Course Structure and Syllabus

For

Bachelor of Technology (B.Tech.)
(Electrical Engineering)

as

Recommended by BOS

(w.e.f. Academic session 2024-25)

Department of Electrical Engineering
Faculty of Engineering and Technology (FET)
M. J. P. Rohilkhand University, Bareilly (U. P.) 243006

May-2024

SCHEME OF COURSES FOR B.TECH. I YEAR
COMMON TO ALL BRANCHES

B.Tech. I Year, I Semester
(Common to all branches)

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total
1.	PH-101T	Engineering Physics-I (All Branches)	4	310	4
2.	CY-101T	Engineering Chemistry (EE, EL & EC)	4	310	4
3.	MA-101T	Engineering Mathematics-I (All Branches)	4	310	4
4.	HU-101T	Communicative English (EE, EL & EC)	3	210	3
5.	CS-101T	Computer Fundamentals & Programming (EE, EL & EC)	4	310	4
6.	ME-107T	Engineering Graphics (CSIT, CH & ME)	2	120	3
7.	EE-101N /EE-103N	Basic Electrical Engineering (EC & EL) /Circuit Theory (EE)	4	310	4
8.	EL-101T	Basic Electronics Engineering (CSIT, CH & ME)	4	310	4
9.	CY-103T	Environments Studies (CSIT, CH & ME)	2	300	3
10.	HU-103T	Fundamentals of Economics (CSIT, CH & ME)	2	300	3
11.	ME-101T	Manufacturing Techniques (EE, EL & EC)	2	200	2
12.	ME-105T	Basic Mechanical Engineering (CSIT, CH & ME)	4	310	4
		Total	**22 (CSIT, CH,ME) /25 (EE,EL, EC)**		**25/25**
Laboratory Courses					
13.	PH-101P	Engineering Physics Lab (CSIT, CH & ME)	2	003	3
14.	CY-101P	Engineering Chemistry Lab (EE, EL & EC)	2	003	3
15.	CS-101P	Computer Programming Lab in C++ (EE, EL & EC)	2	003	3
16.	EE-101P/ EE-103P	Basic Electrical Engg. Lab (EC & EL)/ Circuit Theory Lab (EE)	2	003	3
17.	EL-101P	Basic Electronics Engg. Lab (CSIT, CH & ME)	2	003	3
18.	ME-101P	Workshop Practice Lab (CSIT, CH & ME)	2	003	3
		Total	**6/6**		**9/9**
		G. Total	**28/31**		**34/34**

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SCHEME OF COURSES FOR B.TECH. I YEAR
COMMON TO ALL BRANCHES

B.Tech. I year, II Semester
(Common to all branches)

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total
1.	PH-102T	Engineering Physics-II (All Branches)	4	310	4
2.	CY-101T	Engineering Chemistry (CSIT, CH & ME)	4	310	4
3.	MA-102T	Engineering Mathematics-II (All Branches)	4	310	4
4.	HU-101T	Communicative English (CSIT, CH & ME)	3	210	3
5.	CS-101T	Computer Fundamentals & Programming (CSIT, CH & ME)	4	310	4
6.	ME-107T	Engineering Graphics (EE, EL & EC)	2	120	3
7.	EE-101N	Basic Electrical Engineering (CSIT, CH & ME)	4	310	4
8.	EL-102T	Basic Electronics Engineering (EE, EL & EC)	4	310	4
9.	CY-103T	Environments Studies (EE, EL & EC)	2	300	3
10.	HU-103T	Fundamentals of Economics (EE, EL & EC)	2	300	3
11.	ME-101T	Manufacturing Techniques (CSIT, CH & ME)	2	200	2
12.	ME-105T	Basic Mechanical Engineering (EE, EL & EC)	4	310	4
		Total	**25 (CSIT, CH,ME) /22 (EE,EL, EC)**		**25/25**
Laboratory Courses					
13.	PH-101P	Engineering Physics Lab (EE, EL & EC)	2	003	3
14.	CY-101P	Engineering Chemistry Lab (CSIT, CH & ME)	2	003	3
15.	CS-101P	Computer Programming Lab in C++ (CSIT, CH & ME)	2	003	3
16.	EE-101P	Basic Electrical Engg. Lab (CSIT, CH & ME)	2	003	3
17.	EL-102P	Basic Electronics Engg. Lab (EE, EL & EC)	2	003	3
18.	ME-101P	Workshop Practice Lab (EE, EL & EC)	2	003	3
		Total	**6/6**		**9/9**
		G. Total	**31/28**		**34/34**

B.TECH. SEMESTER-III
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	MA-201T	Engineering Mathematics-III (EE, EL, EC and CSIT)	4	310	4
2.	EL-201T	Analog Electronics (EE, EL & EC)	4	310	4
3.	EE-201N	Network Analysis & Synthesis (EE, EL & EC)	4	310	4
4.	EE-203N	Electrical Machines-I	4	310	4
5.	EE-205N	Electrical Measurement and Instrumentation	4	310	4
6.	EE-207N	Electrical Engineering Materials	4	310	4
Total			**24**		**24**

LABORATORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-203P	Electrical Machines-I Lab	2	003	3
2.	EE-205P	Electrical Measurement and Instrumentation Lab	2	003	3
Total			**4**		**6**
TOTAL (THEORY+LABORATORY)			**28**		**30**

B.TECH. SEMESTER-IV
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EL-202T	Linear Integrated Circuits (EE, EL & EC)	4	310	4
2.	EC-204T	Digital Electronics (EE, EC & CSIT)	4	310	4
3.	CS-204T	Computer Organization (EE, EC, EL & CSIT)	4	310	4
4.	EE-204N	Electrical Machines-II	4	310	4
5.	EE-206N	Power System-I	4	310	4
6.	EE-208N	Electromagnetic Field Theory	4	310	4
Total			**24**		**24**

LABORATORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-204P	Electrical Machines-II Lab	2	003	3
2.	EC-204P	Digital Electronics Circuit Lab (EE, EC & CSIT)	2	003	3
3.	EL-206P	Linear Integrated Circuit Lab (EE, EL & EC)	2	003	3
Total			**6**		**09**
TOTAL (THEORY+LABORATORY)			**30**		**33**

B.TECH. SEMESTER-V
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-301N	Control System (EE, EL & EC)	4	310	4
2.	EE-303N	Power Electronics (EE, EL & EC)	4	310	4
3.	EE-305N	Power System-II	4	310	4
4.		Department Elective 1	4	310	4
5.	EL-301T	Microprocessor & their applications (EE, EL, EC & CSIT)	4	310	4
6.	EC-202T	Signal & System	4	310	4
Total			**24**		**24**

LABORATORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-303P	Power Electronics Lab (EE, EL & EC)	2	003	3
2.	EE-305P	Computer Simulation of Electrical Circuit Lab	2	003	3
3.	EL-301P	Microprocessor Lab (EE, EL, EC & CSIT)	2	003	3
Total			**6**		**12**
TOTAL (THEORY+LABORATORY)			**30**		**36**

Department Elective- I

1. Introduction to Electrical Vehicles (EE 307N)
2. Energy Efficiency & Conservation (EE 309N)
3. Internet of Things (EE 311N)
4. MOOC Course (EE 313N)

B.TECH. SEMESTER-VI
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.		Department Elective -2	4	310	4
2.	EE-304N	Power Plant Engineering	4	310	4
3.	EE-306N	Computer Simulation of Power System	4	310	4
4.	EE-308N	Advanced Control System	4	310	4
5.	EE-310N	Special Purpose Machines	4	310	4
6.	EC-312T	Elements of Communication Engg.	4	310	4
	Total		**24**		**24**

LABORATORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-302P	Control System Lab (EE, EL & EC)	2	003	3
2.	EE-304P	Power System Lab	2	003	3
3.	EC-312P	Communication Lab	2	003	3
	Total		**6**		**9**
TOTAL (THEORY+LABORATORY)			**30**		**33**

Department Elective- II

1. SCADA & Energy Management (EE 314N)
2. Robotics and Automation (EE 316N)
3. FACTSs and Devices (EE 318N)
4. MOOC Course (EE 320N)

B.TECH. SEMESTER-VII
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-401N	Protection & Switchgear	4	310	4
2.	EE-402N	Electric Drives & Control	4	310	4
4.		Department Elective -3	4	310	4
5.		Open Elective	3	310	3
6.	EE-405T	Industrial Training	3	010	1
7.	EE-407T	Seminar	2	020	2
	Total		**20**		**22**

LABORATORY COURSES:

SI. No.	Course No.	Subject	Credits	Teaching Schedule Hrs. LTP	Total Hrs.
1.	EE-401P	Protection & Switchgear Lab	2	003	3
2.	EE-403P	Industrial Automation & PLC Lab/ Minor Project	2	003	3
	Total		**4**		**6**
TOTAL (THEORY+LABORATORY)			**24**		**26**

Department Elective-III	
1. High Voltage Engineering 2. Electrical Machine Design 3. E.H.V AC & DC Transmission 4. Power Quality 5. Power System Operation & Control 6. Non Conventional Energy Sources 7. Neural Networks & Fuzzy Logic 8. Digital signal Processing 9. Utilization of Electrical Power & Traction 10. Human Values and Ethics 11. Artificial Intelligence and Machine Learning	(EE-403N) (EE-404N) (EE-406N) (EE-408N) (EE-410 N) (EE-411N) (EE-413N) (EE-414N) (EE-415N) (EE-416N) (EE-418N)
Open Elective: 1. CY-401T Polymeric Materials and their Applications 2. MA-491T Operations Research 3. PH-419T Futuristic Materials 4. PH- 429T Material Imperfection and Applications	 5. HU-402T Engineering Economics 6. HU-409T Quantitative Methods in Economics 7. HU-407T Foreign Trade 8. HU-449T Principal of Management

B.TECH. SEMESTER-VIII
ELECTRICAL ENGINEERING

THEORY COURSES:

SI. No.	Course No.	Subject	Teaching Schedule Hrs. LTP	Credits
1.	EE-410P	Major Project	310	12
2.	EE-412P/ EE-420N	Internship/ MOOC-I *	310	8
	Total			**20**

* The student shall decide the MOOC course in consultation with the department faculty member and approved by Head of the Department.

B.Tech. FIRST YEAR (FIRST SEMESTER)

ENGINEERING PHYSICS-I

PAPER CODE: PH-101T

Credits: 4 **LTP: 310**

(All Branches)

UNIT-I

Interference: Coherent sources, Theory of interference, displacement of fringes, Fresnel's biprism experiment, Interference in thin film, wedge shaped film, Newton's rings.

UNIT-II

Diffraction: Basic idea of Fresnel & Fraunhofer diffraction, single, double and n slit diffraction, diffraction grating, Rayleigh's criterion of resolution, resolving power of telescope, microscope and grating.

UNIT-III

Polarization: Phenomenon of double refraction, Malus law, Nicol prism, quarter wave and half wave plates, production and analysis of plane, circularly and elliptically polarized light, optical activity, specific rotation, Lorentz half shade and biquartz proarimeters.

UNIT-IV

Wave Mechanics: Elementary idea of quantization, black body radiation, Frank-Hertz experiment, Photoelectric effect. Wave particle duality, De Broglie concept of matter waves, Heisenberg's uncertainty principle, Schrodinger's wave equation, physical significance of wave function, applications of Schrodinger's wave equation: (i) Particle in one dimensional box. (ii) Potential Step (iii) Potential barrier-quantum mechanical tunneling (Basic idea).

