plots, Gain Margin and Phase Margin, Bode plots, Nyquist stability criterion, Relative stability using Nyquist stability criterion

UNIT – IV

6. STATE VARIABLE ANALYSIS OF CONTINUOUS SYSTEMS: (9+3)

Concepts of state, State variables and state model, Derivation of state model from transfer function, Diagonolization, Derivation of transfer function from state model, Solution of state equations, State transition matrix, Concept of Controllability and Observability.

7. COMPENSATION:

Elementary treatment of Compensation.

TEXT BOOKS

1. M. Gopal, *"Modern Control System Theory",* Wiley Eastern Publishers, New Delhi.
2. B.C. Kuo, *"Automatic Control Systems"* 7/e Prentice Hall of India. New Delhi.
3. K.Ogata, *" Modern Control Engineering"* Prentice Hall of India, New Delhi.

REFERENCES

1. I.J. Nagarth & M. Gopal, *"Control System Engineering",* New Age International Publishers, New Delhi.

EC 314 LINEAR INTEGRATED CIRCUITS

Class:III/IV B.Tech. I –Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours

Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT-I

Integrated circuits: Introduction, classification of Ics, Fabrication Techniques of Ics. Introduction to OPAMP: Introduction, Internal blocks of Op-Amps, Ideal & Practical characteristics of Op-Amps, Measurement of Op-Amp parameters, Analysis of Basic Inverting & Non-Inverting Amplifiers and voltage follower.

D.C. Characteristics of OPAMP: Open loop and closed loop frequency response, Op-Amp stability, Frequency compensation techniques. Ideal & Practical characteristics of IC-741.

UNIT-II

Applications of Operational Amplifiers: Summing and difference amplifiers, Integrator and differentiator, current to voltage and voltage to current converters, Instrumentation amplifier, sample and Hold circuit.

Non-Linear Applications: Precision Rectifiers – Half wave and full wave, log and antilog amplifiers.

Comparators and wave form generators: OPAMP comparators, Regenerative (Schmitt Trigger), R.C. phase shift and wiens bridge oscillators, Astable Mulitivibrator (Square wave generator) and Monostable Multivibrator.

UNIT-III

Active Filters: Introduction of filters, Ideal and Realistic frequency responses of various filters, Second Order filters: Analysis and design of I.G.M.F., V.C.V.S configuration of L.P.F, H.P.F., B.P.F. and notch filters.

Monolithic Timers and their applications: Introduction to IC 555 Timer, Functional Diagram, Design of Astable and Monostable multivibrators using 555timer.

UNIT-IV

Voltage regulators: Basic voltage regulator using Op-Amps, General purpose IC Regulator, uA723, Functional diagram, specifications, Design consideration of 723 as low & high voltage regulators. Current limit protection, current feed back, current bossting. Three terminal voltage (fixed) Regulators: Introduction and general features of three terminal regulators, Ic series of three terminal Regulators, their Design, current boosting.

Phase Locked Loops: Voltage controlled oscillator, Basic PLL operation, definitions related to PLL, Monolithic PLL and design considerations, transient response of PLL, typical PLL applications (FSK, AM detectors)

Analog multiplexers, DAC types (R-2R ladder weighted ladder and Inverted ladder), ADCs types (Successive Approximation, Dual-Slop, Flash types).

TEXT BOOKS:

1. Roy Choudhary, Shail Jain, Linear Integrated Circuits, New Age International, New Delhi.
2. Ramakant Gayakwad, Opamp and Linear Integrated Circuits, Pearson Education.
3. G.B. Clayton, Integrated Circuits & Applications, ELBS, Lodon.
4. Rodert F.Coughlin, Frederick F.Driscoll, Operational Amplifiers and Linear Integrated Circuits, Pearson Education, New Delhi.

REFERENCE BOOKS:

1. R.Botkar, Integrated Circuits, Khanna Publishers, New Delhi.
2. Franco, Integrated Circuits & Applications, McGraw Hill, New York.

EC 318 DIGITAL ELECTRONICS

Class:III/IV B.Tech. I –Semester | Lectures: 3
Branch: **Common to CSE, IT, EEE)** | University Examination: 100 marks
Duration of University Examination: 3 Hours | Sessionals: 50 marks

UNIT – I

Number Systems and Codes : Introduction to Number systems, Base conversion among different Number Systems, Signed number representation, Binary arithmetic, Use of 1's and 2's complement representation in Binary Number system

Introduction to Codes, Weighted and Non weighted codes, self complementing and reflecting codes, code conversion, Error detection and correction, Hamming codes.

Switching functions and minimization:

Basic laws of Boolean algebra, logical gates (block diagram representation), Boolean expressions, SOP and POS forms, realization of Boolean expressions with logic gates, simplification of Boolean expressions, Karnaugh map methods, Tabulation method. (**9+3)**

UNIT – II

Half Adder, Full Adder, Serial Adder, Parallel Adder, Carry look ahead Adder, BCD Adder, Subtractor, 1's and 2's complement Adder / subtractor.

Decoders, Seven segment LED displays, Encoders, Multiplexers, De MUX's realization of Boolean expression using MUX's and De MUX's. (**9**+3)

UNIT – III

Sequential circuits : RS, JK, D and T Flip Flops, use of direct inputs, shift registers, applications of shift registers, Ring counter, Johnson counter.

Ripple counters – Design of Mod-N ripple counters.

Synchronous sequential machines – state diagrams, state tables, design of synchronous sequential machines, design of Mod-N synchronous counters, Design of sequence detectors

(9+3)

UNIT – IV

Logic Families : Introduction to logic families. Description of the terms – Fan in, Fan out, Noise margin, Propagation delay, current sourcing, current sinking.

Study of RTL, DCTL, DTL, HTL, TTL, ECL, MOS, CMOS families. **(9+3)**

TEXT BOOKS:

1. Zvi. Kohavi, *Switching and Finite Automata Theory* , Tata McGraw-Hill, New Delhi.
2. Taub & Schilling, *Digital Integrated Circuits,* Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Moris Mano, *Digital Logic Design*, Prentice Hall of India, New Delhi.

2. Samuel.C.Lee & B.S.Sonde, *Digital Circuits & Logic Design*, Prentice Hall of India, New Delhi.

3. R.P. JAIN**, *Modern Digital Electronics,*** Prentice Hall of India, New Delhi

EE 316 ELECTRICAL MACHINES – I LABORATORY

Class: **III/IV B.Tech. I Semester** Practicals:**3**
Branch: **EEE** *University Examination:* **50 marks**
Duration of University Examination: 3 **hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Determination of the magnetisation characteristics and speed versus voltage curve a separately excited D.C. generators.
2. Determination of the load characteristics of a separately excited D.C. Generator.
3. Determination of the load characteristics of a D.C. shunt generator.
4. Determination of torque speed characteristics of a D.C. shunt motor.
5. Retardation test on a D.C. shunt machine.
6. Determination of the torque speed characteristics of a D.C. Series Motor.
7. Performance characteristics of two identical transformers by conducting back to back test. (Sumpners test).
8. Performance test on a scot connected transformer.
9. Performance test on a V-connected transformer.
10. Parallel Operation of Transformers.

EC 317 INTEGRATED CIRCUITS LAB

Class: **III/IV B.Tech. I Semester** *Practicals:***3Hrs.**
Branch: **E&I, EEE, ECE.** *Sessionals :* **25 Marks**
Duration of University Examination: **3 hours.** *University Examination :* **50 Marks**

LIST OF EXPERIMENTS

PART A

1. Realization of Boolean functions, HALF Adder using NAND/NOR gates.
2. Bit ripple counter using JK/TFFS.
3. 4 BIT shift register using DFFS
4. 4 Bit Ring and Johnson Counters
5. Verification of function table of Decade counter IC7490 And displaying O/P using decaders and D 7 Segment display.
6. (a) design of 4:1 MUX using lo gic gates and verification of its function table
7. (b) Realization of Boolean expressions using 8:1 MUX.

PART B

1. Measurement of OP Amp parameters
   - (i) Open Loop gain
   - (ii) I/P bias and offset currents
   - (iii) I/P offset voltage
   - (iv) Slew Rate and
   - (v) CMRR
2. Design and testing of OP Amp Integrator and Differentiator
3. Design and testing of precision rectifier
4. Design and testing of Astable multivibiator and monostable multivibrator using IC 555 timer
5. Design and testing of wien's Bridge oscillatox for required frequency using IC74

KAKATIYA UNIVERSITY:: WARANGAL

SCHEME OF INSTRUCTION AND EVALUATION

II SEMESTER OF III / IV B.TECH(EEE). DEGREE PROGRAMME

ELECTRICAL AND ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			EVALUATION SCHEME			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Practicals	Duration of Exam–hours	Max. Marks	Max. Marks	
OE 321	Open Elective	3	1	-	3	100	50	150
EI 322	Power Electronics	3	1	-	3	100	50	150
EE 324	Power Systems-II	3	1	-	3	100	50	150
EC 326	Digital Signal Processing	3	1	-	3	100	50	150
EI 323	Micro Processor and Micro Controllers	3	1		3	100	50	150
EE 327	Electrical Machines Lab-II	-	-	3	3	50	25	75
EI 328	Micro Processor and Micro Controllers Lab	-	-	3	3	50	25	75
EE 329	Control Systems Lab			3	3	50	25	75
		18	5	9				1125

Open Electives: **OE 321 A. Operations Research**
OE 321 B. Management Information Systems
OE 321 C. Entrepreneurship Development
OE 321 D. Forex & Foreign Trade

OE 321 (A) OPERATIONS RESEARCH

Course: **B.Tech. III/IV II Semester** Theory*:* **3 periods/week**
Branch *:* **Common to all branches**
External Examination: **3 Hours** External Evaluation: **100**
Internal Examination: **2 Hours** Internal Evaluation: **50**

UNIT-I (9)

Linear Programming: Mathematical Model, assumptions of linear programming, principles of simplex method. Applications. Duality, Dual simplex method, revised simplex method.

UNIT-II (9)

Non-linear Programming: Unconstrained Optimization techniques, Random search methods, Decent methods, Steepest Decent method, variable metric method. Constrained optimization techniques. Cutting plane method.

UNIT-III (9)

Dynamic programming: Introduction, Multistage decision process, linear programming as a case of dynamic programming. Computational procedures in dynamic programming.
Special type of linear programming: Special type of linear programming problems - Transportation problems - balanced and unbalanced transportation, time transportation problem. Assignment problem - special case of transportation.

UNIT-IV (9)

Queuing Theory: Description of Queuing Models and applicability. Birth and Death Processes, Single server models with Poisson input and exponential service. Multiple service queuing models.

SUGGESTED TEXT / REFERENCE BOOKS:

1. Handy.A.Taha, "Operation Research" 4th Edn, McMillan, 1984.
2. Kanthiswaroop, etal, Opertions Research, S.Chand & Sons, New Delhi.
3. V.K.Kapoor, "Operation Research" 5th Revd.Edn. S.Chand & sons,1990
4. J.C.Pant, Introduction Optimization, Jain Brothers, New Delhi.
5. S.S.Rao, Optimization Techniques, New Age International, New Delhi.
6. G.Hadley, Linear Programming, Addison Wesley, New Delhi.
7. Gillett, Introduction to Operations Research, Mc.Graw Hill New,Delhi

OE 321 (B) MANAGEMENT INFORMATION SYSTEMS

Course: **III/IV B.Tech II Semester** Theory: **3 Periods/week**
Branch**: Common to all branches** External Evaluation:**100**
External Examination: **3 Hours** Internal Evaluation: **50**
Internal Examination: **2 Hours**

UNIT–I (9)

Management Information Systems (MIS): MIS Concept, Definition, Role and Impact of MIS, MIS and Computer, MIS and Academics, MIS and the User.
Role and Importance of Management: Introduction and Approaches to Management, Functions of Manager, Managers and the Environment, Management as a Control System, Management by Exception, MIS – A Support to the Management.
Process of Management: Management Effectiveness, Planning, Organizing, Staffing, Coordinating and Directing, Controlling, MIS – A Tool for the Management Process.
Organization Structure and Theory: **Basic Model of Organization Structure, Modifications to the Basic Model of Organization Structure, Organizational Behavior, Organization as a System, MIS – Organization.**
Strategic Management of Business: The Concept of Corporate Planning, Essentiality of Strategic Planning, Development of the Business Strategies, Short Range Planning, Tools of Planning, MIS – Business Planning.

UNIT-II (9)

Decision Making: Decision Making Concepts, Decision Methods, Tools and Procedures, Behavioral Concepts in Decision Making, Organizational Decision Making, MIS and Decision Making Concepts.
Information: Information Concepts, Information – A Quality Product, Classification of the Information, Methods of Data and Information Collection, Value of the Information, General Model of a Human as an Information Processor, Summary of Information Concepts and their Implications, Organization and Information, MIS and the Information Concepts.
Systems: Systems Concepts, Systems Control, Types of System, Handling System Complexity, Post Implementation Problems in a System, MIS and System Concepts.
System Analysis and Design: Introduction, The Need for System Analysis, System Analysis of the Existing System, System Analysis of a New Requirement, System Development Model, Structured System Analysis and Design (SSAD), computer System Design, MIS and System Analysis.

UNIT-III (9)

Development of MIS: Development of Long Range Plans of the MIS, Ascertaining the Class of Information, Determining the Information Requirement, Development and Implementation of the MIS, Management of Quality in the MIS, Organization for Development of the MIS, MIS: The Factors of Success and Failure.
Choice of Information Technology: Introduction: Nature of IT Decision, Strategic Decision, Configuration Design, Evaluation, Information Technology Implementation Plan, Choice of the 'Information Technology' and the 'Management Information System'.
Applications in Manufacturing Sector: Introduction, Personnel Management, Financial Management, Production Management, Materials Management, Marketing Management,

Corporate Overview.

Applications in Service Sector: Introduction to the Service Sector, Creating a Distinctive Service, MIS Applications in Service Industry, MIS: Service Industry.

UNIT-IV

(9)

Decision Support Systems: Concept and Philosophy, DSS: Deterministic Systems, Artificial Intelligence (AI) System, Knowledge Based Expert System (KBES), MIS and the Role of DSS.

Technology of Information Systems: Introduction, Data Processing, Transaction Processing, Application Processing, Information System Processing, TQM of Information Systems, Human Factors and User Interface, Real Time Systems and Design, Programming Languages for System coding, CASE Tools.

Business Process Re-engineering (BPR): Introduction, Business Process, Process Model of Organisation, Value Stream Model of Organization, Business Process Delays, Relevance of the Information Technology, MIS and BPR.

Overview of Database Management Systems, Object Oriented Technologies, Client-Server Architecture, Networks.

Case Studies in MIS.

SUGGESTED TEXT / REFERENCE BOOKS*:*

1. W.S.Jawadekar, "Management Information Systems", Tata McGraw Hill, 2nd Edition, ISBN: 0 – 07 – 044575 - 3, 2003.
2. Robert Schultheis, Mary Sumner, "Management Information Systems – The Manager's View", Fourth Edition, Tata McGraw Hill, ISBN: 0 – 07 – 463879 – 3, 2003.
3. Robert G.Murdick, Joel E.Ross, James R.Clagget, "Information Systems for Modern Management", Third Edition, Prentice Hall of India, ISBN: 81 – 203 – 0397 – 0, 2002.
4. Gordon B.Davis, Margrethe H.Olson, "Management Information Systems", Second Edition, Tata McGraw Hill, ISBN: 0 – 07 – 040267 – 1, 2000.
5. Jerome Kanter, "Managing with Information", Fourth Edition, Prentice Hall of India, ISBN: 81 – 203 – 1012 – 8, 2003.

OE 321(C) ENTREPRENEURSHIP DEVELOPMENT

Course: **III/IV B.Tech II Semester** Theory: **3 Periods/week**
Branch: **Common to all branches**
External Examination: **3 Hours** External Evaluation: **100**
Internal Examination: **2 Hours** Internal Evaluation: **50**

UNIT-I (9)

Entrepreneurship: definition, Significance of Entrepreneurship. Role of Entrepreneurship in development advantages and limitations characteristics of a person to become an entrepreneur, human factor in Entrepreneurship, Motivation, Leadership qualities and the essential skills of communication etc., Role of women entrepreneurship, Agencies dealing with entrepreneurship and small scale Industries. Case studies of successful entrepreneurs. Identification of a variable business opportunity, Various methods.
Activity: Inputs from DIC, SFC, IIC & Nationalized Banks**.**

UNIT-II (9)

Business opportunity selection, Opportunities in various branches of Engineering. Sources of new ideas, New product, Service and Trade etc. Planning and Launching of an entrepreneurial activity. Screening, Feasibility studies and market survey. Forecasting the demand. Technical feasibility, Financial viability. Break even analysis. Preparation of preliminary and bankable project reports planning infrastructure, Raw materials and human resource, requirements, fiscal incentives. An introduction to patents process, Trade marks etc.
Activity: Visit to a small scale industry.

UNIT-III (9)

Project planning: Product planning and development process, Definition of a project, Sequential steps in executing the project, principles of layouts, Types of layouts, Factors influencing layouts. choosing an optimum layout suitable to the venture. Tenders, Call for quotations, Purchase orders, Procurement and installation of machinery and equipment, Utilities etc. Fundamentals of Production Management, PPC-Concepts, Functions, Long & short run problems. Marketing Management: Definition, Functions and Segments. Financial Management: Objectives & Functions
Activity: Interaction with Entrepreneurs in the field.

UNIT-IV (9)

Personal and Human resource management: Introduction, Definitions, Importance, Factors effecting Major functions of enterprise management. Selection, recruitment, training, placement, development, performance appraisal systems. Legal issues in Entrepreneurship, Intellectual property rights, Issues in setting up the organization.
Activity: Preparation of project report for variable business venture

SUGGESTED TEXT / REFERENCE BOOKS:

1. Robert D.Hisrich, Michael P. Peters, “Entrepreneurship”, Fifth Edition, Tata McGraw-Hill, 2002.
2. David H. Holt, Entrepreneurship New venture creation prentice hall of India.
3. Handbook for New Entrepreneurs, Entrepreneurship Development Institute of India, Ahmedabad.
4. T.R. Banga, Project Planning and Entrepreneurship Development, CBS Publishers, New Delhi.
5. Personnel efficiency in Entrepreneurship Development-A Practical Guide to Industrial Entrepreneurs, S. Chand & Co., New Delhi.

OE 321 (D) FOREX AND FOREIGN TRADE

Course**: III/IV B.Tech. II Semester** Theory: **3 Periods/week**
Branch**: Common to all Branches**
External Examination**: 3 Hours** External Evaluation**: 100**
Internal Examination**: 2 Hours** Internal Evaluation: **50**

UNIT-I

Business: Nature and Scope. Classification of Business Activities. Functions of Commerce & Trade. Business System: Characteristics and Components of Business System. Objectives of Business: Concept, Significance and Classification of Objectives. Objections against Profit Maximization Objective **(9)**

UNIT-II

Foreign Trade: Introduction of International Trade: Basic of External Trade. Special Problems of Foreign Trade.

Stages In Import Procedure. Stages In Export Procedure. Bill of Lading, Mate's Receipt, Certificate of Origin. State Trading Corporation of India. Export Credit and Guarantee Corporation. Minerals and Metals Trading Corporation of India. **(9)**

UNIT-III

Foreign Exchange: Meaning and Importance of Exchange Rate. Methods of Foreign Payments. The Demand And Supply of Foreign Exchange. The Equilibrium Rate of Foreign Exchange. Functions of Foreign Exchange Market. Determination of Foreign Exchange Rate Under Different Monetary Systems: Mint Policy Theory, Balance of Payment Theory. **(9)**

UNIT-IV

Objectives of Exchange Control: Characteristics – Advantages of Exchange Control – Methods of Exchange Controls. Intervention, Exchange Restriction; Multiple Exchange Rates; Exchange Clearing Agreements – Method of Operation – Exchange Clearing Agreements In Practice. Payments Agreements – Transfer Moratoria – Indirect Methods. Progress Towards Evaluation. Opposition To Exchange Control. **(9)**

SUGGESTED TEXT / REFERENCE BOOKS:

1. Macro Economics by M.L.Seth Lakshmi Narayan Agarwal, Hospital Road, AGRA – 3.
2. Money Banking, Trade & Finance by K.P.M. Sundaram Sultan Chand And Sons, 23, Daryaganj, New Delhi -110 002.
3. Monetary Theory by M.C. Vaish, Ratan Prakashan Mandir, Educational & University Publishers, 21, Dayanand Marg Darya Ganj, Delhi – 2.
4. Business Organization and Modern Management By Y.K.Bhushan
5. Business Organization and Management by S.A. Sherlekhar.
6. Macro Economics by P.N.Chopra. Kalyani Pubnlishers, 1/1, Rajinder Nagar, Ludhiana-141 008.
7. Business Organization & Management by C.B.Gupta Sultan And Sons Publishers, 23. Daryaganj, New Delhi – 110 002.

EE 322 POWER ELECTRONICS

Class: **III/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Characteristics of Power Devices**: Introduction of power semi conductor devices like SCR, DIAC, TRAIC, GTO, MOSFET, UJT, IGBT and their characteristics. Two transistor modes of SCR, protection of SCR against over voltages, over current and voltage and current transients.
2. **Gate Triggering circuits**, Resistance, Resistance – capacitance Trigger circuits, UJT as relaxation oscillator, series and parallel operation of SCRs, String efficiency, Different methods of forced communication Techniques. **9+3**

UNIT – II

3. **Phase controlled Rectifiers**: Phase Angle control Single phase three phase, halfwave, full wave, Half controlled and Fully controlled with and without free wheeling diodes for resistive and inductive loads, effect of source inductance, Dual converters, Power factor improvements. **9+3**

UNIT – III

4. **Choppers:** Basic circuit, step-up step-down, classification of choppers on the basis of various quadrants, chopper commutation, Jones and Morgan chopper.''
5. **Inverters:** Series inverter, parallel inverter, voltage source inverters, and current source inverters, 1-phase and 3-Phase bridge inverters. **9+3**

UNIT – IV

6. **AC Voltage Controllers:** Single Phase AC Controllers with R and RL loads, Three Phase AC Voltage Controllers with Star and Delta connected loads.
   Cyclo converters: Principle and operation of Single phase to single phase, single phase to 3-phase, 3-phase to 1-phase Cyclo converters.
7. **Industrial Applications**: Battery charger, Uninterruptible power supply, Switched mode power supply. **9+3**

TEXT BOOK:

1. M.D. Singh & K.B. Kanchandani, *Power Electronics*, Tata McGraw Hill, New Delhi.
2. M.H. Rashid, *Power Electronics,* Prentice Hall of India, New Delhi.
3. P.S. Bhimbra, *Power Electronics,* Khanna Publishers, New Delhi.
4. Vedam Subramanium, *Power Electronics.*

REFERENCE BOOKS:

1. P.C. Sen, *Power Electronics,* Tata McGraw Hill, New Delhi.

EE 324 POWER SYSTEMS – II

Class: **III/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Performance of transmission line**: Representation of transmission lines, Short transmission lines, Medium length lines, Nominal "T" and "∏" representation, Long transmission lines, Equivalent circuit representation of a long line; A,B,C,D constants, long lines, series (Tandam) and parallel networks, skin effect, proximity effect and Ferranti effect, Suge impedance loading, Power flow through transmission lines, Power circle diagrams. **(9+3)**

UNIT – II

2. **Voltage control**: Introduction, Methods of voltage control, Shunt, series compensation, tap changing transformers, Booster transformers, Synchronous phase modifiers, Determination of their capacities, analytical methods.
3. **Representation of Power systems**: Single line diagram, Impedance and reactance diagrams, per unit quantities, advantages of per unit systems. **(9+3)**

UNIT – III

4. **Symmetrical Components and fault calculations**: Significance of positive, negative, zero sequence components, Average 3-phase power in terms of symmetrical components. Sequence impedances and sequence networks for fault calculations, single line to ground (LG) fault, LL fault, LLG fault, LLLG fault, reactors and their location, short circuit capacity of a bus. **(9+3)**

UNIT – IV

5. **Traveling waves on transmission line**: Production of travelling waves, open circuited line, short circuited line, Line terminated through a resistance, line connected to a cable, reflection and refraction coefficients at a T-junction, Line terminated through a capacitance, attenuators of travelling waves.
6. **System Neutral grounding and insulation Co-ordination**: Introduction, ungrounded neutral system, arcing grounds. Advantages of neutral grounding .Methods of neutral grounding solid grounding, reactance grounding, Peterson coil grounding. Grounding transformer, choice of grounding, insulation co-ordination volt-time curves. **(9+3)**

TEXT BOOKS:

1. Wadhwa, C.L. "ELECTRICAL POWER SYSTEMS" Wiley Eastern Ltd. New Delhi. 1991
2. Stevenson W.D. "ELEMENTS OF POWER SYSTEM ANALYSIS" 4/e McGraw Hill International Publishers.
3. H.Cotton,Barbor, "TRANSMISSION and DISTRIBUTION of ELECTRIC ENERGY"

REFERENCE BOOK:

1. Sony, Gupta, Bhatnagar, "ELECTRIC POWER" Dhanpat Rai & Sons.
2. 2.THE Miller "Reactive power control in Electric systems"by John wiley &sons
3. 3.Modern power system Analysis-by I.J.Nagarath & D.P.Kothari Tata Mcgraw-hill publishing company.

EC 326 DIGITAL SIGNAL PROCESSING

Class:III/IV B.Tech. II–Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours
Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT-I

Basic Elements of Digital Signal Processing, Discrete Time Fourier Transform (DTFT): Definition of DTFT, Properties of DTFT, Magnitude and phase transfer function, steady state response of LTI System to a sinusoidal input,

Discrete Fourier Transform (DFT): Definition of DFT, Properties of DFT, Inverse Discrete Fourier Transform (IDFT), Relation between DTFT, DFT and z-transform.