UNIT-V

Solid State Physics: Structure of crystalline solid: Lattice translational vectors, unit cell, Bravais lattice, Miller indices and simple crystal structures.

Free electron model: Free electron gas in one and three dimensions, Fermi energy, Density of states, Heat capacity of the electron gas, failure of free electron model.

Band theory: Kronig Penny model, motion of electrons in one dimension according to the band theory, effective mass of an electron, concept of hole, distinction between metals, insulators and intrinsic semi-conductors.

Reference Books:

1. Geometrical & Physical Optics: B. K. Mathur
2. Introduction of Solid State Physics: C. Kittel
3. Solid State Physics: A. J. Dekkar
4. Quantum Mechanics: Singh and Bagdel
5. Optics: Ajai Ghatak
6. Quantum Mechanics: B. K. Agarwal & Hari Prakash
7. Optics: A. H. Flower
8. Geometrical & Physical: Zenkin's & White
9. Quantum Mechanics: Eisberg

B.Tech. FIRST YEAR (FIRST SEMESTER)
ENGINEERING CHEMISTRY

PAPER CODE: CY-101T
Credits: 4 **LTP: 310**
I Sem (EE, EL & EC)
II Sem (CSIT, CH & ME)

UNIT-I
Schrodinger equation: origin of quantization; applications of particle in a box problem; hydrogen atom; properties of atomic orbitals; many electron atoms; molecular orbital theory; bonding and intermolecular forces.

UNIT-II
Thermodynamics: Fundamental definition and concepts of thermodynamics; Work, heat and energy; First law: *Cp* and *Cv*; Second law: entropy; Helmholtz and Gibbs Energy; chemical potential; Third law; phase equilibria; chemical equilibrium.

UNIT-III
Chemical kinetics: Rate laws; elementary reaction and chain reaction.

UNIT-IV
Periodic table and periodic properties: basis of periodic table, trends in size, electron affinity, ionization potential and electro negativity, Use of Ellingham diagram and thermodynamics in the extraction of elements; Transition metal chemistry: inorganic complexes, isomerism, nomenclature; bonding in transition metal complexes; valence bond and crystal field theory, magnetism, bonding aspects, structural distortion; Bioinorganic chemistry: storage and transport proteins; Catalysis: hydrogenation, hydroformylation and olefin metathesis.

UNIT-V
Organic Chemistry: Huckel treatment of ethylene, butadiene and benzene, concept of aromaticity, configuration, molecular chirality and isomerism, conformation of alkanes and cycloalkanes, reactivity of carbonyl groups (additions, addition-eliminations, reactions due to acidic proton, reactivity of acid halide, ester and amide), functional group inter-conversions involving oxidation and reduction. Introduction to bio-organic chemistry: carbohydrates, amino acids proteins and nucleic acids. Polymer chemistry definition, classification of polymers, orientation of polymers, types of polymerization, Mechanism of addition and condensation polymerization, thermo plastic and thermo setting revius: Important thermosetting and thermoplastic polymers: eg. Bakelite, polyester, cellulose derivatives, PVC, Poly ethylene, Teflon, Polystyrene, Nylon Natural and synthetic rubbers.

Suggested Books:

1. P. W. Atkins, **Physical Chemistry** (7th Edition), Oxford University Press, 2006.
2. I. A. Levine, **Physical Chemistry**, McGraw Hill, 2009
3. D. A. McQuarrie and J.D. Simon, **Physical Chemistry -a Molecular Approach**, Viva Books Pvt. Ltd., 1998.
4. R. T. Morrison and R.N. Boyd, **Organic Chemistry**, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990
5. G. Solomons and C. Fryhle, **Organic Chemistry**, John Wiley & Sons (Asia) Pte Ltd.
6. J. D. Lee, **Concise Inorganic Chemistry**, (5th Edition), ELBS, 1996.
7. D. F. Shriver and P.W. Atkins, **Inorganic Chemistry,** Oxford University Press, 2006
8. F. W. Billmayer, Polymer Science, Tata McGraw Hill.

B.Tech. FIRST YEAR (FIRST SEMESTER)
ENGINEERING MATHEMATICS-I

PAPER CODE: MA-101T
Credits: 4 **LTP: 310**
(All Branches)

UNIT:I

Differential Calculus: Limit, continuity and differentiability of functions of single variable. Successive, Differentiations, Leibnitz Theorem, Expansion of functions by Maclaurin's and Taylor's theorems.

Functions of several variables: Partial derivatives, Euler's theorem, change of variables, total differential coefficients, maxima and minima, Lagrange's method of multiplier.

UNIT:II

Integral Calculus: Fundamental and mean value theorems of integral calculus. Reduction formulae, Walli's formula, Beta and Gamma functions, Double and Triple integrals, change of orders of integrations. Area enclosed by plane curves, surfaces and volumes of revolutions.

UNIT:III

Vectors and Matrices: Differentiations and integrations of vectors. Gradient, Divergence and Curl. Vector identities, Green's, Gauss's and stoke's theorems with applications.

Types and algebra of matrices, rank, solution of simultaneous linear equations, Eigen values and Eigen vectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

References:

1. E. Kreyszig: Advance Engineering mathematics, John Wiley & Sons, 2005.
2. B. V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., 2008.
3. R. K. Jain & S. R. K. Iyenger: Advance Engineering Mathematics, Narosa Publishing House, 2002.
4. J. C. Sharma: Vector Algebra, Students & Friends Co. Ltd. Agra.
5. J. K. Goel & K. P. Gupta: Matrix algebra, Students & Friends Co. Ltd. Agra.
6. H. K. Dass: Advanced Engineering Mathematics.

B.Tech.FIRST YEAR (FIRST SEMESTER)

COMMUNICATIVE ENGLISH

PAPER CODE: HU101T

Credits: 3 **LTP: 310**

I Semester (EE, EL & EC)

II Semester (CSIT, CH & ME)

UNIT:I

(a) Pronunciation: basic sounds of English (vowels and consonants) and word-stress.

(b) Vocabulary: word-formation (prefixes and suffixes), synonyms and antonyms.

(c) Syntax: parts of speech, active and passive voice, direct and indirect speech, tenses, basic sentence patterns, etc. The literary aspect will be dealt with through suitable texts suchas poems, short stories and plays (chosen be the instructors). The main topics for discussion will be:

(a) What is literature?

(b) The nature of literary language (mainly "figurative" language)

(c) The literary forms or genres

(d) Literature and socio-cultural context

UNIT:II

Pre-Requisities of Scientific Writing: Salient features: BOCUST formula. Grammatical pre-requisites: Usage, Sentence fragments, questions tag. Modifiers, connectives Split infinitives, Dangling participle Gereunds, ellipsis coherence & unity: Method.

B.Tech. FIRST YEAR (FIRST SEMESTER)

COMPUTER FUNDAMENTAL & PROGRAMMING

PAPER CODE: CS-101T

Credits: 4 **LTP: 310**

I Semester (EE, EL & EC)

II Semester (CSIT, CH & ME)

UNIT I:

Introduction: Basic definition, Classification of Computers, Block diagram of computer and brief idea of its part (I/O, Memory, control unit) with their working and example.

Number System: Introduction, Data representation-Decimal, Binary, octal, Hexadecimal and their inter convertibility.

Planning the computer program: Purpose of program planning, algorithms, flowcharts, Pseudo code.

UNIT II:

Computer Software: Introduction to software, hardware, Firmware with example, Type of software, Translators and their types (compiler, interpreter, assembler etc.).

Basic operating system concepts: OS, Types of OS (MSDOS, WINDOWS, Role of OS with its characteristics in brief (Multi-programming, Multitasking, Multiprocessing, Multi-threading, Time-sharing, online-processing, Real-time processing).

UNIT III:

Introduction to C++: Structured verses Object Oriented Development, Elements of Object Oriented Programming, Introduction to Objects, Classes, Encapsulation and data abstraction, Inheritance, Polymorphism, Overloading. C++ Data types, variables, operators and expressions. Statements and Blocks, if- statement, if-else statement, loops, switch statements.

UNIT IV:

Classes and Objects: Introduction, Classes, Class definition, Class member, member function, Public and Private variables, Derived classes, Constructors and Destructors.

UNIT V:

Object Oriented Features: Scope of variables, Inline function, Friend function, Friend class, Parameter passing. Inheritance, types of inheritance. Polymorphism, Overloading, Operator Overloading of Unary and Binary operators, Function Overloading. Templates.

References:

1. Computers Fundamental by Rajaraman.
2. Computers Fundamental by B. Ram.
3. Computers Fundamental by P. K. Sinha.
4. 'Programming in C' by E. Balagrusamy, TMIL.
5. 'Let Us C' by Yashwant Kanetkar, Narosa.
6. Exploring 'C' by Yashwant Kanetkar.

B.Tech. FIRST YEAR (FIRST SEMESTER)

BASIC ELECTRICAL ENGINEERING

PAPER CODE: EE-101N **Credits: 4**

I Semester (EC & EL) **LTP: 310**

II Semester (CSIT, CH & ME)

After successful completion of this course, students will be able to:

CO.1	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
CO.2	Analyze the steady state behavior of single phase and three phase AC electrical circuits.
CO.3	Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
CO.4	Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
CO.5	Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

UNITI:

DC Circuits : Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff‟s laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem, Maximum Power Transfer theorem.

UNITII:

Steady- State Analysis of Single Phase AC Circuits: Representation of Sinusoidal waveforms-Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidal varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNITIII:

Transformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNITIV:

Electrical machines: DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems).

Three Phase Induction Motor: Principle & Construction, Types, Slip torque characteristics, Applications (Numerical problems related to slip only).

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

UNITV:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption and savings, battery backup.

Text Book:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, McGraw Hill.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill.
3. Ritu Sahdev, “Basic Electrical Engineering”, Khanna Publishing House.
4. S. Singh, P.V. Prasad, “Electrical Engineering: Concepts and Applications” Cengage.
5. Electrical Technology by B. L. Theraja.

Reference Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Pearson India.

B.Tech. FIRST YEAR (FIRST SEMESTER)

PAPER CODE: EE-103N **CIRCUIT THEORY** **Credits: 4**

Branch: EE **LTP: 310**

After successful completion of this course, students will be able to:

CO.1	Acquire knowledge of basic concepts of electric circuit elements and apply them to solution of resistive circuit problems
CO.2	To gain knowledge of network theorems and balanced three phase circuits; and apply them to solution of resistive circuit problems
CO.3	Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits
CO.4	To gain knowledge of fundamentals of magnetic circuits and apply them to solution of numerical problems; and also learn about construction and working principle of various measuring instruments

UNIT-I:

DC Circuit Analysis and Network Theorems: Basic concepts and definitions: Concept of network and circuit, Active and passive elements, Unilateral and bilateral elements, Ideal and real voltage and current sources, Dependent & independent voltage and current sources, Concept of linearity and linear network, Basic circuit elements- R, L and C as linear elements, Source transformation, Star-delta transformation, Kirchhoff's laws; Loop and nodal methods of analysis; Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem.

UNIT-II:

Magnetic Circuit: Magnetic effect of electrical current, Magnetic circuit concepts - MMF, Flux, Reluctance, Analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Mutual coupling with dot convention, Mutual inductance coupling coefficient. Magnetic circuit calculations.

UNIT-III:

Analysis of Single-Phase AC Circuits: AC fundamentals: Sinusoidal, square and triangular waveforms, Average and effective values, Form and peak factors; Complex quantities, the operator j, Representation of vectors, different forms of expression of complex quantities, complex expression of voltage, current and impedance, addition, subtraction, multiplication, division, n^{th} root and n^{th} power of complex quantities, Concept of phasors, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series parallel RL, RC, LC and RLC circuits, Resonance in series and parallel circuits, bandwidth and quality factor, Apparent, active & reactive powers, Power factor, Causes and problems of low power factor, Concept of power factor improvement.