Fast Fourier Transform (FFT): Computational Complexity of DFT, Introduction to FFT, Radix-2 FFT Algorithms, Decimation-in-time FFT Algorithm, Decimation-in-Frequency FFT algorithm,

UNIT-II

Infinite Impulse Response (IIR) Filters: Reliability of Ideal Filter, Introduction to IIR Filters, Methods of converting analog transfer function H(s) to its digital equivalent, Necessity of Filter Approximation, IIR Digital filter design using Butterworth Approximation, IIR Digital Filter Design using chebyshev approximation, comparison of Butterworth and Chebyshev filters.

UNIT-III

Finite Impulse Response (FIR) Filters: Introduction to FIR filters, Inherent stability of FIR filters, Linear phase in FIR filters, Design of linear phase FIR filters using windows, Rectangular window, Triangular window, Hamming window, Hanning window and Kaiser window. Design of Linear phase FIR filter using frequency sampling method. Comparison of IIR and FIR filters.

UNIT-IV

DSP Architecture: Introduction to Programmable Digital Signal Processors; MAC, Bus structures and memory access schemes, multiported memory, multiple access memory, VLIW architecture, Pipelining, addressing modes, on-chip peripherals.

Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic unit, registers, flags, on-chip memory and peripherals, assembly language instructions.

TEXT BOOKS:

1. John G.Proakis & D.G.Manolakis, Digital Signal Processing: Principles, Algorithms and Applications (PHI)
2. A.V.Oppenheim & R.W.Schafer, Discrete-Time Signal Processing (Pearson education, PHI)
3. Digital Signal Processors – B.Venkataramani, M. Bhaskar – TMH.

REFERENCE BOOKS:

1. Sanjit K.Mitra, Digital Signal Processing – A Computer Based Approach (TMH)
2. Lyons, Understanding DSP (Pearson Education)
3. Adreas Antanio, Digital filter Analysis and Design (TMH)
4. L.R. Rabiner & Bearnard Gold, Theory and Applications of Digital Signal Processing.(PHI).

EI 323 MICROPROCESSORS & MICRCONTROLLERS

Class:III/IV B.Tech. II –Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours
Lectures: 3
University Examination: 100 marks
Sessionals: 50 marks

UNIT – I

Evolution of Microprocessors, 8085 MPU Architecture, Concept of Memory Segmentation.
8086 Family Architecture: Organization of 8086 CPU, Segments registers, physical and logical addressing, Instruction set, Addressing Modes. (**9+3)**

UNIT – II

Assembly Language Programming: Assembler directives, simple Programming of 8086 Implementation of structures – If – Then, If-Then-else, while do, repeauntil time delays, strings, procedures, macros, pin configuration, Min/Max modes, timing diagrams.
(8+**3)**

UNIT – III

Interfacing with 8086: ADC, DAC interfacing, Interfacing of switches, Keyboards, LEDs, Stepper motor; CRT interface, interfacing through devices like 8255, 8257 and 8253. Interrupts & Priority interrupt controller 8259. (**9+3)**

UNIT – IV

8051 Microcontroller: Architecture, Instruction set, addressing modes, Assembly language Programming timers, I/o Ports, interrupts, serial ports, interfacing with LEDS Switches & Stepper Motor. Real Time Clock. (**10+3)**

TEXTBOOKS:

1. D.V.Hall, *Microprocessors & Interfacing,* Tata McGraw Hill, New Delhi.
2. Yuchangliu, Glen A.Gibson, *Microcomputer Systems. The 8086/8088 family, architecture, programming and design,* Prentice Hall of India, New Delhi.
3. Muhammed Ali Mazidi, *The 8051 Microcontrollers and Embedded systems,* Pearson, New Delhi.

REFERENCE BOOKS:

1. Kennet Ayala, *8086 Microprocessor: Programming & Interfacing with PC,* Penram Publications, Bombay.
2. Brey, *Advanced Microprocessors,* Prentice Hall of India, New Delhi.
3. Kennet Ayala, *The Microcontroller Architecture, Programming and Applications,* Penram Publications, Bombay.

EE 327 ELECTRICAL MACHINES – II LABORATORY

Class: **III/IV B.Tech. II Semester** ***Practicals***:**3**
Branch: **EEE** ***University Examination:*** **50 marks**
Duration of University Examination: *3* **hours** ***Sessionals:*** **25 marks**

LIST OF EXPERIMENTS

1. Pre Determination of Voltage regulation of an alternator by synchronous impedance method and magneto-motive force method.
2. Pre Determination of Voltage regulation of an alternator by zero power factor method.
3. Determination of direct and quadrature axis of synchronous reactance of a synchronous machine.
4. Load test on an alternator.
5. Load sharing by two alternators running in parallel.
6. Determination "V" curves of a synchronous motor.
7. Performance characteristics of a single phase induction motor.
8. Performance characteristics of a stepper motor.
9. Speed Control of induction motor by pole changing method
10. Pre Determination of the performance characteristics of 3-phase induction Motor.
11. Speed Control of a slip-ring induction motor by rotor impedance control (Ward Leonard Control Method)
12. Performance characteristics of a squirrel cage induction motor at different frequencies.

EI 328 MICROPROCESSORS & MICROCONTROLLERS LAB

Class:III/IV B.Tech. II –Semester
Branch: ECE, E&I, EEE
Duration of University Examination: 3 Hours
Practicals: 3
University Examination: 50 marks
Sessionals: 25 marks

LIST OF EXPERIMENTS

Assembly Language Programming on 8086 Microprocessor

1. Study of 8086 kits
2. Finding Sum, Average, Multiplication.
3. Sorting (a) Ascending (b) Descending.
4. Transfer of bytes from DS to ES
5. Code Conversions (i) BCD to Binary (ii) Binary to BCD (iii) Binary to ASCII
6. String Comparison
7. Generation of time Delays – counters

   Interfacing with 8086
8. Wave form Generation using DAC modules (i) Square wave (ii) Sawtooth (iii) Triangular.
9. Stepper Motor interfacing
10. ADC interfacing
11. LED/LCD interfacing.
12. Traffic Controller

    ALP on 8031/51 Micro Controllers.
13. Study of Micro Controller kits, Assembly Language Programming
14. Multiplication, Division
15. Sorting
16. Code Conversion
17. Time delays – Counters
18. Stepper motor, LED, switches – interfacing.

TEXT BOOKS:

1. D.V.Hall, Microprocessors & Interfacing, Tata McGraw Hill, New Delhi.

EE 329 CONTROL SYSTEM LABORATORY

Class: **III /IV B.Tech. II Semester**
Branch: **E.E.E.**
Duration of University Exam: **3 Hrs.**

Practicals: **3 Hrs**
University Exam: **50 Marks**
Sessionals: **25 Marks**

LIST OF EXPERIMENTS

1. Study of speed-torque characteristics of d.c servomotor.
2. Study of speed-torque characteristics of 2-Φ a.c servomotor.
3. Study of pid controller.
4. Closed loop &open loop control of 3-Φ induction motor.
5. Study of synchro transmitter and receiver
6. Study of lead-lag network unit.
7. Closed loop&open loop control of d.c motor
8. Study of second order system response.
9. State space model for classical transfer
10. Function using matlab package
11. Obtaining the root locus and bode plots using matlab package

SCHEME OF INSTRUCTION AND EVALUATION
I SEMESTER OF IV YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			Scheme of Evaluation			Total Marks
		Lectures	Tutorials	Drawing/ Practical	External Evaluation		Sessionals	
					Duration of Exam	Max. Marks	Max. Marks	
EE 411	Power System Operation and Control	3	1	-	3 Hrs	100	50	150
EE 412	Utilization of Electrical Energy	3	1	-	3 Hrs	100	50	150
EE 413	Power Semi Conductor Drives	3	-	-	3 Hrs	100	50	150
EE 414	Professional Elective - I	3	1	-	3 Hrs	100	50	150
EE 415	Switch Gear & Protection	3	1	-	3 Hrs	100	50	150
EE 416	Power Electronics & Drives Lab	-	-	3	3 Hrs	50	25	75
EE417	Digital Simulation Lab	-	-	3	3 Hrs	50	25	75
EE-418	Project Work			3			50	50
		15	4	9				950

Professional Elective – I:

EE-414(A) - Neural Networks & Fuzzy Logic
EE-414(B) – High Voltage Engineering
EE-414(C) – Unified Theory of Electrical Machines
EE-414(D) -- FACTS
EE-414(E) – Advanced Control Systems

EE 411 POWER SYSTEM OPERATION AND CONTROL

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Load flow studies**: Introduction,Bus classification,Nodal admittance matrix, Load flow equations, Interactive methods –Gauss, Gauss seidel and Newton Raphson methods. Newton decoupled and Fast decoupled. Merits and Demerits of these methods, system data for load flow study. **(9+3)**

UNIT – II

2. **P - Q Control**: Effect of Synchronous machine excitation, Power angle of synchronous machines, Specifications of Voltages, capacitor banks, control by transformers, Introduction to static VAR compensators.
3. **Economic Operation of Power Systems:** Distribution of load between units with in a plant, transmission loss as a function of plant generation, calculation of loss coefficients, distribution of load between plants. Unit commitment- Introduction , constraints in unit commitment problems. **(9+3)**

UNIT – III

4. **Load Frequency control**: Introduction, Load frequency problem, Megawatt frequency (or P-F) control channel, Megavar voltage (or Q – V) control channel. Dynamic interaction between P-F and Q-V loops, Mathematical model of speed governing system, turbine models division of power system into control areas, P-F control of single control area (the uncontrolled and controlled cases) P-F control of two area systems (the uncontrolled and controlled cases). **(9+3)**

UNIT – IV

5. **Power System Stability**: The stability problem, steady state stability limit,Expression using ABCD parameters, steadt state stability of synchronous machine. transient stability, swing equation, equal area criterian of stability and its further applications, step by step solution swing equatioin, some factors affecting transient stability & Methods of improving stability . Concept of Dynamic stability –effect of excitation on generator power limits.

TEXT BOOKS:

1. W.D. Stevenson, "ELEMENTS OF POWER SYSTEMS ANALYSIS".TMH
2. Olle I Elgerd, "ELECTRIC ENERGY SYSTEM THEORY" Tata McGraw Hill Publishers.
3. Peter.W.Sauer & M.A.Pai **"Power System Dynamics & stability."**Pearson. edu
4. E.W.Kimbark " Power system stability " vol-1&III .John wiley & sons edition.
5. P.M. Anderson , A.A..Found "power system control & stability " Galgortia publications, vol-I edition.
6. Economic operation of power systems – by L.K.Kirchmayer wiley Eastern ltd.

REFERENCE BOOKS:

1. C.L.Wadhwa, "ELECTRICAL POWER SYSTEMS".Khanna Publishers
2. Generation operation and control of power system by Allen wood & Woolen berg.TMH

EE 412 UTILIZATION OF ELECTRICAL ENERGY

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Electric Traction: Systems of electric traction, Transmission of drive, Mechanics of train movement, Speed-time curves, Effect of speed, Acceleration and distance and schedule, Power and energy output from driving axles, Specific energy output, series-parallel method of speed control, shunt-bridge transition, collection of current, third rail over head wires, part two graph collections, different types of electric braking, reverse current, rheostat and regenerative braking, counter current braking of AC and DC motors. **(9+3)**

UNIT – II

Industrial Utilization: Introduction, Factors governing selection of Electric Motors, Nature of electric supply, Types of drives, Nature of loads, Standard Ratings of Motors, Choice of ratings of Motors, Types of Motors used in industrial Drives, Motors for particular service. **(9+3)**

UNIT –III

Electric Heating: Elementary principle of heat transfer, Stefan's law, electric furnaces, Resistance furnace, design of heating, losses and efficiency – construction and working of different types of induction furnaces – Dielectric heating Arc furnaces, control equipment.
Welding: Types of welding, Resistance, Gas and Arc welding, Characteristics of Carson and metallic Are welding, Comparison (Excluding electronics controls) **(9+3)**

UNIT – IV

Illumination: Introduction, Laws of Illumination, Light production by excitation, Gas discharge lamps, Fluorescent lamps, ultra violet lamps, Arc lamps, Filament lamps, Polar curves, Effect of voltage variation, Basic principles of Light control, Types and design of Lighting schemes, lighting calculations, flood lighting and street lighting, Factory lighting.
Power factor correction: Introduction, Disadvantages of a low Power factor, Causes of low power factor, Power factor improvement, Power factor correction by Static Capacitors, Economics of PF improvement, Most economical Power factor when K W demand is constant, Most economical Power factor when KVA demand is constant. **(9+3)**

TEXT BOOKS:

1. E.Openshaw Taylor, "UTILIZATION OF ELECTRIC ENERGY" Orient Longman
2. H.Partab, "UTILIZATION OF ELECTRICAL ENERGY" Dhanpat Rai & Sons.
3. J.B.Gupta "A COURSE IN ELECTRIC POWER" S.K.Kataria &Sons

REFERENCE BOOKS:

1. T.Starr,"GENERAL TRANSMISSION & UTILIZATION"
2. C.L.Wadhwa, "GENERATION,UTILIZATION and DISTRIBUTION of ELECTRICAL ENERGY" New age International Publishers.
3. Soni Gupta Bhatnagar, "A COURSE IN ELECTRICAL POWER" Dhanpat Rai & Sons.
4. B.L.Theraja & A.K.Theraja "TRANSMISSION,DISTRIBUTION & UTILIZATION" S.Chand.

EE 413 POWER SEMICONDUCTOR DRIVES

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Fundamentals of Electric Drives**: Electric Drives, advantages of electric drives, parts of electric drives, choice of electric drives, status of D.C. drives and A.C. drives.starting, Braking,speedcontrol of AC and DC motors
2. **Dynamics of Electric drives**: Fundamental torque equations, types of load, Quadrant diagram of speed-Torque characteristics, Dynamics of load torque combinality, steady state stability and Transient stability of an Electric drives. Load equalization. Calculation of time and energy loss in Transient operation, Drive specifications. **(9+3)**

UNIT – II

Control of D.C. Drives

3. **Rectifier control of dc drives**: Controlled rectifier circuits, braking operation of rectifier controlled separately excited dc motor, single phase and three phase half and fully controlled rectifier fed separately excited dc motor ,multi quadrant operation of fully controlled rectifier fed separately excited dc motor.
4. **Chopper control of dc drives** : chopper control of separately excited and series dc motors , multi quadrant control of chopper fed motors **(9+3)**

UNIT – III

Control of Induction Motor Drives

5. **AC Voltage Controllers**: control of induction motor by AC voltage controllers.
6. **Frequency controlled Induction motor drives**: control of Induction motor by Voltage Source Inverter (VSI), Current Source Inverter (CSI), Current controlled PWM inverters and cyclo converters.
7. **Slip power controlled wound-rotor induction motor drives:** static rotor resistance control, static scherbius drives, krammer drives. **(9+3)**

UNIT – IV

Control of Synchronous Motor Drives

8. Operation of cylindrical rotor synchronous motor from VSI and CSI, self controlled Synchronous Motor Drives using cyclo converters. **(9+3)**

TEXT BOOKS:

1. G.K. Dubey, “Fundamentals of Electrical Drives”, Narosa Publishers, New Delhi. 1988
2. N.K. De and P.K. Sen, “Electrical Drives”, Prentice Hall of India, New Delhi. 1999
3. G.K. Dubey, “Power Semiconductor Drives”, Narosa Publishers, New Delhi. 1988

REFERENCE BOOKS:

1. Vedam Subrahmanyam, “Thyristor Control of Electrical Drives”, Tata McGraw Hill, New Delhi. 1988.
2. B.K. Bose “Modern Power Electronics & A.C Drives’.Pearson .edu
3. P.S.Bimbhra “ Power Electronics” Khanna publishers.

EE414(A) – NEURAL NETWORKS & FUZZY LOGIC

Class: **IV/IV B.Tech. I Semester** *Lectures:***3**
Branch: **EEE** *University Examination:***100marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Biological Neural Networks: Neuron Physiology, Neuronal Diversity, Specifications of the brain, They Eye's Neural Network.
Concepts of Artificial Neural Networks: Neural Attributes, Modeling, Basic Model of Neuron, Learning in Artificial Neural Networks, Characteristics of ANNs, ANN Parameters, ANN Topologies, ANN adaptability, The stability Plasticity Dilemma. **9**

UNIT – II

Neural Network Paradigms: McCulloch – Pitts Model, The perception, ADALINE and MADALINE Models, Winner – Takes – All Learning algorithm, Back-propagation Learning Algorithm, Cerebellum Model Articulation Controller (CMAC), Adaptive Resonance Theory (ART) paradigm, Hopfield Model, Competitive Learning Model, Memory – Type paradigm, Linear Associative Memory, Real – Time Models, Linear Vector Quantization, Self-organizing Map, Probabilistic Neural Network, Radial Basis function, Time-Delay Neural Net, Congnitron and Neo congnitron Models, Simulated Annealing, Boltzmann Machine. **9**

UNIT – III

Fuzzy Logic: Propositional Logic, The Membership function, Fuzzy logic, Fuzzy Rule Generation, Defuzzification of Fuzzy Logic, Time – Dependent Fuzzy Logic, Crisp logics, Temporal Fuzzy logic (TFL), Time Invariant Membership function, Time-variant Membership function, Intervals, Semilarge Intervals, Interval operators, Temporal Fuzzy logic syntax, Applying Temporal Fuzzy operators, Defuzzification of Temporal Fuzzy logic, Applicability of TFL in communication systems **9**

UNIT – IV

Fuzzy Neural Networks: Fuzzy Artificial Neural Network (FANN), Fuzzy Neural Example, Neuro-Fuzzy control, Traditional control, Neural control, Fuzzy control, Fuzzy – Neural control.
Applications: Signal Processing, Image Data Processing, Hand written characteristics Recognition, Visual Image Recognition, Communication systems, Call processing, Switching, Traffic control Intelligent control, Optimization techniques. **9**

TEXT BOOK:

1. Stamatios V. Kartalopoulos, *Understanding Neural Networks & Fuzzy Logic*, Prentice Hall of Inida, (IEEE Press), New Delhi.
2. Simon Haykin "Neural Networks a Comprehensive foundation". Pearson .edu

REFERENCE BOOKS:

1. Hassoun, *Fundamentals of Artificial Neural Networks*, Prentice Hall of India, New Delhi.
2. Anderson, *Introduction to Neural Networks*, Prentice Hall of India, New Delhi.
3. Kosko, *Neural Networks and Fuzzy Systems*, Prentice Hall of India, New Delhi

EE 414(B) – HIGH VOLTAGE ENGINEERING
(EE 414 Professional Elective – I)

Class: **IV/IV B.Tech. I Semester** *Lectures:***3**
Branch: **EEE.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Breakdown Mechanism of Solids and Liquids**: Introduction, Intrinsic Breakdown, Electro Mechanical Breakdown, Thermal Breakdown, Breakdown of Solid dielectrics in practice, Chemical and Electro Chemical Deterioration and Breakdown, Breakdown due to Treeing and Tracking, Breakdown due to Internal discharges, Breakdown in composite dielectrics,
2. Break down of liquids as Insulators, Pure Liquids and commercial liquids, Conduction and Breakdown in commercial liquids – Suspended particle theory, cavitation and the Bubble theory, Thermal mechanism of the Breakdown, Stressed volume theory.
3. **Mechanism of Breakdown of Gases**, Townsend's First Ionization coefficient, Cathode processor, Secondary effects, Townsend's Second Ionization coefficient, Townsend's Breakdown Mechanism, Experimental Determination of coefficients $\propto$ and γ Breakdown in Electronegative Gases, Steamer or Kanal Mechanism of Breakdown, Paschen's Law, Penning Effect, Breakdown in Non uniform fields and Corona Discharges, Time – Lag, Practical considerations in using Gases for Insulation purposes, Vacuum Insulation. (**9)**

UNIT – II

4. **Generation of High D.C.&A.C, Voltages and Currents**: Halfwave rectifier circuit, Voltage doubler circuits, Cockroft-Walton Voltage multiplier circuit, Electrostatic Generator, VandeGraff Generator, Generation of High AC voltages, Cascaded Transformers, Resonant Transformer, Generation of High frequency AC High voltages, Generation of Rectangular current pulses, Tripping control of Impulse Generator.
5. **Definition of Impulse currents & voltages:** Impulse voltage Generator circuits any two type, Marx's multi stage voltage generator,tripping control of impulse voltage generator,Generation of switching surges,definition of impulse current wave forms,impulse current generator, (**9)**

UNIT – III

6. **Measurement of High Voltage DC, AC and Impulse Currents & Voltages**: Measurement of High D.C. voltages – High ohm series Resistance, Resistance potential Divider, R-C capacitive voltage divider, Generating Voltmeter
7. Series capacitance voltmeter, CVT, Electrostatic voltmeters, Peak reading a.c. voltmeters (Chubb – Fortescue method) Spharical Measurements (Spherical gaps) for High D.C. and AC voltages, Impulse voltage, Measurement of High AC, D.C. and Impulse currents, Hall Generators for D.C. current Measurements, Resistive shunts, Bipolar Strip shunt, Coaxial Tubular shunt, Squirrel cage shunts, C.R.O. for Impulsive voltage and current Measurements. (**9)**

UNIT – IV

8. **High Voltage Testing Techniques**: Principle of Insulation co-ordination on H.V. and EHV Power System, Power frequency and Impulse Testing of Isolators, Bushings, Cables and Transformer, Testing of Insulators and circuit breakers, Testing of Surge Divertor. **(9)**

TEXT BOOKS:

1. M.S.Naidu, V.Kamaraju, "HIGH VOLTAGE ENGINEERING" Tata McGraw Hill
2. C.L. Wadhwa, "HIGH VOLTAGE ENGINEERING", New Age International.

REFERENCE BOOKS:

1. Kuffel & Abdulla, "HIGH VOLTAGE ENGINEERING"
2. Zangel & Kuffel, "HIGH VOLTAGE ENGINEERING"

EE 414(C) UNIFIED THOERY OF ELECTRICAL MACHINES
(EE 414 Professional Elective – I)

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Theory of Transformation**: Basic Machine, Conventional, the basic two pole machine, voltage and torque equation of the basic electrical machine, Vector and matrix power, Matrix form of performance equation, Concept of equivalance of mmf invariance of power, Active linear transformation, Orthogonality, Passive transformations, Concept of equivalent circuit and vector diagram. **(9+3)**

UNIT – II

2. **Phase Transformation of 3-Phase Induction Motor:** Reference phase transformation of induction motor, stator reference frame, , equations in state variable from.
3. **Phase Transformation of Synchronous Motor:** Reference phase transformation of synchronous motor, rotor reference frame, Equations in State variable form. **(9+3)**

UNIT – III

4. **DC Machines:** Mathematicl model for DC seperately excited motor, DC series motor, DC copound motor, Transferfunction approach for these motors. **(9+3)**

UNIT – IV

5. 1- Phase Commutated motors, series motors, repulsion motor, 1-Phase motors.
6. Steady State balance operation induction motor voltage equation , equivalent circuit, steady state torque analysis, symmetrical component transformation and application to induction motor, un balnced operation**.** **(9+3)**

TEXT BOOKS:

1. P.C. Krause, "ANALYSIS OF ELECTRICAL DRIVES", Tata McGraw Hill, New Delhi.
2. P.S. Bhinbra, " GENERALIZED CIRCUIT THEOTY OF ELECTRICAL MACHINES"
3. Vedam Subramaniam, " THYRISTOR CONTROL OF ELECTRIC DRIVES"

REFERENCE BOOKS:

1. AdKINS, "GENERALISED MACHINE THEORY"
2. Kimbark, "POWER SYSTEM STABILITY VOL-III".

EE 414 (D) FLEXIBLE AC TRANSMISSION SYSTEMS

Class: **IV / IV B.Tech. I Semester** *Lectures:***3,**
Branch: **EEE .** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

POWER TRANSMISSION CONTROL: Introduction, Fundamentals of ac power transmission, Transmission problems and needs, FACTS controllers, FACTS control considerations, Basic functions of power electronics, Power semiconductor devices for high power converters, Static power converters, AC controlled-based structures **(9)**

UNIT – II

SHUNT COMPENSATION: SVC AND STATCOM:- Introduction, STATCOM configuration, control, applications. Introduction, Principles of operation, configuration and control of SVC. **(9)**

UNIT – III

SERIES COMPENSATION: Intriduction, principles of operation, applications of TCSC for damping of electromechanical oscillations. Applications of TCSC, TCSC Layout and protection, Principles of operation of SSSC. **(9)**

UNIT – IV

PHASE SHIFTER: Introduction, principles of operation of a phase shifter, applications.
UNIFIED POWER FLOW CONTROLLER:-Introduction, Basic operating principles and characteristics, control and dynamic performance`. **(9)**

TEXT BOOKS:

1. "Flexible AC Transmission Systems", IEE Power and Energy Series.
2. "Understanding Facts Concepts", HINGORANI, NARAIN G, IEEE – PRESS.

EE 414E ADVANCED CONTROL SYSTEMS

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Controllability and observability: Tests for continuous time systems for controllability and observability-time varying case, minimum energy control, time invariant case, principle of duality, controllability and observability from Jordan canonical form and other canonical forms.

Stability: Stability in the sense of Lyapunov.Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for the linear continuous time autonomous systems.

UNIT – II

Model control: Effect of state feedback on controllability and observability. Pole placement by feedback. Full order observer and reduced order observer. Deadbeat control by state feedback. Deadbeat observers.

UNIT – III

Optimum control: Formulation of optimal control problem, Minimum time, Minimum energy, and Minimum fuel problems. State regulator problem. Output regulator problem. Tracking problem.
Calculus of variations approach: Minimization of functionals of single function. Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints.

UNIT –IV

Dynamic programming: Multistage decision process in discrete time principle of causality. Principle of invariant imbedding. Principle of optimality. Multistage decision process in continuous time. Computation of optimal control policy in discrete time control systems with state and control quantization.