UNIT-IV:

Three Phase AC Circuits: Three phase system its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, concept of three phase power. Three phase unbalanced system – supply side and load side. Concept of neutral shifting.

UNIT-V:

Transient State Analysis: Transient phenomenon, Transient vs. steady state, Transient response analysis of RL and RC circuits to DC excitation, Elementary idea about transient response of series RL circuit with alternating voltage source; Need of Earthing of equipment and devices, important electrical safety issues

Text Books:

1. Electrical Technology by B. L. Theraja.
2. Basic Electrical Engineering, Kothari & Nagrath, TMH.

Reference Books:

1. Basic Circuit Theory by L.P. Huelsman, PHI.
2. Hughes Electrical Technology by M. Smith, Addison-Wessley Pub.
3. Electrical Engineering Fundamentals by V. Deltoro, PHI.

PAPER CODE: EE-101T (Old) BASIC ELECTRICAL ENGINEERING
Credits: 4 LTP: 310
I Semester (EE, EL & EC)
II Semester (CSIT, CH & ME)

UNIT I:
Basic Concept: Definitions & units, Introduction to Basic Laws, Circuit Elements, KVL, KCL, Ideal & Real Sources, Dependent & Independent Sources, Conversion of Voltage Source into Current Source & vice Versa, Controlled and Uncontrolled Sources, Loop and Nodal Method of analysis, Star to Delta Transformation & vice-versa.

UNIT II:
Magnetic Circuit: MMF, Flux, Reluctance, Magnetic Effect of Electrical Current, Hysterisis & Eddy Current Losses.

UNIT III:
Network Theorems: Superposition, Thevenin, Norton, Maximum Power Transfer & Reciprocity Theorems.

UNIT IV:
Steady-State Response: Steady-State Response of Circuit to Sinusoidal functions, Phasor Representation of Sinusoids, Concept of Complex Impedance, Series & Parallel AC Circuits, Series & Parallel resonance

UNIT V:
Balanced Three-Phase Circuit: Generation of Three Phase Voltage, Star/Delta Connected Supply, Balanced Load Circuits, Line and Phase Voltage & current Relations. Concept of Three Phase Power.

UNIT VI:
Transient: Response of RC, RL & RLC Circuit to DC Excitation only (simple problem).

UNIT VII:
Instruments: Introduction to MI, MC Instruments, Extension of range, Dynamometer Type Wattmeter, Simple problems based on these instruments.

Books:
1) Basic Circuit Therory by L.P. Huelsman, PHI.
2) Hughes Electrical Technology by M. Smith, Addison-Wessley Pub
3) Electrical Technology by B.L. Theraja.
4) Electrical Engineering Fundamentals by V. Deltoro, PHI.

B.Tech. FIRST YEAR (FIRST SEMESTER)
MANUFACTURING TECHNIQUES

PAPER CODE: ME-101T
Credit: 2 **LTP: 200**
I Semester (EE, EL & EC)
II Semester (CSIT, CH & ME)

Unit:I

Carpentry:-Wood, timber-exogenous & endogenous, Cross section of an exogenous tree, Seasoning of wood, Seasoning methods, defects (Both natural and that occurs during conversion), Brief description of carpentry tools, various carpentry process, Carpentry joints.

Unit:II

Pattern & Pattern making:-Pattern, types of pattern (Single piece, split, Match plate, Sweep, Loose piece, Gated patterns), Pattern making allowances, Design considerations in pattern making, pattern making materials, Core prints.

Unit:III

Foundry:-Moulding materials, types of foundry sands; characteristics of foundry sands; Binders& additives; moulding procedures: Floor moulding, Bench moulding, Pit moulding, Machine moulding, Green sand moulding, Dry sand moulding, CO_2, Core making processes.

Unit:IV

Foundry' tools &equipments:-Tools used in foundry (hand tools); moulding machine- (Jolt machine, Squeezing machine, Sand Slinger, Push off machine), Furnaces (Pit furnace, cupola furnace).

Unit:V

Welding:-Welding: Pressure and non-pressure, arc welding (AC and DC arc welding, Introduction to Carbon arc welding, metal arc welding, TIG &MIG welding); Electric resistance welding (Spot, seam, projection, But, thermit welding), welding tools and equipments, Gas welding (oxyacetylene).

Unit:VI

Bench work & fitting:-Tools (holding tools, striking tools, cutting tools), various operations performed in fitting shop (in detail).

Unit:VII

Machine tools: Definition, type: Lathe specifications; Lathe operations in brief (facing, plain turning, step turning, taper turning, threading, drilling and boring). Milling machine (introduction & brief description of operations only).

Unit:VIII

Jigs & Fixture: Introduction, Location points, Basic Design of Jigs & Fixture, Types of Jigs & Fixture.

Text Book:

1. A text Book on workshop technology by B. S. Raghuvanshi.

Reference Book:

1. Workshop technology by Hazara & Chaudhry.
2. Production technology by R. K. Jain.

Subject: Computer Programming Lab in C++ **Code: CS-101P** **Credits: 2**
Branches: I Semester (EE, EL & EC) **L T P: 0 0 3**
II Semester (CSIT, CH & ME)

Section A.
Without using class:

1. Write a program to test arithmetic operators.
2. Write a program to swap two nos.
3. Write a program to find largest no. among three nos.
4. Write a program to demonstrate switch statement.
5. Write a program to check whether the given no. is palindrome or Not.
6. Write a program to perform addition of two matrices.
7. Write a program to perform multiplication of two matrices.
8. Write a program to find factorial of a given no. using recursion.
9. Write a program to demonstrate call by value and call by reference.
10. Write a program to print the following format.

```
1
2   3
4   5   6
7   8   9   10
```

Section B:
Using Class:

1. Program to demonstrate class content.
2. Program to demonstrate function overloading.
3. Program to demonstrate on destructor.
4. Program to demonstrate on copy constructor.
5. Program to demonstrate friend function.
6. Program for unary operator overloading.
7. Program for binary operator overloading.
8. Program for member function overloading.
9. Program for single and multiple inheritance.
10. Program for overriding of member functions.
11. Program to demonstrate constructor calling mechanism in inheritance.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Basic Electrical Engineering Lab **Code: EE−101P** **Credits: 2**
Branches: I Semester (EC & EL) **L T P: 0 0 3**
II Semester (CSIT, CH & ME)

LIST OF EXPERIMENTS

1. To verify Kirchhoff's Current and Voltage Law.
2. To Verify Superposition theorem.
3. To verify Thevenin's theorem.
4. To verify Norton's theorem.
5. To verify Maximum Power Transfer theorem.
6. To perform polarity test on a two winding single phase transformer.
7. To perform open circuit test on a single phase transformer and determine the parameters of its equivalent circuit.
8. To perform short circuit test on a single phase transformer.
9. To perform the load test on a single phase transformer and determine its efficiency.
10. To obtain external characteristics of dc shunt generator.
11. To perform load test on dc shunt motor.
12. To perform the no load test on a three phase Induction Motor.
13. To perform open circuit test on three phase Alternator.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Circuit Theory Lab	**Code: EE−103P**	**Credits: 2**
Branch: EE	**Sem: I Semester**	**L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To verify Kirchhoff's Current Law.
2. To verify Kirchhoff's Voltage Law.
3. To Verify Superposition theorem.
4. To verify Thevenin's theorem.
5. To verify Norton's theorem.
6. To verify Maximum Power Transfer theorem.
7. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor.
8. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
9. Connection and measurement of power consumption of a fluorescent lamp (tube light).
10. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
11. Determination of parameters of ac single phase series RLC circuit.
12. To observe the B-H loop of a ferromagnetic material in CRO.

Note:-In addition, Institutes may include more experiments based on the expertise.

B.Tech. FIRST YEAR (SECOND SEMESTER)

ENGINEERING PHYSICS-II

PAPER CODE: PH-102T

Credit: 4 **LTP: 310**

(All Branches)

UNIT:I

Dielectric Properties of Materials: Polarization of dielectrics, dielectric constant, electric susceptibility, non-uniform polarization, electric displacement vector, Lorentz local field, Polarizability, Clausius-Mosotti relation, frequency dependence of dielectric constant.

UNIT:II

Magnetic Properties of Materials : Magnetization, three magnetic vectors (B.M & H), susceptibility and permeability, Dia, Para, and ferromagnetism, Magnetic domains, hysteresis, Ferro electricity & Piezoelectricity.

UNIT:III

Maxwell's Equations: Displacement Current, Maxwell's equation in vacuum & medium (Integral and Differential forms), Poynting theorem, Poynting vector.

UNIT:IV

Electromagnetic Waves: Wave equation, plane waves, Propagation of electromagnetic waves through non-conducting medium, reflection and transmission.

UNIT:V

Superconductivity: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, BCS theory (Qualitative), high temperature superconductors. Characteristics of superconductors in superconducting state, applications of superconductors.

UNIT:VI

Nuclear Physics: Basic properties and constituents of nucleus, mass defect, packing fraction and binding energy, semi empirical mass formula, elementary idea of nuclear forces and their characteristic properties, Nuclear fission, important components and working of nuclear fission reactor, Basic Concept of nuclear fusion reactors.

Books:

1. Electricity and Magnetism: Berkley Physics Course-II.
2. Electromagnetic waves & Radiating systems: Jordan and Keith.
3. Solid State Physics: C. Kittel.
4. Nuclear Physics: I. Kaplan.
5. Modern Physics: A. Beiser.
6. Electrodynamics: d. Griffith.

B.Tech. FIRST YEAR (SECOND SEMESTER)

ENGINEERING MATHEMATICS-II

PAPER CODE: MA-102T

Credits: 4 **LTP: 310**

(All Branches)

UNIT:I

Numerical Techniques: Numerical solution of algebraic and transcendental equations by Bisection method, Secant method, Regula-Falsi and Newton-Raphson methods. Numerical integration by Gauss quadrature formula, Trapezoidal rule, Simpson's rule and Weddle's rule. Numerical solution of ordinary differential equations by Euler's method, Milne's method and Runge-Kutta method.

UNIT:II

Probability and statistics: Definitions of probability and simple theorems, conditional probability, Baye's Theorem, random variables, discrete and continuous distributions, Binomial, Poisson and normal distributions, correlation and linear regression.

UNIT:III

Complex Analysis: Analytic functions, C-R equations in Cartesian and polar forms, Harmonic functions, Milne-Thomson method, complex integration, Cauchy's theorem, Cauchy's integral formula. Lioville's and Morera's Theorems, Taylor's and Laurent's theorems. Residues: Cauchy's residue theorem, evaluation of real integrals of the type $\int_0^{2\pi}$ f (cos θ, sin θ) do and $\int_{-\infty}^{\infty}$ fen, dx.

References:

1. E. Balagurusamy: Numerical Methods, Tata McGraw Hill, 2008.
2. Devi Prasad: An introduction to Numerical analysis, Narosa Publishing House, 2006.
3. J. B. Conway: Functions of one complex variable, springer verlag, International Students Edition Narosa Publishing House, 1980.
4. A. M. Goon, M. K. Gupta & B. Das Gupta: Basic Statistics, The world Pren Pvt. Ltd., Calculta, 1991.
5. L. V. Alhfors: Complex analysis, Tata McGraw Hill, 1979.