TEXT BOOKS:

1. Modern Control System Theory-by M.Gopal, New, New age International Publishers, 2nd edition, 1996.
2. Distributed Computer Control Systems by S.S.Lamba and V.P.Singh.

REFERENCE BOOKS:

1. Modern control engineering by K.Ogata, PHI, 3rd edition, 1998.
2. Digital Control and State Variable Methods by M.Gopal, TMH, 1997.

EE 415 SWITCH GEAR & PROTECTION

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Switch Gear and Circuit Breakers**: Introduction, principle of circuit Interruption, short circuit studies in power systems, circuit breakers, types and characteristics, circuit breaker rating, Restriking voltage, transient, characteristics of restriking voltage, circuit breaker operating mechanism, Air-break, circuit breakers, oil circuit breakers, Air-blast circuit breaker, Vacuum circuit breakers, SF_6 circuit breakers Modification of circuit breaker duty by shunt resistors, HVDC circuit breaking, Design of circuit breakers, Testing of circuit breakers, Selection of circuit breaker, Types of switch gear, AC indoor switch gear, Medium voltage a.c. switch gear, medium voltage AC H.R.C. fuses applications. **(9+3)**

UNIT – II

2. **Protection Relays**: Basic ideas of relay protection, Need for protection relaying in power systems, Basic requirements of protective relaying. Principles and characteristics of protective relaying, Classification of relays, Theory of application of relays, principal types of Electro magnetic relays, Theory of Induction relay torque, General equations of Comparators, over current relays, Instantaneous over current relay, Directional relays, Distance relays, differential relay. **(9+3)**

UNIT – III

3. **Static Relays**: Basis for Static relay development, classification of static relays, basic components of static relay, comparators, Amplitude comparators, Phase comparators. Co-incidence type phase comparator, Over current relay, differential protection, and static distance protection. **(9+3)**

UNIT – IV

4. **Protection**: Protection of transmission line with distance relays, over current and differential relays, Unit protection of transmission, Bus protection, Generation protection with differential relays, Earth fault relays, Miscellaneous faults and protection. Transformer protection with differential relays, earth fault relays, Buchlog relay.Horngaps, surge divertors, Rod gaps, Ground rods, Ground wires. **(9+3)**

TEXT BOOKS:

1. Badhri Ram, "SWITCHGEAR & PROTECTION" New Age International Ltd. New Delhi.
2. C.L. Wadhwa, " POWER SYSTEM ANALYSIS"
3. B.R. Gupta , "POWER SYSTEM ANALYSIS"

REFERENCE BOOKS:

1. Ravindranath & Chander, "SWITCH GEAR & PROTECTION" Wiley Easter Ltd.
2. Sunil S.Rao "SWITCH GEAR & PROTECTION" S.Chand & Co., New Delhi.

EE 416 POWER ELECTRONICS & DRIVES LABORATORY

Class: **IV/IV B.Tech. I Semester** *Practicals*:**3**
Branch: **EEE** *University Examination:* **50 marks**
Duration of University Examination: 3 **hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Determination of static characteristics of a SCR, MOSFET, IGBT.
2. Determination of characteristics of UJT, Design of UJT oscillator circuit and UJT verification of its properties.
3. Determination of Edc and Idc of half wave and full wave rectifiers with R and RL loads.
4. Performance of a single-phase inverter circuit and its verification.
5. Design of a SCR circuit for DC motor control.
6. Performance of a chopper circuit.
7. Determination of speed – torque characteristics of DC servo motor.
8. Determination of transient and frequency response of a D.C. servo system.
9. Determination of transient and frequency response of an A.C. servo system.
10. Measurement of transfer function using TFA.
11. Determination of speed – torque characteristics of AC servo meter
12. Performance of 1-Phase voltage controllers for R and RL loads.

EE 417 DIGITAL SIMULATION LABORATORY

Class: **IV/IV B.Tech. I Semester** *Practicals:***3Hrs.**
Branch: **EEE** *Sessionals :* **25 Marks**
Duration of University Examination: **3 Hrs** *University Examination:* **50 Marks**

LIST OF EXPERIMENTS

(Experiments are to be conducted in the areas of POWER SYSTEMS, POWER ELECTRONIC CIRCUITS & MACHINES using Software like MATLAB, VHDL / View Logic, PSPICE/ PSIM/ MIPOWER etc.)

POWER SYSTEMS:

1. SIMULATION OF

1 .1 Load flow analysis
1.2 Short Circuit Study
1.3. Transient stability
1.4. Relay Co-Ordination
1.5. Long term Demand forecast.

POWER ELECTRONICS:

2. SIMULATION OF

2.1 Motor Drive Module for adjustable drives & Motion Control
2.2 Digital Control Module for Z-domain Digital Control System.
2.3 Simcoupler Module for Co-Simulation with MAT LAB/Simulink.

PSPICE:

3. SIMULATION OF :

3.1 RC, RL, RLC Circuit
3.2 Rectifiers
  3.1 Half wave
  3.2 Full wave
  3.3 Simulation of 1-Φ inverter circuits.
3.4 Simulation of step up & step down choppers.

MATLAB:

4. SIMULATION OF :
4.1 Simulation of PI,PID,PID Controllers
4.2 Load frequency Control
4.3 Frequency Response
4.4 Pole Zero Plots

SCHEME OF INSTRUCTION AND EVALUATION
II SEMESTER OF IV YEAR OF 4-YEAR B.TECH. DEGREE PROGRAMME

ELECTRICAL & ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			Scheme of Evaluation			Total Marks
		Lectures	Tutorials	Drawing/ Practical	External Evaluation		Sessionals	
					Duration of Exam	Max. Marks	Max. Marks	
EE 411	Power System Operation and Control	3	1	-	3 Hrs	100	50	150
EE 412	Utilization of Electrical Energy	3	1	-	3 Hrs	100	50	150
EE 413	Power Semi Conductor Drives	3	-	-	3 Hrs	100	50	150
EE 414	Professional Elective - I	3	1	-	3 Hrs	100	50	150
EE 415	Switch Gear & Protection	3	1	-	3 Hrs	100	50	150
EE 416	Power Electronics & Drives Lab	-	-	3	3 Hrs	50	25	75
EE 417	Digital Simulation Lab	-	-	3	3 Hrs	50	25	75
EE 418	Project Work			3			50	50
	Total	**15**	**4**	**9**				**950**

Professional Elective – I:

EE-414(A) - Neural Networks & Fuzzy Logic
EE-414(B) – High Voltage Engineering
EE-414(C) – Unified Theory of Electrical Machines
EE-414(D) -- FACTS
EE-414(E) – Advanced Control Systems

EE 411 POWER SYSTEM OPERATION AND CONTROL

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Load flow studies**: Introduction,Bus classification,Nodal admittance matrix, Load flow equations, Interactive methods –Gauss, Gauss seidel and Newton Raphson methods. Newton decoupled and Fast decoupled. Merits and Demerits of these methods, system data for load flow study. **(9+3)**

UNIT – II

2. **P - Q Control**: Effect of Synchronous machine excitation, Power angle of synchronous machines, Specifications of Voltages, capacitor banks, control by transformers, Introduction to static VAR compensators.
3. **Economic Operation of Power Systems:** Distribution of load between units with in a plant, transmission loss as a function of plant generation, calculation of loss coefficients, distribution of load between plants. Unit commitment-Introduction, constraints in unit commitment problems. **(9+3)**

UNIT – III

4. **Load Frequency control**: Introduction, Load frequency problem, Megawatt frequency (or P-F) control channel, Megavar voltage (or Q – V) control channel. Dynamic interaction between P-F and Q-V loops, Mathematical model of speed governing system, turbine models division of power system into control areas, P-F control of single control area (the uncontrolled and controlled cases) P-F control of two area systems (the uncontrolled and controlled cases). **(9)**

UNIT – IV

5. **Power System Stability**: The stability problem, steady state stability limit,Expression using ABCD parameters, steadt state stability of synchronous machine. transient stability, swing equation, equal area criterian of stability and its further applications, step by step solution swing equatioin, some factors affecting transient stability & Methods of improving stability . Concept of Dynamic stability –effect of excitation on generator power limits.

TEXT BOOKS:

1. W.D. Stevenson, "ELEMENTS OF POWER SYSTEMS ANALYSIS".TMH
2. Olle I Elgerd, "ELECTRIC ENERGY SYSTEM THEORY" Tata McGraw Hill Publishers.
3. Peter.W.Sauer & M.A.Pai **"Power System Dynamics & stability."**Pearson. edu
4. E.W.Kimbark " Power system stability " vol-1&III .John wiley & sons edition.
5. P.M. Anderson , A.A..Found "power system control & stability " Galgortia publications, vol-I edition.
6. Economic operation of power systems – by L.K.Kirchmayer wiley Eastern ltd.

REFERENCE BOOKS:

1. C.L.Wadhwa, "ELECTRICAL POWER SYSTEMS".Khanna Publishers
2. Generation operation and control of power system by Allen wood & Woolen berg.TMH

EE 412 UTILIZATION OF ELECTRICAL ENERGY

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Electric Traction: Systems of electric traction, Transmission of drive, Mechanics of train movement, Speed-time curves, Effect of speed, Acceleration and distance and schedule, Power and energy output from driving axles, Specific energy output, series-parallel method of speed control, shunt-bridge transition, collection of current, third rail over head wires, part two graph collections, different types of electric braking, reverse current, rheostat and regenerative braking, counter current braking of AC and DC motors. **(9+3)**

UNIT – II

Industrial Utilization: Introduction, Factors governing selection of Electric Motors, Nature of electric supply, Types of drives, Nature of loads, Standard Ratings of Motors, Choice of ratings of Motors, Types of Motors used in industrial Drives, Motors for particular service. **(9+3)**

UNIT –III

Electric Heating: Elementary principle of heat transfer, Stefan's law, electric furnaces, Resistance furnace, design of heating, losses and efficiency – construction and working of different types of induction furnaces – Dielectric heating Arc furnaces, control equipment.
Welding: Types of welding, Resistance, Gas and Arc welding, Characteristics of Carson and metallic Are welding, Comparison (Excluding electronics controls) **(9+3)**

UNIT – IV

Illumination: Introduction, Laws of Illumination, Light production by excitation, Gas discharge lamps, Fluorescent lamps, ultra violet lamps, Arc lamps, Filament lamps, Polar curves, Effect of voltage variation, Basic principles of Light control, Types and design of Lighting schemes, lighting calculations, flood lighting and street lighting, Factory lighting.
Power factor correction: Introduction, Disadvantages of a low Power factor, Causes of low power factor, Power factor improvement, Power factor correction by Static Capacitors, Economics of PF improvement, Most economical Power factor when K W demand is constant, Most economical Power factor when KVA demand is constant. **(9+3)**

TEXT BOOKS:

1. E.Openshaw Taylor, "UTILIZATION OF ELECTRIC ENERGY" Orient Longman
2. H.Partab, "UTILIZATION OF ELECTRICAL ENERGY" Dhanpat Rai & Sons.
3. J.B.Gupta "A COURSE IN ELECTRIC POWER" S.K.Kataria &Sons

REFERENCE BOOKS:

1. T.Starr,"GENERAL TRANSMISSION & UTILIZATION"
2. C.L.Wadhwa, "Generation, Utilization and Distribution of Electrical Energy" New age International Publishers.
3. Soni Gupta Bhatnagar, "A Course In Electrical Power" Dhanpat Rai & Sons.
4. B.L.Theraja & A.K.Theraja "Transmission,Distribution & Utilization" S.Chand.

EE 413 POWER SEMICONDUCTOR DRIVES

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Fundamentals of Electric Drives: Electric Drives, advantages of electric drives, parts of electric drives, choice of electric drives, status of D.C. drives and A.C. drives.starting, Braking,speedcontrol of AC and DC motors

Dynamics of Electric drives: Fundamental torque equations, types of load, Quadrant diagram of speed-Torque characteristics, Dynamics of load torque combinality, steady state stability and Transient stability of an Electric drives. Load equalization. Calculation of time and energy loss in Transient operation, Drive specifications. **(9+3)**

UNIT – II

Control of D.C. Drives

Rectifier control of dc drives: Controlled rectifier circuits, braking operation of rectifier controlled separately excited dc motor, single phase and three phase half and fully controlled rectifier fed separately excited dc motor ,multi quadrant operation of fully controlled rectifier fed separately excited dc motor.

Chopper control of dc drives : chopper control of separately excited and series dc motors , multi quadrant control of chopper fed motors **(9+3)**

UNIT – III

Control of Induction Motor Drives

AC Voltage Controllers: control of induction motor by AC voltage controllers.

Frequency controlled Induction motor drives: control of Induction motor by Voltage Source Inverter (VSI), Current Source Inverter (CSI), Current controlled PWM inverters and cyclo converters.

Slip power controlled wound-rotor induction motor drives: static rotor resistance control, static scherbius drives, krammer drives. **(9+3)**

UNIT – IV

Control of Synchronous Motor Drives

Operation of cylindrical rotor synchronous motor from VSI and CSI, self controlled Synchronous Motor Drives using cyclo converters. **(9+3)**

TEXT BOOKS:

1. G.K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishers, NewDelhi. 1988.
2. N.K. De and P.K. Sen, "Electrical Drives", Prentice Hall of India, NewDelhi. 1999
3. G.K. Dubey, "Power Semiconductor Drives", Narosa Publishers, NewDelhi. 1988.