B.Tech. FIRST YEAR (SECOND SEMESTER)

ENGINEERING GRAPHICS

PAPER CODE: ME-107T **Credits: 02**

I Semester (CSIT, CH & ME) **LTP: 120**

II Semester (EE, EL & EC)

UNIT:I

Importance of Engineering Drawing, Engineering Drawing Instruments and uses, Layout of Drawing sheet, Lettering and Dimensioning, Types of Lines. Scales: What is scale,Representative factor, Types of Scale: Plain, Diagonal and Vernier scales, Metric Measurements and conventions, Plain Scale, diagonal scale& vernier scale (forward & backward both).

UNIT:II

Conic Section, Definition, and different methods of construction of ellipse, hyperbola and parabola by Eccentricity method Construction of parabola and ellipse by Concentric circles method, Oblong method, Parallelogram method.

UNIT:III

Projections, Principle, types and conventions, Theory of Projections and orthographicprojections:- Introduction, Types of projections, Orthographic projections, Planes of Projection, Four quadrants, Types of orthographic projections, (a) Projections of point and straight lines, (b) Projections of lines inclined to both the planes, Projection of planes, (a) Projection of solids (b) Projection of solids inclined to both H.P. & V.P. (of prisms pyramids etc).

UNIT:IV

Isometric Projections: Theory of isometric projection- Isometric lengths, Isometric scales:- Methods to draw Isometric view or projection, various positions of Isometric axes. Isometric projection with isometric lines, non-isometric lines and with curved & circular surfaces.

Recommended Text Book:

1. A Text book of Engineering Drawing (Geometrical Drawing) by R. K. Dhawan.
2. Engineering Drawing & Graphics, by K. Venugopal Rao.
3. Engineering Drawing by P. S. Gil.
4. Engineering Drawing by N. D. Bhatt.

Subject: Basic Electronics Engg. **Code: EL−101T/102T** **Credits: 4**
Branches: I Semester (CSIT, CH & ME) **L T P: 3 1 0**
II Semester (EE, EL & EC)

Course Outcomes; At the end of the course, student will be able to:
CO1: Understand the concept of semiconductor physics.
CO2: Characterize junctions diode.
CO3: Apply the concept of diode in rectifying circuits, filters circuits and DC power supplies.
CO4: Understand the application of diode in wave shaping, in voltage multiyear.
CO5: Understand fundamental principles of bipolar junction transistors.

UNIT I:
Introduction of Semiconductor Physics: Band Theory of solids, Insulator, Semiconductor & Metals, Mobility and Conductivity, Electrons and holes in an intrinsic semiconductor, Carrier concentration in an intrinsic semiconductor, n-type material, p-type material, Donor and Acceptor impurities, Charge densities in a semiconductor, Hall-effect, Diffusion, the continuity equation, Fermi level in a semiconductor having impurities.
UNIT II:
Junction Diode Characteristics: p-n junctions, Forward bias, Reverse bias junction, V-I characteristics, Effect of temperature on a p-n junction diode, Maximum temperature operation, Reverse break down voltage, Capacitive effects in a p-n junction diode, Space charge capacitance, Diffusion capacitance, Diode Resistance, Static and Dynamic Resistance, Comparison of practical with ideal diode, load line analysis of a diode circuit.
UNIT III:
Rectifying Circuits and DC Power supplies: p-n junctions as an rectifier, form factor, average voltage and current, haft wave & full wave rectifier, voltage regulation, Ripple factor, Bridge rectifier, Comparison of rectifier circuits, Filter circuits for power supplies, inductor filter, capacitor filter, Effect of capacitor series resistance, Peak inverse voltage of a half wave rectifier, LC filter, Comparison of filter circuits.
UNIT4:
Diode Applications: Clippers, Series and parallel, Clampers, Zener diodes, Zener diode specification, Voltage regulator circuits, Design of a voltage regulator circuits, Effect of supply voltage variations, Zener diode breakdown mechanism, Voltage multiplier circuits, voltage doublers, voltage Tripler, Quadrupoler.
UNIT5:
Bipolar Junction Transistor: The junction transistor, Transistor current components, transistor as an amplifier, Common base configuration. Early effect, the input and output characteristics, Common emitter configuration I/O characteristics, Active, Saturation, Cut-off regions for both configurations, common collector configuration, common base current gain, common emitter current gain.

References:

1. Integrated Electronics: Analog and Digital Circuits and System by Millman, halkias and Parikh, TMH, Second Edition.
2. Electronic Devices and Circuits, An introduction by Allen Mottershead, TMH.
3. Electronic Devices and Circuits theory by Robert L. Boylestad, Lonis nashelsky.

B.Tech. FIRST YEAR (SECOND SEMESTER)
ENVIRONMENTAL STUDIES

PAPER CODE: CY-103T
Credits: 2 **LTP: 300**
I Semester (CSIT, CH & ME)
II Semester (EE, EL & EC)

Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health. Consumption of natural resources and environmental degradation of forests, water, coal, minerals, energy, and land. Sustainable development, Environmental policy and legislation, Environmental impact assessment. Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems. Solid and hazardous waste management: causes, effects and control measures. Air and noise pollution, science and engineering of pollution control, Global Issues including climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, Disaster management, industrial accidents, floods, earthquakes, cyclones and landslides, Green house effect etc.

Suggested Books:

1. W. P. Cunningham and M. A. Cunningham, **Principles of Environmental Science,** Tata McGraw-Hill Publishing Company, New Delhi, 2002.
2. J. A. Nathanson, **Basic Environmental Technology**, Prentice Hall of India, New Delhi, 2002.
3. S. J. Arceivala, and S. R. Asolekar, **Waste water Treatment for Pollution Control and Reuse** (3rd Edition), Tata McGraw Publishing Co. Ltd., New Delhi, 2006.
4. S.R. Asolekar, and R. Gopichandran, **Preventive Environmental Management: An - Indian Perspective**, Foundation Books Pvt. Ltd., New Delhi, 2005. Some selected book-chapters, monographs and journal papers.

B.Tech. FIRST YEAR (SECOND SEMESTER)

FUNDAMENTALS OF ECONOMICS

PAPER CODE: HU-103T
Credits: 2 **LTP: 300**
I Semester (CSIT, CH & ME)
II Semester (EE, EL & EC)

UNIT:I

Microeconomics: What is Economics? basic economic problems and nature of economics; demand and supply; consumer choice; individual and market demand; production and cost of production; profit maximization and perfect competition; market structure-monopoly, monopsony, monopolistic competition, and oligopoly; externalities and public goods; factor markets-land, labour and capital market.

UNIT:II

Macroeconomics: National income accounting-income, expenditure and components of GDP; consumption and saving; investment spending and demand for money; financial systems-central bank, money, credit, financial markets and asset prices; income and spending; money, interest and income; fiscal and monetary policies; economic growth and accumulation; aggregate supply- wages, prices and unemployment; inflation.

Suggested Books:

1. R.S. Pindyck and D.L. Rubinfeld. **Microeconomics** (7th Edition), Pearson Prentice Hall, New Jersey, 2009.
2. R. Dornbusch, S. Fischer, and R. Startz. **Macroeconomics** (9th Edition), McGraw-Hill Inc. New York, 2004.

B.Tech. FIRST YEAR (SECOND SEMESTER)

BASIC MECHANICAL ENGINEERING

PAPER CODE: ME-105T
Credits: 4 **LTP: 310**
I Semester (CSIT, CH & ME)
II Semester (EE, EL & EC)

A. THERMODYNAMICS:

UNIT:I

Fundamental Concepts and definitions: Definition of thermodynamics, system, surrounding and universe, phase, concept of continuum, macroscopic & microscopic point of view. Density, specific volume, pressure, temperature. Thermodynamic equilibrium, property, state, path, process, cyclic process, Energy and its form, work and heat, Enthalpy.

UNIT:II

Zeroth Law: Concepts of temperature, zeroth law.

First Law: First law of thermodynamics. Concept of processes, flow processes and control volume, flow work, steady flow energy equation, Mechanical work in a steady flow of process.

Second Law: Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator, Statements of second law. Carnot cycle, Clausius inequality, Concept of Entropy.

UNIT:III

Properties of steam and thermodynamics cycles: Properties of steam, use of property diagram, Steam-Tables, processes involving steam in closed and open systems. Rankine cycle. Introduction to I.C. Engines-two & four stoke S.I. and C.I. engines. Otto cycle, Diesel cycle.

B. MECHANICS

UNIT:IV

Force system and Analysis:

Basic Concept: Laws of motion. Transfer of force to parallel position. Resultant of planer force system. Free Body Diagrams, Equilibrium and its equation, Centre of gravity, Moment of Inertia. **Friction:** Introduction, Laws of coulomb friction, Equilibrium of bodies involving dry friction- Belt Friction.

UNIT:V

Stress and Strain Analysis:

Simple stress and strain: Introduction, Normal shear stresses, stress-strain diagrams for ductile and brittle materials, elastic constants, one dimensional loading of members of varying cross sections, strain Energy.

UNIT:VI

Newton's Second Law: D' alemberts Principle-problems (for horizontal & inclined surface). Analysis of lift, motion problem. Motion of several connection bodies, Motion of two bodies connected by as tiring, when one body is lying on horizontal surface and other is hanging free, when one body is lying on inclined plane and other is hanging free case (i) Smooth inclined surface case (ii) Rough inclined surface of co-efficient of friction 'μ' (only problems).

Work Power & Energy: work-Units of work-Problems (horizontal & inclined surface). Power Derivation of the expression for power required to drive a body, problems energy, Types ofenergy problems. Laws of conservation of energy. Newton's law of conservation of momentum. Plastic impact & Elastic impact.Driving a pile into ground-problems. Motion of connected bodies, work done by spring.

Book:

1. Thermodynamics by P. K. Nag.
2. Thermodynamic by P. L. Ballaney.
3. Engineering Mechanics & Strength of Materials by R. K. Bansal (Chapter 6, 7 & 9) Lakshmi Publications, New Delhi.
4. Holman, J. P.: Thermodynamics, McGraw Hill book Co. NY.
5. Yadav R.: Thermodynamics and Heat Engines. Vol I &II (SI Edition) Central Publishing House Allahabad.
6. Yadav R.: Steam & Gas Turbines.
7. Engineering Mechanics by S. S. Bhavikatti & K. G. Rajashekarappa (Chapter 9 & 10) New Age Publications, New Delhi.
8. F. L. Singer: Strength of Materials.
9. Timoshenko: Strength of Materials.

Sub: Engineering Physics Lab **Code: PH-101P** **Credits: 2**
Branches: I Semester (CSIT, CH & ME) **L T P: 0 0 3**
II Semester (EE, EL & EC)

LIST OF EXPERIMENTS

1. To determine the variation of T with l for a compound pendulum (Bar pendulum) and then to determine

(a) The value of **acceleration due to gravity (g)** in the laboratory, **(b) Position of centre of gravity** of the bar and the, **(c) The radius of gyration (k)** of the bar about an axis passing through C.G. and perpendicular to its length.

2. To determine the (a) **coefficient of damping (K)** (b**) relaxation time τ**, and (c) **the quality factor Q** of a damped simple harmonic motion using a simple pendulum.

3. To determine the **frequency of A.C. mains** by means of Melde's experiment.

4. To determine the **Young's Modulus of the material** of a given beam supported on two knife edges and loaded at the middle point, using spherometer arrangement.