REFERENCE BOOKS:

1. Vedam Subrahmanyam, "Thyristor Control of Electrical Drives", Tata McGraw Hill, New Delhi. 1988.
2. B.K. Bose "Modern Power Electronics & A.C Drives'.Pearson .edu
3. 3.P.S.Bimbhra " POWER ELECTRONICS" Khanna publishers.

EE414A NEURAL NETWORKS & FUZZY LOGIC

Class: **IV/IV B.Tech. I Semester** *Lectures:***3**
Branch: **EEE** *University Examination:***100marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Biological Neural Networks: Neuron Physiology, Neuronal Diversity, Specifications of the brain, They Eye's Neural Network.
Concepts of Artificial Neural Networks: Neural Attributes, Modeling, Basic Model of Neuron, Learning in Artificial Neural Networks, Characteristics of ANNs, ANN Parameters, ANN Topologies, ANN adaptability, The stability Plasticity Dilemma. **(9)**

UNIT – II

Neural Network Paradigms: McCulloch – Pitts Model, The perception, ADALINE and MADALINE Models, Winner – Takes – All Learning algorithm, Back-propagation Learning Algorithm, Cerebellum Model Articulation Controller (CMAC), Adaptive Resonance Theory (ART) paradigm, Hopfield Model, Competitive Learning Model, Memory – Type paradigm, Linear Associative Memory, Real – Time Models, Linear Vector Quantization, Self-organizing Map, Probabilistic Neural Network, Radial Basis function, Time-Delay Neural Net, Congnitron and Neo congnitron Models, Simulated Annealing, Boltzmann Machine. (**9)**

UNIT – III

Fuzzy Logic: Propositional Logic, The Membership function, Fuzzy logic, Fuzzy Rule Generation, Defuzzification of Fuzzy Logic, Time – Dependent Fuzzy Logic, Crisp logics, Temporal Fuzzy logic (TFL), Time Invariant Membership function, Time-variant Membership function, Intervals, Semilarge Intervals, Interval operators, Temporal Fuzzy logic syntax, Applying Temporal Fuzzy operators, Defuzzification of Temporal Fuzzy logic, Applicability of TFL in communication systems **(9)**

UNIT – IV

Fuzzy Neural Networks: Fuzzy Artificial Neural Network (FANN), Fuzzy Neural Example, Neuro-Fuzzy control, Traditional control, Neural control, Fuzzy control, Fuzzy – Neural control.
Applications: Signal Processing, Image Data Processing, Hand written characteristics Recognition, Visual Image Recognition, Communication systems, Call processing, Switching, Traffic control Intelligent control, Optimization techniques. **9**

TEXT BOOK:

1. Stamatios V. Kartalopoulos, *Understanding Neural Networks & Fuzzy Logic*, Prentice Hall of Inida, (IEEE Press), New Delhi.
2. Simon Haykin "Neural Networks a Comprehensive foundation". Pearson .edu

REFERENCE BOOKS:

1. Hassoun, *Fundamentals of Artificial Neural Networks*, Prentice Hall of India, New Delhi.
2. Anderson, *Introduction to Neural Networks*, Prentice Hall of India, New Delhi.
3. Kosko, *Neural Networks and Fuzzy Systems*, Prentice Hall of India, New Delhi

EE 414(B) – HIGH VOLTAGE ENGINEERING
(EE 414 Professional Elective – I)

Class: **IV/IV B.Tech. I Semester** *Lectures:***3**
Branch: **EEE.** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Breakdown Mechanism of Solids and Liquids: Introduction, Intrinsic Breakdown, Electro Mechanical Breakdown, Thermal Breakdown, Breakdown of Solid dielectrics in practice, Chemical and Electro Chemical Deterioration and Breakdown, Breakdown due to Treeing and Tracking, Breakdown due to Internal discharges, Breakdown in composite dielectrics,
Break down of liquids as Insulators, Pure Liquids and commercial liquids, Conduction and Breakdown in commercial liquids – Suspended particle theory, cavitation and the Bubble theory, Thermal mechanism of the Breakdown, Stressed volume theory.
Mechanism of Breakdown of Gases, Townsend's First Ionization coefficient, Cathode processor, Secondary effects, Townsend's Second Ionization coefficient, Townsend's Breakdown Mechanism, Experimental Determination of coefficients $\propto$ and γ Breakdown in Electronegative Gases, Steamer or Kanal Mechanism of Breakdown, Paschen's Law, Penning Effect, Breakdown in Non uniform fields and Corona Discharges, Time – Lag, Practical considerations in using Gases for Insulation purposes, Vacuum Insulation. (**9)**

UNIT – II

Generation of High D.C.&A.C, Voltages and Currents: Halfwave rectifier circuit, Voltage doubler circuits, Cockroft-Walton Voltage multiplier circuit, Electrostatic Generator, VandeGraff Generator, Generation of High AC voltages, Cascaded Transformers, Resonant Transformer, Generation of High frequency AC High voltages, Generation of Rectangular current pulses, Tripping control of Impulse Generator.
Definition of Impulse currents & voltages: Impulse voltage Generator circuits any two type, Marx's multi stage voltage generator,tripping control of impulse voltage generator,Generation of switching surges,definition of impulse current wave forms,impulse current generator. (**9)**

UNIT – III

Measurement of High Voltage DC, AC and Impulse Currents & Voltages: Measurement of High D.C. voltages – High ohm series Resistance, Resistance potential Divider, R-C capacitive voltage divider, Generating Voltmeter
Series capacitance voltmeter, CVT, Electrostatic voltmeters, Peak reading a.c. voltmeters (Chubb – Fortescue method) Spharical Measurements (Spherical gaps) for High D.C. and AC voltages, Impulse voltage, Measurement of High AC, D.C. and Impulse currents, Hall Generators for D.C. current Measurements, Resistive shunts, Bipolar Strip shunt, Coaxial Tubular shunt, Squirrel cage shunts, C.R.O. for Impulsive voltage and current Measurements. **9**

UNIT – IV

High Voltage Testing Techniques: Principle of Insulation co-ordination on H.V. and EHV Power System, Power frequency and Impulse Testing of Isolators, Bushings, Cables and Transformer, Testing of Insulators and circuit breakers, Testing of Surge Divertor. **(9)**

TEXT BOOKS:

1. M.S.Naidu, V.Kamaraju, “HIGH VOLTAGE ENGINEERING” Tata McGraw Hill
2. C.L. Wadhwa, “HIGH VOLTAGE ENGINEERING”, New Age International.

REFERENCE BOOKS:

1. Kuffel & Abdulla, “HIGH VOLTAGE ENGINEERING”
2. Zangel & Kuffel, “HIGH VOLTAGE ENGINEERING”

EE 414(C) UNIFIED THOERY OF ELECTRICAL MACHINES
(EE 414 Professional Elective – I)

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Theory of Transformation**: Basic Machine, Conventional, the basic two pole machine, voltage and torque equation of the basic electrical machine, Vector and matrix power, Matrix form of performance equation, Concept of equivalance of mmf invariance of power, Active linear transformation, Orthogonality, Passive transformations, Concept of equivalent circuit and vector diagram. **(9+3)**

UNIT – II

2. **Phase Transformation of 3-Phase Induction Motor:** Reference phase transformation of induction motor, stator reference frame, , equations in state variable from.
3. **Phase Transformation of Synchronous Motor:** Reference phase transformation of synchronous motor, rotor reference frame, Equations in State variable form. **(9+3)**

UNIT – III

4. **DC Machines:** Mathematicl model for DC seperately excited motor, DC series motor, DC copound motor, Transferfunction approach for these motors. **(9+3)**

UNIT – IV

5. 1- Phase Commutated motors, series motors, repulsion motor, 1-Phase motors.
6. Steady State balance operation induction motor voltage equation , equivalent circuit, steady state torque analysis, symmetrical component transformation and application to induction motor, un balnced operation**.** **(9+3)**

TEXT BOOKS:

1. P.C. Krause, "ANALYSIS OF ELECTRICAL DRIVES", Tata McGraw Hill, New Delhi.
2. P.S. Bhinbra, " GENERALIZED CIRCUIT THEOTY OF ELECTRICAL MACHINES"
3. Vedam Subramaniam, " THYRISTOR CONTROL OF ELECTRIC DRIVES"

REFERENCE BOOKS:

1. AdKINS, "GENERALISED MACHINE THEORY"
2. Kimbark, "POWER SYSTEM STABILITY VOL-III".

EE 414 (D) FLEXIBLE AC TRANSMISSION SYSTEMS

Class: **IV / IV B.Tech. I Semester** *Lectures:***3,**
Branch: **EEE .** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

POWER TRANSMISSION CONTROL: Introduction, Fundamentals of ac power transmission, Transmission problems and needs, FACTS controllers, FACTS control considerations, Basic functions of power electronics, Power semiconductor devices for high power converters, Static power converters, AC controlled-based structures **(9)**

UNIT-II

SHUNT COMPENSATION: SVC AND STATCOM:- Introduction, STATCOM configuration, control, applications. Introduction, Principles of operation, configuration and control of SVC. **(9)**

UNIT-III

SERIES COMPENSATION: Intriduction, principles of operation, applications of TCSC for damping of electromechanical oscillations. Applications of TCSC, TCSC Layout and protection, Principles of operation of SSSC. **(9)**

UNIT-IV

PHASE SHIFTER: Introduction, principles of operation of a phase shifter, applications
UNIFIED POWER FLOW CONTROLLER:- Introduction, Basic operating principles and characteristics, control and dynamic performance`. (9)

TEXT BOOKS:

1. FLEXIBLE AC TRANSMISSION SYSTEMS :IEE POWER AND ENERGY SERIES
2. UNDERSTANDING FACTS CONCEPTS: HINGORANI,NARAIN G,IEEE PRESS

EE 414E ADVANCED CONTROL SYSTEMS

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Controllability and observability: Tests for continuous time systems for controllability and observability-time varying case, minimum energy control, time invariant case, principle of duality, controllability and observability from Jordan canonical form and other canonical forms.

Stability: Stability in the sense of Lyapunov.Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for the linear continuous time autonomous systems.

UNIT – II

Model control: Effect of state feedback on controllability and observability. Pole placement by feedback. Full order observer and reduced order observer. Deadbeat control by state feedback. Deadbeat observers.

UNIT – III

Optimum control: Formulation of optimal control problem, Minimum time, Minimum energy, and Minimum fuel problems. State regulator problem. Output regulator problem. Tracking problem.
Calculus of variations approach: Minimization of functionals of single function. Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints.

UNIT –IV

Dynamic programming: Multistage decision process in discrete time principle of causality. Principle of invariant imbedding. Principle of optimality. Multistage decision process in continuous time. Computation of optimal control policy in discrete time control systems with state and control quantization.

TEXT BOOKS:

1. Modern Control System Theory-by M.Gopal, New, New age International Publishers, 2nd edition, 1996.
2. Distributed Computer Control Systems by S.S.Lamba and V.P.Singh.

REFERENCE BOOKS:

1. Modern control engineering by K.Ogata, PHI, 3rd edition, 1998.
2. Digital Control and State Variable Methods by M.Gopal, TMH, 1997.

EE 415 SWITCH GEAR & PROTECTION

Class: **IV/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Switch Gear and Circuit Breakers**: Introduction, principle of circuit Interruption, short circuit studies in power systems, circuit breakers, types and characteristics, circuit breaker rating, Restriking voltage, transient, characteristics of restriking voltage, circuit breaker operating mechanism, Air-break, circuit breakers, oil circuit breakers, Air-blast circuit breaker, Vacuum circuit breakers, SF_6 circuit breakers Modification of circuit breaker duty by shunt resistors, HVDC circuit breaking, Design of circuit breakers, Testing of circuit breakers, Selection of circuit breaker, Types of switch gear, AC indoor switch gear, Medium voltage a.c. switch gear, medium voltage AC H.R.C. fuses applications. **(9+3)**

UNIT – II

2. **Protection Relays**: Basic ideas of relay protection, Need for protection relaying in power systems, Basic requirements of protective relaying. Principles and characteristics of protective relaying, Classification of relays, Theory of application of relays, principal types of Electro magnetic relays, Theory of Induction relay torque, General equations of Comparators, over current relays, Instantaneous over current relay, Directional relays, Distance relays, differential relay. **(9+3)**

UNIT – III

3. **Static Relays**: Basis for Static relay development, classification of static relays, basic components of static relay, comparators, Amplitude comparators, Phase comparators. Co-incidence type phase comparator, Over current relay, differential protection, and static distance protection. **(9+3)**

UNIT – IV

4. **Protection**: Protection of transmission line with distance relays, over current and differential relays, Unit protection of transmission, Bus protection, Generation protection with differential relays, Earth fault relays, Miscellaneous faults and protection. Transformer protection with differential relays, earth fault relays, Buchlog relay.Horngaps, surge divertors, Rod gaps, Ground rods, Ground wires. **(9+3)**

TEXT BOOKS:

1. Badhri Ram, "SWITCHGEAR & PROTECTION" New Age International Ltd. New Delhi.
2. C.L. Wadhwa, " POWER SYSTEM ANALYSIS"
3. B.R. Gupta , "POWER SYSTEM ANALYSIS"

REFERENCE BOOKS:

1. Ravindranath & Chander, "SWITCH GEAR & PROTECTION" Wiley Easter Ltd.
2. Sunil S.Rao "SWITCH GEAR & PROTECTION" S.Chand & Co., New Delhi.