5. To determine the **surface tension** of a liquid by a capillary rise method.

6. To determine the **wavelength of sodium light** by Newton's rings.

7. To determine the **wavelength of prominent lines of mercury** by plane diffraction grating.

8. To determine the **specific rotation of cane sugar solution** with the help of a polarimeter.

9. To determine the **dispersive power of the material** of the prism for violet and yellow colours of mercury light with the help of a spectrometer.

10. To study the **V-I characteristics** of **P-N Junction** Diode.

11. To study the **V-I characteristics** of **Zener Diode** and find zener breakdown voltage.

12. To verify the **Stefan's law**.

13. To find the **Planck's constant** by using LEDs of different colours.

14. To find the **energy band gap** of a given material by Four Probe Method.

15. (i) To find the value of **Rydberg constant**.

(ii) To measure the **wavelength of visible spectral lines in Balmer series** of atomic hydrogen.

Subject: Basic Electronics Engg. Lab **Code: EL-101P/102P** **Credits: 2**
Branches: I Semester (CSIT, CH & ME) **L T P: 0 0 3**
II Semester (EE, EL & EC)

Course outcome: At the end course student s are able to understand:
Cos1: Understand about Electrical component such as resistance, capacitors and Inductor.
Cos2: Understand about Bread Board, multimeter, cathode ray oscilloscope and function generator.
Cos3: Understand about various types of semiconductor devices like diode, BJT transistors.
Cos4: Understand about half wave and full wave rectifier.

LIST OF EXPERIMENTS

1. To study the Resistance and estimate its value on the basis of color code and Digital Multimeter.
2. To study the Capacitors.
3. To study the Inductors.
4. Study of Bread Board.
5. Study of Multimeter and Tong Tester
6. To study the various types of diodes: Semiconductor diodes, Zener diode & Light emitting diode.
7. To study the Bipolar Junction Transistors.
8. To study the Cathode Ray Oscilloscope (CRO).
9. To study the Function Generator and demonstrate the waveform on CRO.
10. To study the Half-wave rectifier and demonstrate I/P and O/P waveforms.
11. To study the Full-wave rectifier and demonstrate I/P and O/P waveforms.

Note:-

(1) In addition, Department may include more experiments based on the future requirement.

(2) The details of other lab experiments can be taken from concerned departments.

Subject: Engineering Mathematics-III ***Code: MA-201T*** ***Credits: 4***
Branches: EE, EL, EC & CSIT ***SEM: III Semester*** ***L P T: 3 1 0***

Note: A setting of eight questions will be there covering all the units proportionally out of which any five are to be attempted.

UNIT:1 **Ordinary Differential Equations:** First order equations (linear and non-linear). Linear equations of second and higher orders with constant and variable coefficients. Solution of second order equations by removing first derivative, changing of dependent and independent variables and method of variation of parameters.

UNIT:2 **Special Functions & Partial Diff. Eqns:** Power Series solutions of second order equations by frobenious method. Legendre polynomials and Berel's functions of first kind and their properties method of separation of variable for heat, wave and Laplace equations: Their solutions and related application.

UNIT:3 **Integral Transforms:** Laplace transform, existence theorem, Laplace transform of derivatives and integrals, Laplace transform of special functions. Inverse Laplace transform, convolution theorem. Applications of Laplace transform and its inverse to solve ordinary and partial differential equation.
Introduction to Fourier transforms. Fourier series, half range sine and cosine series, related applications.

References:

1. J. N. Sharma: Differential Equations, Krishna Prakashan Media (P) Ltd., Meerut.
2. B. V. Raman: higher Engineering Mathematics, Tata McGraw Hill Co., Ltd., 2008.
3. R. K. Jain & S. R. K. Iyenger: Advance Engineering Mathematics, Narosa Publishing House, 2002.
4. A. R. Vashistha: Integral Transforms Krishan Prakashan Media (P) Ltd., Meerut.
5. G. G. Simmons: Differential Equations, Tata McGraw Hill Co. Ltd., 1981.

Subject: Analog Electronics	**Code: EL-201T**	**Credits: 4**
Branches: EE, EL & EC	**Sem: III semester**	**L T P: 3 1 0**

Course Outcomes: At end of the course, students will be able to:

CO1: Analyze simple electronic circuits based on diode and transistor with special focus on designing amplifiers with discrete components.

CO2: Design simple linear power supply according to required specifications; analysed biased circuit for BJTs and amplifiers(CE,CB,CC for BJT and FET).

CO3: Perform analysis of AC of amplifiers based on weak signal model (small signal).

CO4: Demonstrate about the feedback effect in amplifier (BJT and FET).

Unit 1:- Transistor as an amplifier: Transistor Biasing and thermal stabilization: The operating point, Biasing Circuits, fixed bias, bias stability, self bias or emitter bias, fixing of Q-point using graphically & analytical methods, stabilization against variation in I_{CO}, V_{BE}, β: Bias compensation Diode for I_{CO}, V_{BE}.

Unit 2:- The Transistor at low frequencies: Two port devices and the hybrid model. The h-paratmeter, determination of h-parameter from input and output characteristics. Analysis of a transistor amplifier circuit using h-parameters; the emitter follower (its modelling), miller's theorem and its dual, cascading transistor amplifier (up to 2 stages), simplified hybrid model, high input resistance transistor circuit e.g. Darlington, Emitter follower.

Unit 3:- Field effect transistors: General description on FET, JFET operations, and its characteristic, MOSFET, the FET small signal model, CS and CD amplifiers at high and low frequencies.

Unit 4:- Feedback amplifiers: Classification of amplifiers, feedback concepts, transfer gain with feedback, general characteristics of negative feedback amplifier, input and output resistances for voltage series, current series, current shunt, voltage shunt feedback, analysis of feedback amplifier (voltage series, current series, current shunt, voltage shunt feedback).

Unit 5:- Power amplifier: Class A large signal amplifier, second harmonic distortion, higher order harmonic generation, the transfer audio power amplifier, efficiency, class B, class C, class AB and push-pull amplifier.

References:

1. Integrated Electronics Analog and Digital circuits and systems, J. Millman, Halkias and Prikh, TMD.
2. Electronics Devices and Circuit Theory; Robert Boylestad & Nashlasky (PHI).
3. Electronics Devices and Circuit: Allen mottershed (TMH).

B.TECH. SEMESTER-III
NETWORK ANALYSIS AND SYNTHESIS
EE-201N

Branches: EE, EL & EC

L T P	TOTAL
3 1 0	4

After successful completion of this course, students will be able to:

CO.1	Apply the fundamental knowledge of Network Theorems to solve the different problems of electric circuits.
CO.2	Analyze and apply the Graph Theory, Laplace transform and Fourier series approaches in electric circuits.
CO.3	Understand and analyze the one port and two port networks, and network functions.

Unit I:

Graph Theory : Graph of a Network, Planar & Non- Planar Graphs, Isomorphism, Concept of tree, co- tree, twig, link, sub-graph, connected graph, Incidence matrix, Fundamental cut set, Cut set matrix, Tie set matrix, Duality, Dual of a network and graph, Loop and Nodal methods of analysis.

Unit II:

Network Theorems (Applications to ac networks): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Dual of Millman's theorem, Compensation theorem, Tellegen's theorem.

Unit III:

Network Functions: Concept of Complex frequency, Transform Impedances, Network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions, Time response and stability from pole zero plot, Routh-Hurwitz Stability Criteria.

Unit IV:

Two Port Networks: Characterization of LTI two port networks Z, Y, ABCD, A'B'C'D', h and g parameters, Equivalent circuits of Z, Y, h and g parameters, Condition of reciprocity and symmetry of two port parameters. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks, Open Circuit and Short Circuit impedances, T & Π Representation.

Unit V:

Network Synthesis: Hurwitz Polynomial, Positive real function: definition and properties; Properties of LC, RC and RL driving point immittance functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms for one port Network.

Filters: Image parameters and characteristics impedance, passive and active filter fundamentals, Low pass, High pass, Band pass, Band stop and constant K type filters.

TextBooks:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers.
2. Network Analysis and Synthesis, C.L.Wadhwa, New Age International Publishers.
3. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli 4thedition. Tata Mc Graw Hill Education Pvt. Ltd.

Reference Books:

1. Network Analysis, M. E. Valkenburg, Pearson Education.
2. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S.Chand.
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The McGraw Hill Company.
4. Electric Circuit, M. Nahvi & J.A. Edminister, Schum's outline series, The McGraw Hill Company.
5. Electric Circuit Analysis, S. Sivanagaraju, G. Kishor, C. Srinivasa Rao, Cengage Learning.
6. Fundamental of Electric Circuits, Charles K. Alexander, Mathew. N. O. Sadiu, Tata McGraw Hill Educaton.
7. Engineering Circuit Analysis, W.H. Hayt, J.E. Kemmerly, S.M. Durbin, The McGraw Hill Companies.
8. Introduction to Electric Circuits, Richard C. Dorf, James A. Svoboda, Wiley India Edition.

B.TECH. SEMESTER-III
NETWORK ANALYSIS AND SYNTHESIS
EE-201T (Old)

Branches: EE, EL & EC	**L T P**	**TOTAL**
	3 1 0	**4**

Unit-I:

Graph Theory : Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis.

Unit-II:

Network Theorems (Applications to ac networks): Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.

Unit-III:

Laplace transforms: Introduction to Laplace Transform

Unit-IV:

Fourier Series: Introduction to Fourier Analysis.

Unit-V:

Network Functions: Concept of Complex frequency , Transform Impedances, Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot.

Unit-VI :

Two Port Networks: Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & π Representation.

Unit-VII :

(a)Network Synthesis : Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b)Filters: Image parameters and characteristics impedance, passive and active filter fundamentals, low pass, highpass, (constant K type) filters, and introduction to active filters.

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers.
2. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers.
3. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli 4th edition. Tata Mc Graw Hill Education Pvt. Ltd.
4. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference Books:

1. Network Analysis, M.E. Valkenburg, Pearson Education.
2. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit,S. Chand.
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company.
4. Electric Circuit, M. Nahvi & J.A. Edminister, Schum's outline series, The Mc Graw Hill Company.
5. Electric Circuit Analysis, S. Sivanagaraju, G. Kishor, C. Srinivasa Rao, Cengage Learning
6. Fundamental of Electric Circuits, Charles K. Alexander, Mathew. N.O. Sadiu, Tata Mc Graw Hill Educaton.
7. Engineering Circuit Analysis, W.H. Hayt, J.E. Kemmerly, S.M. Durbin, The Mc Graw Hill Companies
8. Introduction to Electric Circuits, Richard C. Dorf, James A. Svoboda, Wiley India Edition.

B.TECH. SEMESTER-III
ELECTRICAL MACHINE-I
EE-203N/ EE-203T (Old)

Branch: EE **L T P** **TOTAL**
3 1 0 **4**

After successful completion of this course, students will be able to:

CO.1	Assimilate the construction & operation of transformer & DC machines.
CO.2	Draw the characteristics, phasor diagram & equivalent circuits of the machines.
CO.3	Apply the acquired skills to identify, analyze & select a machine for a specified application.
CO.4	Investigate the machine parameters under specific operating conditions through experiments.

UNIT–I:
Electromechanical Energy Conversion Principles:
Principle of energy conversion.

UNIT-II:
Single Phase Transformer:
Construction & principle of ideal two winding transformer, no-load current waveform, plotting of no-load current waveform from B-H curve, phasor diagrams at no-load and at load conditions, rating, equivalent circuit, tests, voltage regulation, losses and efficiency, auto transformer, parallel operation of single phase transformer.

UNIT-III:
Three Phase Transformer:
Types of connections, 3 to 2 phase & 3 to 6 phase conversions.

UNIT-IV:
D.C. Machines:
Construction of DC Machines, Armature winding, Emf and torque equation, Armature Reaction, Commutation, Inter poles and Compensating Windings, Self excitation of shunt generator, Performance, Types & Characteristics of D.C. generators.

UNIT-V:
D.C. Machines (Contd.):-
Performance & Characteristics of D.C. motors, Starting of D.C. motors; 3 point and 4 point starters, Speed control of D.C. motors: Field Control, armature control and Voltage Control (Ward Leonard method); Efficiency and Testing of D.C. machines (Hopkinson's Test, Swinburne's Test & Direct load test)

Text Books:

1. I. J. Nagrath & D. P. Kothari, "Electrical Machines", Tata McGraw Hill.
2. Husain Ashfaq, "Electrical Machines", Dhanpat Rai & Sons.
3. A. E. Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery" 6th Edition McGraw Hill, International Student Edition.
4. B. R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New Age International.

Reference Books:

1. Irving L. Kosow, "Electric Machine and Transformers", Prentice Hall of India.
2. M. G. Say, "The Performance and Design of AC machines", Pitman & Sons.
3. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press, 2001.

B.TECH. SEMESTER-III
ELECTRICAL MEASUREMENT AND INSTRUMENTATION
EE-205N

Branch: EE

L T P	TOTAL
3 1 0	4

After successful completion of this course, students will be able to:

Pre requisite of the course: Basic Electrical Engg./Circuit Theory

CO.1	Evaluate errors in measurement as well as identify and use different types of instruments for the measurement of voltage, current, power and energy.
CO.2	Get acquainted with the knowledge of measurement of electric quantities like resistance, inductance and capacitance with the help of bridges.
CO.3	Identify Instrument Transformers, it's working and perform the error calculations in CT and PTs.
CO.4	Manifest the working of electronic instruments like voltmeter, multimeter, frequency meter and CRO with different experiments set-ups.
CO.5	Identify the importance of transducers, their classifications and applications for the measurement of physical quantities like motion, force, pressure, temperature, flow and liquid level.

Unit I:

Electrical Measurements: Measurement system, Characteristics of instrumentation, Methods of measurement, Errors in measurement and Measurement standards, Review of indicating and integrating instruments, Voltmeter, Ammeter and Wattmeter.

Unit II:

Measurement of Resistance, Inductance & Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

Unit III:

Instrument Transformers: Current and Potential transformer, ratio and phase angle errors, design considerations and testing.

Unit IV:

Electronic Measurements: Electronic instruments, Voltmeter, Multimeter, Wattmeter and Energy meter, Frequency and phase angle measurements using CRO, Storage oscilloscope, Spectrum and wave analyzer, Digital counter, frequency meter and digital voltmeter.

Unit V:

Instrumentation: transducers and sensors, classification and selection of sensors, measurement of force using strain gauges, measurement of pressure using Piezoelectric sensor, measurement of temperature using thermistors and thermocouples, measurement of displacement using LVDT, measurement of position using hall effect sensors, concept of signal conditioning and data acquisition systems, concept of smart sensors and virtual instrumentation.

Text Book:

1. Electrical Measurement & Instrumentation Published, Dhanpat Rai & Sons, By:- A. K. Sawhney.
2. Modern Electronic Measurement and Instrumentation by Helfrick & Cooper.

References Books:

1. Electrical Measurement and instrumentation by Golding and Widdies.
2. Introduction to Measurement and instrumentation by A. K. Ghosh.

B.TECH. SEMESTER-III
ELECTRICAL MEASUREMENT
EE-205T (Old)

Branch: EE	**L T P**	**TOTAL**
	3 1 0	**4**

UNIT I:

(1)Philosophy of Measurement:

Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards.

(2)Analog Measurement of Electrical Quantities:

Electrodynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energy meter.

UNIT II:

Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor.

UNIT III:

Measurement of Parameters:

Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter.

UNIT IV:

(1) AC Potentiometer: Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement

(2) Magnetic Measurement: Ballistic Galvanometer, flux meter, determination of hysteresis loop, measurement of iron losses.

Text Book:

1. E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India.
2. A.K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India .

Reference Books:

3. Forest K. Harries, "Electrical Measurement", Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,"Basic Electrical Measurement" Prentice hall of India, India.
5. W.D. Cooper," Electronic Instrument & Measurement Technique "Prentice Hall International.
6. Rajendra Prashad, "Electrical Measurement & Measuring Instrument" Khanna Publisher.
7. J.B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons.

B.TECH. SEMESTER-III
ELECTRICAL ENGINEERING MATERIALS
EE-207N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Interpret the salient features of structure property co-relationship.
CO.2	Investigate the behavior of metals, dielectrics and semi conducting materials under different applications
CO.3	Characterize the properties of conductors, semiconductors, dielectrics and magnetic materials in terms of conductivity, mobility, permittivity and magnetic permeability.

UNIT-I

Elementary Materials Science Concepts: Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, Energy Bandgap Theory, temperature dependence of resistivity, skin effect, Hall effect.

UNIT-II:

Dielectric Material: Dielectric Constant, Polarization, Atomic Interpretation of Dielectric Constants of Mono-atomic Gases, Poly-Atomic Molecules & Poly-Atomic Gases, Internal Fields in Solids & Liquids, Static Dielectric Constant of Solids, Ferro-Electric Materials, Spontaneous Polarization Piezoelectricity, Frequency Dependence of Electrical Polarizability, Complex Dielectric Constant, Dielectric Relaxation, Dielectric Losses.

UNIT – III:

Semiconductor Material: Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials.

UNIT – IV:

Magnetic Properties of Material: Magnetization of matter, Magnetic Material Classification, Ferromagnetic Origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density.

UNIT – V:

Materials For Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation.

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TextBooks:

1. A. J. Dekker, “Electrical Engineering Materials” Prentice Hall of India.
2. R. K. Rajput, “Electrical Engg. Materials”, Laxmi Publications.
3. C. S. Indulkar & S. Triruvagdan “An Introduction to Electrical Engg. Materials”, S. Chand & Co.

ReferenceBooks:

1. Solymar, “Electrical Properties of Materials” Oxford University Press.
2. Ian P. Hones, “Material Science for Electrical and Electronic Engineering,” Oxford University Press.
3. G. P. Chhalotra & B. K. Bhat, “Electrical Engineering Materials” Khanna Publishers.
4. T. K. Basak, “Electrical Engineering Materials” New age International.

B.TECH. SEMESTER-III
ELECTRICAL ENGINEERING MATERIALS
EE-207T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

UNIT – I:
Crystal Structure of Materials:
A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth.
B. Energy bands in solids, classification of materials using energy band.

UNIT-II:
Dielectric Material:
Dielectric Constant, Polarization, Atomic Interpretation of Dielectric Constants of Mono-atomic Gases, Poly-Atomic Molecules & Poly-Atomic Gases, Internal Fields in Solids & Liquids, Static Dielectric Constant of Solids, Ferro-Electric Materials, Spontaneous Polarization Piezoelectricity, Frequency Dependence of Electrical Polarizability, Complex Dielectric Constant, Dielectric Relaxation, Dielectric Losses.

UNIT – III:
Conductivity of Metals:
Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals.

UNIT – IV:
Mechanism of Conduction in semiconductor materials:
Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials.

UNIT – V:
Magnetic Properties of Material:
Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Text Books:
1 A.J. Dekker, "Electrical Engineering Materials" Prentice Hall of India.
2 R.K. Rajput, " Electrical Engg. Materials," Laxmi Publications.
3 C.S.Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials", S.Chand & Co.

Reference Books:
1. Solymar, "Electrical Properties of Materials" Oxford University Press.
2. Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.
3. G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers.
4. T. K. Basak, "Electrical Engineering Materials" New age International.

Subject: Electrical Machines-I Lab **Code: EE-203P** **Credits: 2**
Branch: EE **Sem: III Semester** **L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To perform polarity test on a two winding single phase transformer.
2. To perform open circuit test on a single phase transformer and determine the parameters of its equivalent circuit.
3. To perform short circuit test on a single phase transformer.
4. To perform the load test on a single phase transformer and determine its efficiency.
5. To perform Sumpner's test and determine the efficiency of a transformer.
6. To obtain the magnetization characteristics of separately excited dc generator.
7. To obtain external characteristics of dc shunt generator.
8. To perform load test on dc shunt motor.
9. To perform speed control of dc shunt motor by armature control method.
10. To perform speed control of dc shunt motor by field control method.
11. To obtain the efficiency of dc machine using Swinburne's test.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Electrical Measurement and Instrumentation Lab Code: EE-203P Credits: 2
Branch: EE Sem: III Semester L T P: 0 0 3

LIST OF EXPERIMENTS

1. To determine the value of unknown self-inductance using Anderson's Bridge.
2. To determine the value of unknown self-inductance using Maxwell's Bridge.
3. To determine the value of unknown capacitance using De-Sauty's Bridge.
4. To determine the value of unknown capacitance using Wein's Bridge.
5. To determine the value of low resistance using Kelvin's Double Bridge.
6. Calibration of single phase induction type energy meter by using a standard wattmeter.
7. To measure power and power factor by using Two wattmeter method.
8. Measurement of temperature by resistance temperature detector (RTD).
9. Measurement of temperature by thermocouple.
10. Measurement of displacement using LVDT.
11. Measurement of load, displacement, strain using Strain Gauge transducer.
12. Measurement of temperature using Thermistor.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Linear Integrated Circuits **Subject Code: EL-202T** **Course credit: 04**
Branch: EE, EL & EC **Sem.: IV** **L T P: 3 0 1 0**

Course Outcomes: At end of the course, students will be able to:

CO-1: Understand the concepts of various amplifiers, active filters, PLL and Oscillators.

CO-2: Analyze the various electrical parameters of Op-Amp using negative feedback, active filters circuits and oscillators.

CO-3: Design and implementation of op-amp based circuits and active filters.

CO-4: Perform experiments to obtain output of circuits based on 741IC op-amp and presents the results.

Course Pre-requisites: Students should have the basic fundamentals and applications of Basics Electronics Engineering, Analog Electronics and Network Analysis.

Unit 1:- Differential Amplifier-Introduction, Differential amplifier circuit configurations, D.C and A.C analysis of dual input balanced output differential amplifier, Constant current bias circuit, Transistor current mirror and active loads, Level translator stages of op-amp

Unit 2:- Operational Amplifier and its Characteristics- Introduction, Block diagram representation of typical op-amp; Electrical parameters like-Input offset voltage, Input offset current, Input bias current, CMRR, Slew rate etc.; The ideal Op-Amp, Equivalent circuit of an Op-Amp, Voltage transfer curve, Open-loop Op-Amp Configurations.

Unit 3:- Negative Feedback and Frequency Response of Op-Amp- Block diagram representation of Feedback configurations, Voltage series and Voltage shunt feedback amplifier, Concentrating on Voltage gain, Input and Output resistances, Bandwidth and feedback expressions, voltage follower circuits. Frequency response, Compensating networks, High frequency op-amp equivalent circuit, Open-loop voltage gain as a function of frequency.

Unit 4:- Applications of Op-Amp- Summing amplifier, Scaling and averaging amplifier, Instrumentation amplifier, Integrator, Differentiator, Differential amplifier realization using one and two op-amp.

Active Filters, Advantages of active filters over passive filters, First order low pass Butterworth filter design, Second order low pass Butterworth filter, First and second order high pass Butterworth filters, Band pass and band reject filters, All pass filters.