EE 416 POWER ELECTRONICS & DRIVES LABORATORY

Class: **IV/IV B.Tech. I Semester** Practicals:**3**
Branch: **EEE** *University Examination:* **50 marks**
Duration of University Examination: 3 **hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Determination of static characteristics of a SCR, MOSFET, IGBT.
2. Determination of characteristics of UJT, Design of UJT oscillator circuit and UJT verification of its properties.
3. Determination of Edc and Idc of half wave and full wave rectifiers with R and RL loads.
4. Performance of a single-phase inverter circuit and its verification.
5. Design of a SCR circuit for DC motor control.
6. Performance of a chopper circuit.
7. Determination of speed – torque characteristics of DC servo motor.
8. Determination of transient and frequency response of a D.C. servo system.
9. Determination of transient and frequency response of an A.C. servo system.
10. Measurement of transfer function using TFA.
11. Determination of speed – torque characteristics of AC servo meter
12. Performance of 1-Phase voltage controllers for R and RL loads.

EE 417 DIGITAL SIMULATION LABORATORY

Class: **IV/IV B.Tech. I Semester** *Practicals:***3Hrs.**
Branch: **EEE** *Sessionals :* **25 Marks**
Duration of University Examination: **3 Hrs** *University Examination:* **50 Marks**

LIST OF EXPERIMENTS

(Experiments are to be conducted in the areas of POWER SYSTEMS, POWER ELECTRONIC CIRCUITS & MACHINES using Software like MATLAB, VHDL / View Logic, PSPICE/PSIM/MIPOWER etc.)

POWER SYSTEMS

1. SIMULATION OF :

1 .1 Load flow analysis
1.2 Short Circuit Study
1.3. Transient stability
1.4. Relay Co-Ordination
1.5. Long term Demand forecast.

POWER ELECTRONICS

2. SIMULATION OF :

2.1 Motor Drive Module for adjustable drives & Motion Control
2.2 Digital Control Module for Z-domain Digital Control System.
2.3 Simcoupler Module for Co-Simulation with MAT LAB/Simulink.

PSPICE:

3. SIMULATION OF :

3.1 RC, RL, RLC Circuit
3.2 Rectifiers
- 3.1 Half wave
- 3.2 Full wave
- 3.3 Simulation of 1-Φ inverter circuits.

3.4 Simulation of step up & step down choppers.

MATLAB

4. SIMULATION OF :

4.1 Simulation of PI,PID,PID Controllers
4.2 Load frequency Control
4.3 Frequency Response
4.4 Pole Zero Plots

KAKATIYA UNIVERSITY: WARANGAL
SCHEME OF INSTRUCTION AND EVALUATION

IISEMESTER OF IV YEAR 4-YEAR B.TECH . DEGREE COURSE
ELECTRICAL AND ELECTRONICS ENGINEERING

Course No.	Course	Hours of Instruction Per week			Scheme of Evaluation			Total Marks
		Lectures	Tutorials	Drawing / Practical	External Evaluation		Sessionals	
					Duration of Exam hours	Max. Marks	Max. Marks	
EE 421	Computer Methods in Power System	4	-	-	3 Hrs	100	50	150
EE 422	Professional Elective -II	4		-	3 Hrs	100	50	150
EE 423	Professional Elective -III	4		-	3 Hrs	100	50	150
EE 424	Power Systems Laboratory	-	-	3	3 Hrs	50	25	75
EE 426	Project Work	-	-	6	Viva –Voce & Report	100	150	250
		12	-	9				775

Professional Elective II

EE-422(A) Data Structures
EE-422(B) Computer Organization
EE-422(C) VLSI Design
EE-422(D) Advanced Digital Signal Processing
EE-422 (D) Digital Control Systems

Professional Elective III

EE-423(A) Reliability Engineering
EE-423(B) HVDC Transmission
EE-423(C) Non-Conventional Energy Sources
EE-423(D) Design of Electrical Machines
EE-423(E) EHV AC Transmission

EE 421 COMPUTER METHODS IN POWER SYSTEMS

Class: **IV/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

1. **Network Modeling**: Impedance and admittance matrices, Graphs, Element to node incidence matrix A, Bus incidence Matrix A, Primitive network, Network matrix, Y bus and Z bus, formulation of network matrices, inversion of matrix using partial inversion technique, Algorithm approach of building 3-phase balance network, Π representation of off nominal transformers. **(9+3)**

UNIT – II

2. **Short Circuit Studies**: Introduction, Physical Assumptions, Three phase balanced networks and faults, Fault in impedance form, Fault in admittance form, General fault representation in phase quantities, Short circuit calculations for balanced networks using Z bus, Review of load flow methods. **(9+3)**

UNIT – III

3. **Transient Stability Analysis**: Derivation of swing equation, Representation of synchronous Machines, Modeling of network and load, Numerical methods, Euler Method, Runge-Kutta Method, Fast stability analysis, Predicting stability, Equal area criterion, Long duration transient Stability study, Dynamic stability study **(9+3)**

UNIT – IV

4. **Power System State Estimation Techniques:** Introduction, weighted least square techniques and weighted least square for DC state estimation **(9+3)**

TEXT BOOKS:.

1. Stagg and E.L.Abaid, "COMPUTER METHODS IN POWER SYSTEM ANALYSIS".
2. Allenwood

REFERENCE BOOKS:

1. R.N.Dhar, "COMPUTER AIDED POWER SYSTEM OPERATION & ANALYSIS".
2. M.A. Pai, "COMPUTER TECHNIQES IN POWER SYSTEM ANALYSIS"

EE422 A - DATA STRUCTURES

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3**
Branch: **EEE** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

Introduction: Algorithms, Program, Data Structures Definitions, Design and Analysis steps, Time and Storage Analysis.
Arrays: Ordered Lists, Sparse matrices, representation of arrays.
Stacks and Queues: Fundamentals, Evaluation of expression Multiple stacks and Queues 9

UNIT – II

Linked Lists: Singly linked lists – Stacks and Queues, Polynomial addition equivalent relations – Sparse matrices – Doubly linked lists – Dynamic storage, Management Generalized lists – Garbage collection and compaction. 9

UNIT – III

Trees: Terminology Binary Trees – Representation Traversal, Threaded Binary Trees, Binary tree representation of trees, application.
Graphs: Terminology and representations. Traversals. Connected components and spanning tress, Shortest paths 9

UNIT – IV

Internal Searching and Sorting Techniques: Searching – Binary search. Fibbonacci Search etc. Sorting Techniques – Insertion, quick, 2-way merge, Heap and multi-key sorting.

***Table Processing*:** Static and Dynamic tree tables – Height Balanced trees. Balanced factor. It's Definition, Hash tables – Hashing function, Overflow handling. 9

(All above topics with intuitive notion of complexity of algorithm)

TEXT BOOKS:

1. **Horowitz and Sahni,** *Fundamentals of Data Structures in C++ - III Ed.,* **Galgotia, 1991.**

REFERENCE BOOKS:

1. **Seymour Lipschutz**, *Theory and Problems of Data Structures*, **Schaum's series, McGraw Hill.**
2. **Tremblay and Sorenson,** *An Introduction to Data Structures with applications, II ed.,* **McGraw Hill,1985**.
3. **Knuth, D.H,** *Fundamental Algorithms: The art of computer programming, Vol.I,* **Addison Wesley, 1973, Narsoa Publishing House Fifth reprint,1990**.
4. **Allen M.Weiss,** *Data Structures in C.*

EE 422B COMPUTER ORGANIZATION

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3**
Branch: **EEE** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

1. Basic Structure of Computer Hardware and Software:
Functional units – Basic operational concepts – Bus structures – Software performance – Distributed computing – Historical perspective.
2. Addressing methods and machine program sequencing:
Basic concepts – Main memory operations – Instructions – Instruction sequencing – Addressing modes – Assembly language – Basic input output operations – Stacks and queues – Subroutines.
3. THE PROCESSING UNIT: Basic concepts – Execution of a complete instruction – Hard wired control – Microprogrammed control.

UNIT – II

4. INPUT-OUTPUT ORGANISATION : Accessing I/O devices – Interrupts – Direct Memo Access – Programmed I/O.
5. THE MEMORY : Basic concepts – Semiconductor RAM memories –ROM – Speed, 8i and Cost – Cache memory – addressing mapping- virtual memories/

UNIT –III

6. ARITHEMATIC: Number representation – Adding of positive numbers – Fast address Signed addition and Subtraction – Arithmetic and branching conditions – Multiplication of positive numbers – Signed operand multiplication –Integer division – Floating point numbers at operations.

UNIT-IV

7. COMPUTER PERIPHERALS: I/O devices – Online storage – System performance considerations.
8. Introduction to CISC, RISC – Motorola and Power PC processor families.

TEXT BOOKS:
1. **V.C.Hamacher** – *Computer Organisation* – **(TMGH) 4th edition**.

REFERENCE BOOKS:
1. **Morris Mano** – *Computer System Architecture* **- (PHI)1991**
3. **John P.Hayes** – *Computer System Architecture and Organization* – **(MGH) 1998.**

EE 422 (C) VLSI DESIGN
(Professional Elective-I)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3** *Tutorials:* **1**
*Branch:**E.E.E.*** *University Exam. :* **100 marks**
Duration of University Examination: **3 hours.** *Sessionals :* **50 marks**

UNIT – I

1.Introduction to MOS Technology: MOS and related VLSI Technology, Basic MOS transistors, enhancement and Depletion mode transistor action n MOS fabrication, CMOS fabrication, Bi CMOS Technology.

2.Basic Electrical properties of MOS AND Bi CMOS circuits. MOS and Bi CMOS circuit design processor. **9+3**

UNIT – II

3.Basic Circuit Concepts: Sheet resistance, Area capacitances of layers, capacitance calculations, The delay units, Inverter delays, Driving large capacitive loads, propagation delays, wiring capacitances, scaling of MOS circuits. **9+3**

UNIT – III

4.Sub System Design & Layout: Architectural issues, Switch logic, Gate logic, The inverter, Examples of structured design, clocked sequential circuits, sub system design process **9+3**

UNIT – IV

5. Illustration of Design Process: Computational elements, Memory, register, timing considerations, Introduction to GaAs technology, Introduction to various HDLS. **9+3**

TEXT BOOKS:

1. Douglas A Pucknell & Kamran Eshragaian, *Basic VLSI Design* , Prentice Hall of India, New Delhi.
2. Bhaskar "VHDL" Pearson.edu New Delhi.

REFERENCE BOOKS:

1. Weste, *Principles of CMOS VLSI Design*, Addison Wesley, New York.
2. Gelger.R.L Allen .P.E Strader NR.VLSI Design Technology for Analog and Digital Circuits

EE 422D ADVANCED DIGITAL SIGNAL PROCESSING

(EE 422 Professional Elective – II)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
*Branch :**E.E.E*** *University Examination :* **100 marks**
Duration of University Examination: **3 hours**. *Sessionals*: **50 marks**

UNIT – I

1.Multirate Digital Signal Processing: Multirate Signal processing, Decimation, Interpolation, Time domain and frequency domain characterization of sampling rate alteration devices, Fractional sampling rate conversion, Direct-form FIR structures, Polyphase filter structures, Time-variant filter structures, Multistage implementation of sampling rate conversion, Design of Phase shifters, Interfacing of digital system with different sampling rates, Implementation of Narrow band low pass filters, Implementation of digital filter banks, sub band coding of speech signals, Quadrature mirror filters, Transmultiplexers, oversampling ADCs and DACs.

9

UNIT – II

2.Power Spectrum Estimation: Cross correlation and Auto correlation of discrete – time signals, power spectral density, periodogram, use of DFT in power spectrum estimation, non parametric methods for power spectrum estimation – Bartlett method, Welch method, Blackman & Tukey method; Parametric methods for power spectrum estimation – Autoregressive (AR), Moving average (MA) and Auto regressive – Moving average (ARMA) models, Yule-Walker method, Burg method, Unconstrained least squares method. 9

UNIT – III

3.Adaptive Signal Processing: Adaptive Systems, Open and closed loop adaptations, General form of adaptive linear combines, performance surface, gradient and minimum mean-square error, input correlation matrix, eigen values and eigen vectors of correlation matrix, Gradient search methods, Simple gradient search algorithm and its solution, learning curve, newton method, Method of Steepest descent; Gradient component estimation – derivative measurement, Variance of gradient estimate, Weight-vector solution, mis adjustment. 9

UNIT – IV

4.Adaptive Algorithms & Structures: Derivation of LMS algorithm, Convergence of weight vector, learning curve, noise in the weight-vector solution, mis adjustment, comparison of steepest descent and LMS algorithms, Z-transform in adaptive signal processing – Correlation function and power spectra, performance function, performance surfaces; LMS/Newton algorithm, sequential Regression (SER) algorithm, Linear Random Search (LRS), Adaptive recursive filters, Lattice Structures

9

TEXT BOOKS:

1. John. G. Proakis, D.G. Manolakis, *Digital Signal Processing*: *Principles, Algorithms & Applications,*Prentice Hall India,New Delhi.
2. Bernard Widrow, S.D. Stearns, *Adaptive Signal Processing*, Pearson Publication, New Delhi.