Unit5:- Oscillators and Signal Generators- Oscillator Principles, Oscillator Types, Phase Shift Oscillator, Wien Bridge Oscillator, Voltage controlled Oscillator. Basic comparator, Zero crossing detector, Schmitt Trigger, Square wave generator, Triangular wave generator, Introduction to 555 Timer, Monostable and Astable operation of 555 Timer, Phase locked loop.

Text Books:

1. Op-amps and Linear Integrated Circuits by Ramakant A. Gayakwad, PHI, India.
2. Operational amplifiers and linear Integrated circuits by Coughlin and Driscoll-PHI, India.
3. Linear Integrated Circuits by D. Roy Chaudhary, Shail Jain, New Age International (P) Ltd, India.

Subject: Digital Electronics	***Code: EC-204T***	***Credits: 4***
Branches: EE, EC & CSIT	***SEM: IV Semester***	***L P T: 3 1 0***

Course outcomes: At the end of the course, the student will have the ability to:

CO1: understand the Boolean algebra and minimization of functions.

CO2: understand the different logic families and their working principle.

CO3: designing the combinational logic circuit with different digital gates.

CO4: designing the Sequential logic circuit with different digital gates.

CO5: designing the different register and counter.

Unit1:-Basic concept of Boolean algebra: Different rules for arithmetic operation, minimization of switching functions with theorem and K-Map up to five variables, reduction techniques, prime and essential implicants, concepts of don't care condition, min. and max. Terms SOP, POS variables, entered mapping VEM, plotting & reading theory, QM methods.

Unit 2:- Digital logic families: TTL, RTL, DTL, ECL, Totem pole and open collector concept, comparison of logic families.

Unit3:-Combinational Logic: Design of combinational logic circuit using different chips/gates. Code converter: BCD-gray, excess three, encoders, decoders, multiplexers, de- multiplexers, 7-segment decoder/driver, ROM, PLA, full and half adder/subtractor, parallel adder/subtractor, look ahead carry generator, parity bit checker/generator, implementation of Boolean function with mux and decoder.

Unit4:-Sequential logic circuit: Concept of memory storage, Latches, Flip Flops, JK, SR, T, D, Master slave, characteristic table truth table, concept of flip flop, conversion techniques, race around condition, Triggering of flip flop, classification of sequential machines, oscillators, analysis of synchronous sequential circuits, design steps for sequential circuits, state diagram, state reduction minimization of the next state decoder, o/p decoder designing.

Unit 5:- Design of single mode and multimode counter: Ripple & ring, Registers, Shift register, Shift register sequences, Ring counter using shift register and memories type of register universal and directional.

REFERENCES:

1. Digital Logic and Computer Design by M. Morris Mano (PHI)
2. Digital Principles and Applications by Malvino & Leach, McGraw-Hill Book Co.
3. Fundamental of Digital Electronics by T.C. Bartee, TMH

Subject: Computer Organization ***Code: CS-204T*** ***Credits: 4***
Branches: EE, EL, EC & CSIT ***SEM: IV Semester*** ***LPT: 310***

UNIT I:

Introduction: Review of digital logic gates, Design of adder and subtractor using gates & K-MAP.

Arithmetic for Computer:- Introduction to number system, negative numbers, Arithmetic Algorithms (addition, subtraction, Booth Multiplication), IEEE standard for Floating point numbers

UNIT II:

Processor Design: Von-Neumann Structure, Processor Organization: General register organization, Stack organization, Addressing modes, instruction types, RISC and CISC.

UNIT III:

Control Design: - Control memory address sequencing, micro instruction interpretation, CPU control unit, Hardwired & Micro Programmed Control Unit, basic concepts of micro programmed control, micro program sequencer for a control memory, micro instruction formats.

UNIT IV:

Memory Organization:- Characteristics of memory systems, Memory Hierarchy, Virtual Memory, Dynamic Address Translation Scheme addressing scheme for main memory, TLB, characteristics and principles of cache memory, elements of cache design, Cache memory organization, Block replacement policies and mapping techniques.

UNIT V:

System Organization:- Synchronous & asynchronous communication, standard communication interfaces, Bus arbitration (Serial and Parallel procedure), Modes of transfer, Programmed I/O (IO addressing, IO instruction), DMA (Cycle Stealing Concept, DMA Controller and DMA Transfer), interrupt driven I/O: Interrupt processing, interrupt hardware, types of interrupts and exceptions.

REFERENCES

1. Computer Architecture and Organization, By John P. Hayes, TMH.
2. Computer organization and design, by John L. Hennessy & David A. Petterson, Morgan Kaufman.
3. Computer System Architecture, by M. Morris Mano, PHI.
4. Computer Organization, Stallings (PHI).
5. Structured Computer Organization, Tannenbaum (PHI).

B.TECH. SEMESTER –IV
ELECTRICAL MACHINE –II
EE-204N/ EE-204T (Old)

Branch: EE

L T P	TOTAL
3 1 0	4

After successful completion of this course, students will be able to:

CO.1	Analyze EMF, torque, power equations, equivalent circuit & phasor diagram of AC Electrical Machines.
CO.2	Evaluate test data to develop regulation techniques.
CO.3	Apply the basic concepts of electromechanical theory to analyze the performance of AC machines.
CO.4	Select a suitable AC machine for a specified application.

UNIT-I:

Synchronous Machine I:

Constructional features, methods of excitation, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torque & power output equation.

UNIT-II:

Synchronous Machine II:

Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating characteristics

Synchronous Motor:

Starting methods, Effect of varying field current at different loads, V-Curves, Hunting & damping, synchronous condenser

UNIT-III:

Three phase Induction Machine:

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, methods of starting, methods of speed control of induction motor: pole changing, stator voltage control, stator frequency control, cascading, V/F method of speed control, rotor voltage injection method, cogging, crawling.

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Electric Machines" ,Tata McGraw Hill.
2. Ashfaq Hussain "Electric Machines" Dhanpat Rai & Company.
3. Fitzerald, A. E., Kingsley and S.D. Umans "Electric Machinery", McGraw Hill.

Reference Books:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers.
2. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers.
3. M.G. Say, "Alternating Current Machines", Pitman & Sons

B-TECH. SEMESTER-IV
POWER SYSTEM-I
EE-206N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Acquire knowledge of general structure of power system, its components and supply system.
CO.2	Analyze mechanical and electrical design aspects of transmission system.
CO.3	Analyze effect corona and interference on existing power system.
CO.4	Acquire knowledge of insulators and insulating cables.

Unit-I:

Power System Components: Single line Diagram of Power system, Brief description of power system Elements, Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.

Supply System: Different kinds of supply system and their comparison, choice of transmission voltage.

Transmission Lines: Configurations, types of conductors, resistance of line, skin effect, Kelvin's law, Proximity effect.

Unit-II:

Over Head Transmission Lines: Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines.

Performance of Over Head Transmissions Lines:

Representation of lines, short transmission lines, medium length lines, nominal T and л-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect, Surge impedance loading.

UNIT-III:

Inductance and Capacitance Calculations of Transmission Lines: Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

UNIT-IV:

Mechanical Design of Over Headlines: Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers.

Overhead line Insulators: Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.

Unit-V:

Corona and Interference: Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines.

Insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.

Text Books:

1. Kothari & Nagrath, "Power System Engineering", McGraw-Hill Education.
2. C.L. Wadhwa, "Electrical Power System", New Age International Ltd. Third Edition.
3. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
4. J.B Gupta, 'A Course in Power Systems', S.K. Kataria and Sons.
5. Asfaq Hussain, "'Power System", CBS Publishers and Distributors.

Reference Books:

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A textbook on Power Systems Engg.', Dhanpat Rai and Sons, New Delhi.
2. S. L. Uppal, "Electric Power", Khanna Publishers.
3. S.N.Singh, "Electric Power Generation, Transmission& distribution." PHI Learning.

B.TECH. SEMESTER-IV
ELECTROMAGNETIC FIELD THEORY
EE-208N

Branch: EE **L T P TOTAL**
3 1 0 4

After successful completion of this course, students will be able to:

CO.1	Understand Coordinate system namely Cartesian cylindrical spherical and should be able to specify the practical coordinate system to be used for a quantitative or numerical problem.
CO.2	Determine & describe static & dynamic electric & magnetic fields for technologically important structures the coil change distribution, dipole, coaxial cables dielectric & connecting spheres immersed in electric field.
CO.3	Apply Knowledge & understanding boundary conditions for electric & magnetic fields voltage induces by time varying fields.
CO.4	Knowledge & physical enter potation of & ability to apply Maxwell's equations to determine field waves potential waves & their characteristic parameters.

Unit I:

Vector Calculus and Coordinate systems: Vector algebra; Cartesian, Cylindrical and Spherical coordinate systems; Differential length, area and volume; Line, surface and volume integrals; Del operator, Divergence and Curl of a vector field, Divergence theorem; Gradient of a scalar field; Stokes's theorem, Laplacian of a scalar.

Unit II:

Electrostatic fields: Coulomb's Law, Electric field-intensity, Electric field due to charge distributions, Electric flux and flux density, Gauss's Law – a Maxwell's equation, Electric dipole, Conservative property of electrostatic field, Energy, work and potential; Energy density in electrostatic fields; Conductors: Convection and conduction current densities, Continuity relation for current; Dielectric materials: Polarization, Dielectric-constants, Boundary relations for dielectric- free space interphase and dielectric- dielectric interphase, Multiple dielectric capacitors; Boundary value problems: Poisson's equations, Laplace's equation and its applications; Method of Images.

Unit III:

Magnetostatic fields: Magnetic forces, Lenz's law, Bio-savart law, Ampere's law- Maxwell's equation, Applications of ampere's law, Stokes theorem, Magnetic flux density Maxwell's equation, Vector and scalar magnetic potentials, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Energy stored in magnetic field; Self, and mutual inductances. Analogy between electric and magnetic field.

Unit IV:

Time varying fields and Maxwell's equations: Charge particle moving in a static magnetic field, Moving conductor in a static magnetic field, Farady's law, Principle of induction, Displacement current, Modified Ampere's law- Maxwell's equation, Integral and differential forms of Maxwell's equations for non- time varying and time varying cases.

Unit V:

Electromagnetic waves: Concept of homogeneous medium, Wave equation in in perfect dielectric (free space) and in conducting medium, Time harmonic wave equation (phasor notation), Uniform plane wave equation, Characteristic impedance, Wave propagation in lossy dielectrics (conducting medium), lossless (perfect) dielectrics and good dielectric; Wave propagation in and good conductor Plain waves in good conductors, Skin Depth, The Poynting vector and power flow. Polarization: Linear, circular and elliptical polarization.

Unit VI:

Reflection of waves and Transmission lines: Reflection of a plain wave on normal incidence. Transmission Lines and Smith Chart.

Text Books:

1. MNO Sadiku, "Elements of Electromagnetic', Oxford University Press.
2. S.P. Seth, "Electromagnetic Fields" Dhanpat Rai & Company.

Reference Books:

1. William H. Hayt Jr., "Engineering Electromagnetics" Tata McGraw- Hill Edition.
2. John D. Kraus, "Electromagnetic", Tata McGraw- Hill Edition.

Subject: Electromagnetic Theory ***Code: EC-203T (Old)*** ***Credits: 4***
Branch: EE ***SEM: IV Semester*** ***L P T: 3 1 0***

Unit 1:- Elements of Vector Calculus: Co-ordinate system, differential volume, surface 7 line elements, gradient, divergence, curl and del-operator.