REFERENCE BOOKS:

1. S. K. Mitra, Digital Signal Processing: A Computer Based Approach, Tata McGraw-Hill, New Delhi.
2. L.R. Rabiner & B. Gold, *Digital Signal Processing,* Prentice Hall of India, New Delhi.
3. A.V.Oppenheim & R.W. Schafer, *Digital Signal Processing,* Pearson Publication, New Delhi.
4. Mischa Achwartz & Leonard Shaw, *Detection & Estimation of Signals,* McGraw Hill, New York, 1976.

EE 422 E DIGITAL CONTROL SYSTEMS
(Professional Elective – II)

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3**
Branch: **EEE** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

Introduction to Discrete Control Systems: Introduction, Discrete time control, Continuous time control, Comparison, Block diagram of digital control.
Z-Transforms: Z-Transforms of elementary functions, Properties, Inverse Z-transforms, Z-transform method for solving difference equations 9

UNIT – II

Discrete type control system in Z-plane Analysis: Introduction, Impulse sampling and data hold, Z-transform by convolution Integral method. Reconstruction of original signal from sampled signal pulse transfer function, Realization of Digital Controllers and Digital filters 9

UNIT – III

State Variable Analysis of Digital Control Systems: Introduction, State description of digital processors, State description of sampled continuous time plants, state description of systems with dead time, solution of state difference equation, controllability and observability, Multi variable systems. 9

UNIT – IV

Design of Digital Control: Introduction, Mapping between S-plane and Z-plane, Stability analysis of closed loop system in Z-plane, Transient and Steady State response analysis, Design based on Root locus method, frequency response method and analytical design method. 9

TEXT BOOKS:

1. **Ogats,** *Discrete-Time Control System*, **Pearson Education.**
2. **B.C. Kuo**, *Digital Control System*, **Prentice Hall of India.**

REFERENCE BOOKS:

1. **M.Gopal,** *Digital Control and State Variable Methods*, **Tata McGraw Hill, New Delhi.**

EE 423(A) RELIABILITY ENGINEERING
(EE 423 Professional Elective – III)

Class: **IV/IV B.Tech. II Semester** *Lectures:***3,**
Branch: **EEE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT - I

1. **Fundamental concepts in Reliability Engineering**: Introduction, General reliability function, General concepts, Hazard rate, reliability function, Bath tub Hazard rate curve, Mean time failure.
2. **System reliability**: Series configuration, Parallel configuration, Mixed configuration, application to specific hazard models, Mean time to failure of systems, Logic diagrams, Marker models, Marker graphs. **9**

UNIT – II

3. **Failure Data Analysis**: Failure data, Mean failure rate, Mean time to failure, Mean time between failures, Graphical plots, MTTF in terms of failure density, Reliability in terms of Hazard rate and failure.
4. **Hazard Models**: Constant Hazard, Linearly increasing Hazard, The weibull model, Distribution functions and reliability analysis, Density functions, expected value, some important distributions, Standard deviation & variance. **9**

UNIT – III

5. **Reliability Improvement**: Improvement of components, redundancy, element redundancy, Unit redundancy, Standby redundancy, Optimization, Reliability cost trade off.
6. **Maintainability and Availability**: Maintainability, availability, System down time, Instantaneous repair rate, Mean time to repair, Reliability and availability functions. **9**

UNIT – IV

7. **Applications**: Software reliability, Mechanical reliability, Power System reliability, and Computer System reliability modeling, Human reliability. **9**

TEXT BOOKS:

1. L.S. Srinath, "RELIABILITY ENGINEERING".
2. Ranganth, "RELIABILITY ENGINEERING".

REFERENCE BOOK:

1. Billington, & Alan, "RELIABILITY ENGINEERING".

EE423B H.V.D.C. TRANSMISSION
(Professional Elective – III)

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3** *Tutorials*: **1**
Branch: **E.E.E.** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

1. **Introduction:** Choice of HVDC Transmission system, types of HVDC systems, configuration and parts of HVDC system, Economic comparison of HVDC with EHVAC systems, merits of HVDC system interconnection.
2. **Fundamental equations** of HVDC power flow, steady state Vd Vs Id characteristics of converters, Reversal of power through HVDC link.
3. **Converter connections,** rectifier and inverter wave forms – Single phase bridge connection, three phase six pulse bridge, Three phase twelve pulse bridge connection, inversion, commutation and commutating reactance, analysis of voltage waveforms with overlap angle. 9+3

UNIT – II

4. **Equations of Voltage and current on DC side and AC side of converter -** no load without phase control, no load with phase control, rectifier mode, with phase control and load current / over lap angle rectifier mode, equivalent circuit of rectifier, Equations for Inverter, equivalent circuit of inverter, complete equivalent circuit of HVDC link.
5. **Harmonic filters:** Introduction, terms and definitions, shunt filters, series filters, configuration of AC harmonic filters harmonics in DC voltage, DC harmonic filters, damping circuit and DC surge capacitors, configuration of DC filters 9+3

UNIT – III

6. **HVDC Circuit breaker:** Principle of DC current interruption, commutation principle.
7. **HVDC System Control:** Review of Control requirements, alternative principles for HVDC control – terms and definitions, hybrid control current control, converter unit control tap changing valve unit firing control, individual phase control equidistant firing control. 9+3

UNIT-IV

8. **Reactive Power Compensation in HVDC Systems –** Reactive power requirements, compensation practice, reactive power balance, equations for active and reactive power on AC & DC side, power factor and reactive power requirements of rectifier and inverter equivalent circuit of AC network and converter. 9+3

TEXT BOOK:

1. **S.Rao,** *EHV-AC & HVDC Transmission Engg. Practice*, **Khanna Publishers, 1990.**

REFERENCE BOOK:

B.W.Khobark, ***H.V.D.C. Transmission, Vol – I,*** Wiley Inter-Science

EE423(C) NON-CONVENTIONAL ENERGY SOURCES
(Professional Elective – III)

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3**
Branch: **E.E.E.** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

1. INTRODUCTION: Distinction between conventional and non-conventional sources of energy – Brief Description of different sources 2

2. SOLAR ENERGY: Solar Energy option- solar radiation- solar flat plate collectors- air heaters- collectors with booster mirrors- concentric collectors- Thermal Storage systems. Solar photo voltaic (SPV) systems.

Introduction Prospects of SPV systems. Principle of a PV Cell. Large scale SPV systems. Economic considerations of SPV systems. PV sell technology. Merits and Limits of SPV systems. Applications of SPV systems- Street lighting, domestic lighting, Battery charging, SPV pumping systems. Concept of satellite solar power systems (SSPS) 7

UNIT-II

3. WIND ENERGY

Brief history of wind power- Principles of wind power- Operation of a wind turbine- Site Characteristics.

4. GEOTHERMAL ENERGY:

Origin and types of geothermal energy- Operational Difficulties- Vapor dominated systems- Liquid dominated systems- Petro- thermal systems- Hybrid geo thermal systems. 9

UNIT-III

5. ENERGY FROM OCEANS:

Ocean temperature differences- the open and closed cycle analysis- Modification of the Open cycle Analysis- Closed or the Anderson cycle Analysis- Ocean waves- Wave motions and tides- Energy from the waves. 9

UNIT-IV

6. BIO-ENERGY: Introduction-Bio-mass conversion- Technologies- Wet Process- Dry Process- Photo synthesis- Biogas generation- Biogas from power plant wastes-methods of maintaining Biogas production- Utilization of Biogas- Biogas gasification. Applications of gasifies. 5

7. MAGNETO-HYDRO DYNAMIC (MHD) POWER GENERATION: MHD system- Open and Closed systems- MHD design problems and developments- Advantages of MHD systems. **4**

TEXT BOOKS:

1. Bansal N.K, Kaleeman and M.Miller, "RENEWABLE *ENERGY SOURCES AND CONVERSION TECHNOLOGY*", TATA Mc Graw-Hill, New Delhi
2. Rai G.D "*NON-CONVENTIONAL ENERGY SOURCES*", Khanna Publishers, New delhi.

REFERENCE BOOKS:

1. EL-Wakil M.M, "*POWER PLANT TECHNOLOGY*", Mc Graw-Hill, New York.
2. Duffie and Beckman, "*SOLAR ENERGY THERMAL PROCESS*", John Wiley & Sons, New york.

EE 423D DESIGN OF ELECTRICAL MACHINES
(Professional Elective –III)

Class: **IV/IV B.Tech. II Semester** | *Lectures*: **3**
Branch: **E.E.E.** | *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** | *Sessionals:* **50 Marks**

UNIT-I

1. **Basic Principles of design of electrical machines:** Main Dimensions, Loading, Output equation, size of machine, choice of magnetic loading, choice of electric loading, effect of increasing linear dimensions in electrical machines. 9

UNIT – II

2. **Transformer:** Core, Windings, Output equation, Copper and iron lesson-optimum design, designs for minimum cost, Effect of change in frequency, Thermal rating, heating time constant of transformer, design of tank, testing of transformer, cooling of transformer, powers transformers, current transformer. Formulation of design problem, variables required, flow chart, evaluation of main dimensions. 9

UNIT – III

3. **D.C.Machines:** Output equation, number of poles, relation between length and diameter of armature, armature conductor ampere turns of magnetic circuit, design of commutator, interpoles, Design problem formulation, choice variables of performance, flow chart, objective and constraint functions, main dimensions.

4. **Induction Motor**: Output equation, main dimensions, stator windings, slot insulation, rotor design, air gap length number of rotor slots, slot winding, skewing, temperature rise and losses stator winding design, rotor winding design. Design principles. Operation with variable frequency, non sinusoidal supply, torque pulsations, flow chart, min. dimensions.

9

UNIT – IV

5. **Synchronous Machines**: Salient pole alternators, turbo alternators, output equation design of salient pole machine, armature design, stator design, field winding design, damper winding, cylindrical rotor design. 9

TEXT BOOKS:

1. **A.K.Shawney,** *Electrical Machines Design*, **Khanna Publishers.**
2. **H.M.Rai,** *Principles of Electrical Machine Design*, **Satyaprakashan Publishers**.

REFERENCE BOOKS:

1. **M.G.Say,** *Performance and Design of A.C.Machines*, **ELBS.**
2. **Clayton,** *Performance and Design of D.C. Machines*.

EE 423 (E) EHV AC TRANSMISSION
(Professional Elective –III)

Class: **IV/IV B.Tech. II Semester** *Lectures*: **3**
Branch: **E.E.E.** *University Exam:* **100 Marks**
Duration of University Exam: **3 Hrs.** *Sessionals:* **50 Marks**

UNIT-I

Line Parameters: Preliminaries- necessity of EHV AC transmission- advantages- Line and ground parameters- Resistance of conductors- Properties of Bundled conductors- Inductance, Capacitance calculations, Sequence inductances and Capacitance- Modes of Propagation- Ground return. 9

UNIT-II

Voltage gradient of conductors: Electrostatics- Field sphere gap-field of line charges and properties- charge- potential relations for multi conductors- surface voltage gradient on conductors- Distribution of voltage gradient on sub conductors of bundle. 9

UNIT-III

Electro static Field: Calculation of Electro static field of EHV lines, Effect on human, animals and plants- electrostatic induction in unexercised circuit of double circuit line. 9

UNIT-IV

Voltage Control: Voltage control using synchronous condensers- cascade connection of shunt and series compensation- Sub synchronous resonance in series compensator lines- Static, Reactive compensation system. 9

TEXT BOOKS:

1. EHV AC Transmission Engineering by R.D. Bega mudre- New Age International PVT ltd.

REFERENCE BOOKS:

1. EHVAC and DC Transmission by S. Rao- Khanna Publishers.
2. HVDC Transmission by E.W. Kimbark- John Wiley and Sons Publications.

EE 424 POWER SYSTEMS LABORATORY

Class: **IV/IV B.Tech. II Semester** Practicals:**3**
Branch: **EEE** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Performance characteristics of long artificial transmission line.
2. Reactive power characteristics of long artificial transmission lined
3. Steady state power limit of normal T and ∏ transmission lines
4. Reactive power control by tap changing transformers.
5. Testing IDMT over current relay.
6. Testing of static differential relay.
7. Sequence reactance of power system components.
8. Active and Reactive power control of synchronous machine.
9. Short circuit oscillographic studies on an alternator.
10. Measurement of sequence impedance for 3-phase 2-winding and 3-winding transformer.