Unit 2:- Review of static electric field: Coulomb's Law, Electric field-intensity, electric flux and flux density, Gauss's Law, conservation properties of electrostatic field, electric potential, Energy and work in electric field, Current, current density and conductor capacitance & dielectric materials, polarization relative permittivity, multiple dielectric capacitors, energy stored in a capacitor.

Unit 3:- Review of magnetic field: Faraday's law, Lenz's law, bio-savart law, Ampere's law, Magnetic flux density, Vector magnetic potential, stokes theorem, magnetic force, Displacement current, self, internal and mutual inductance.

Unit 4:- Maxwell's Laplace's and Poisson's Equation and Boundary condition: Introduction and its applications.

Unit 5:- Electromagnetic waves: Introduction and solutions for partially-conducting perfect dielectric and good conductor mediums, skin depth, interface conditions ate normal incidence, oblique incidence and Snell's laws, perpendicular and parallel polarization, standing wave, power and the pointing vectors.

Unit 6:- Transmission Lines: Wave equation for ideal transmission line, characteristics impedence, propagation & reflection, VSWR, impedance, transformation, smith chart, parallel and co-axial transmission lines, Impedance Matching, single and double stub matching, impedance matching single and double stub matching, impedance measurement, Motion of charged particles in an Electric & Magnetic Field.

REFERENCES:

1. Electromagnetic; john D. Kraus TMH.
2. Schaum's outline series on Electromagnetic; Joseph A. Edinister ,Tata Mc Graw hill inc.
3. Engineering Electromagnetics; Haytt, Kemmerly.
4. Electromagnetic wave and radiating system; John, Balmin.
5. Engineering Electromagnetics; William Haytt.

B-TECH. SEMESTER-IV
ELEMENTS OF ELECTRICAL MACHINES
EE-202T (Old)

Branches: EC, EL & ME

L	T	P	TOTAL
3	1	0	4

UNIT-I:

TRANSFORMER:

Principle & construction of single phase transformer, EMF equation, phasor diagram, equivalent circuit diagram ,SC test, OC test, efficiency.

UNIT-II:

DC MACHINES:

Principle & construction of DC generator, types of windings, types of DC generator, OCC, load characteristics, principle & construction of DC motor, back EMF, torque equation, load characteristics.

UNIT-III:

INDUCTION MOTORS:

Principle and construction of 3-phase induction motor, concept of slip, phasor diagram. Equivalent circuit diagram, T-S characteristics.

UNIT-IV:

SYNCHRONOUS MACHINES:

Principle and construction of synchronous machines, EMF equation, OCC & SCC, synchronous impedence, principle of synchronous motor, V-curve, synchronous condenser.

Text Books:

1. Electrical Technology by B.L.Theraja.
2. P.S.Bimbhra, “Electrical Machinery”, Khanna Publisher

Subject: Electrical Machines-II Lab **Code: EE-204P** **Credits: 2**
Branches: EE **Sem: IV Semester** **L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To perform the block rotor test on a three phase Induction Motor.
2. To perform the no load test on a three phase Induction Motor.
3. To perform break pulley direct load test on a three phase Induction Motor.
4. To determine X_d & X_q of the synchronous generator.
5. To perform open circuit and short circuit test on three phase Alternator.
6. To plot V- curve of three phase synchronous motor.
7. To determine the synchronizing condition of two parallel Alternator.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Digital Electronic Circuit Lab **Code: EC-204P** **Credits: 2**
Branches: EE, EC & CSIT **SEM: IV Semester** **L T P: 0 0 3**

Course Outcomes:

After the end of this course, students will be able to:

- CO1 Conduct experiments using digital ICs and components.
- CO2 Work in a team to demonstrate an application of digital circuits
- CO3 Present the findings in a detailed report.

LIST OF EXPERIMENTS

1. Verification of the truth tables of TTL gates.
2. Verify the NAND and NOR gates as universal logic gates.
3. Design and verification of the truth tables of Half and Full adder and subtractor circuits.
4. Verification of parallel Adder & subtractor circuits.
5. Design and verification of Excess -3 code to BCD converter and vice versa.
6. Design and verification of Binary to grey code converter and vice versa.
7. Verification of the truth table of one bit and two-bit comparator using logic gates.
8. Verification of the truth table of the Multiplexer and De-Multiplexer.
9. Verification of the truth table of the Multiplexer and De-Multiplexer using NAND gates.
10. Design and test of an S-R flip-flop using NOR/NAND gates.
11. Verify the truth table of a J-K flip-flop (7476).
12. Verify the truth table of a D flip-flop (7474).
13. Operate the counters 7490, 7493.
14. Design of 4-bit shift register (shift right).
15. Design of modulo-4 counter using J K flip flop.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Linear Integrated Circuit Lab	**Code: EL-206P**	**Credits: 2**
Branches: EE, EL & EC	**SEM: IV**	**L T P: 0 0 3**

Course outcomes: At the end of the Lab, student will be able to:

CO1: Work in a team to demonstrate various application of IC 741 OP-AMP.

CO2: Investigate the response of a given op-amp (IC 741) based circuits for standard input signals.

CO3: Present the observations made by their team in record while avoiding plagiarism.

LIST OF EXPERIMENTS

1. To perform the op-amp based Inverting amplifier.
2. To perform the op-amp based Non-Inverting Amplifier.
3. To perform the op-amp based Voltage follower amplifier.
4. To perform the op-amp based Adder.
5. To perform the op-amp based Subtractor.
6. To perform the op-amp based Integrator circuit.
7. To perform the op-amp based Differentiator circuit
8. To perform the op-amp based Comparator circuit.

Note:-In addition, Institutes may include more experiments based on the expertise.

B.TECH. SEMESTER-V
CONTROL SYSTEM
EE-301N

L	T	P	TOTAL
3	1	0	4

Branches: EE, EL & EC

After successful completion of this course, students will be able to:

CO.1	Apply the fundamental knowledge of control theory in design of linear control systems.
CO.2	Evaluate and analyze the stability of the linear system.
CO.3	Understand and solve the complex problems of linear control system.

Unit-I:

The Control System: Open loop & closed control; servomechanism, Physical systems. Principle of feedback Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback.

Unit-II:

Time Response analysis: Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants,

Unit-III:

Stability and Algebraic Criteria: Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.

Root Locus Technique: The root locus concepts, construction of root loci

Unit-IV:

Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar plots, Bode plots

Stability in Frequency Domain: Frequency Domain specifications, Nyquist stability criterion, assessment of relative stability: gain margin and phase margin,

Unit-V:

State variable Analysis: Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B. C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley India Ltd., 2008.
4. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

1. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
3. R. T. Stefani, B. Shahian, C. J. Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. N. C. Jagan, "Control Systems", B. S. Publications, 2007.

B.TECH. SEMESTER-V
CONTROLSYSTEM
EE-301T (Old)

Branches: EE, EL & EC	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:

The Control System:

Open loop & closed control; servomechanism, Physical systems. Principle of feedback Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback.

Unit-II:

Time Response analysis:

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants, Design specifications of second order systems: basic concept of P, PD, PI, PID controllers.

Unit-III:

Stability and Algebraic Criteria:

Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.

Root Locus Technique:

The root locus concepts, construction of root loci.

Unit-IV:

Frequency response Analysis:

Frequency response, correlation between time and frequency responses, polar plots, Bode plots.

Stability in Frequency Domain:

Frequecy Domain specifications, Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley India Ltd, 2008.
4. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

5. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
6. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
7. R.T. Stefani, B. Shahian, C.J. Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
8. N.C. Jagan, "Control Systems", B.S. Publications, 2007.

B.TECH. SEMESTER-V
POWER ELECTRONICS
EE-303N/ EE-303T (Old)

Branches: EE, EL & EC

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Identify the different solid switches and analyze its characteristics.
CO.2	Apply the fundamental knowledge of different circuits in application.
CO.3	Analyze the methods of designing of various circuits.
CO.4	Apply the acquired skills to design the circuits for various applications.

Unit-I: Power semiconductor Devices: Power semiconductor devices their symbols and static characteristics. Characteristics and specifications of switches, types of power electronic circuits. Operation, steady state & switching characteristics & switching limits of Power Transistor. Operation and steady state characteristics of Power MOSFET and IGBT.
Thyristor: Operation, V- I characteristics, two transistor model, methods of turn-on. Operation of GTO, MCT and TRIAC.

Unit-II: Power Semiconductor Devices(Contd): Protection of devices. Series and parallel operation of thyristors. Commutation techniques of thyristor, R, R-C, UJT & Static Firing Circuits.
DC Choppers: Principles of step-down chopper, step down chopper with R-L load, Principle of step-up chopper, and operation with RL load, classification of choppers.

Unit-III: Phase Controlled Converters: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters.
Performance Parameters. Three phase half wave converters. Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters.

Unit-IV: AC Voltage Controllers: Principle of On-Off and phase controls. Single phase ac voltage controller with resistive and inductive loads. Three phase ac voltage controllers (various configurations and comparison only), Single phase transformer taps changer.

Unit-V: Inverters: Single phase series resonant inverter. Single phase bridge inverters. Three phase bridge inverters Voltage control of inverters. Harmonics reduction techniques. Single phase and three phase current source inverters.

Unit-VI: Cycloconverters: 1-ϕ & 3-ϕ Cyclo-converters, mid-point & bridge type cyclo-converters, advantage of cyclo-converters.

Text Books:

1. Power Electronics by A.K.Gupta , Dhanpat Rai publishers.
2. M. H. Rashid, “Power Electronics: Circuits, Devices & Applications”, Prentice Hall of India Ltd.3rd Edition,2004.
3. M. D. Singh and K. B. Khanchandani, “Power Electronics” Tata McGraw Hill, 2005.
4. V. R. Moorthy, “ Power Electronics: Devices, Circuits and Industrial Applications” Oxford University Press, 2007.

Reference Books:

1. M.S. Jamil Asghar, “Power Electronics” Prentice Hall of India Ltd., 2004
2. Chakrabarti & Rai, “Fundamentals of Power Electronics & Drives” Dhanpat Rai & Sons.
3. Ned Mohan, T.M. Undeland and W.P. Robbins, “Power Electronics: Converters, Applications and Design”, Wiley India Ltd, 2008.
4. S.N.Singh, “A Text Book of Power Electronics” Dhanpat Rai & Sons.

B.TECH. SEMESTER-V
POWER SYSTEM-II
EE-305N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	apply the fundamental knowledge of per unit system and single line diagram in power system.
CO.2	analyze the methods to solve problems in power system.
CO.3	Identify and sketch constructional details of power system elements.
CO.4	Apply the acquired skill to identify the faults and remedial action for a specified applications.

Unit-I:

Representation of Power System Components: One-line diagram, Impedance and reactance diagram, per unit system changing the base of per unit quantities, advantages of per unit system.

Symmetrical components: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.

Unit-II:

Fault Calculations: Fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase faults, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus.

Unit-III:

Traveling Waves: Travelling Waves on Transmission Lines: Production of travelling waves, velocity of propagation, surge impedance, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves, Bewley's Lattice diagram. Protection of equipment and line against traveling waves.

Unit-IV:

Neutral grounding: Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices.

Unit-V:

Insulation Coordination: Introduction, Definitions, Determination of Insulation, Impulse Level and Insulation Level of Sub Station Equipment – Lighting Arrester Selection and Location.

Text Books:

1. W. D. Stevenson, "Element of Power System Analysis", McGraw Hill.
2. C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition.
3. Asfaq Hussain, "'Power System", CBS Publishers and Distributors.
4. B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
5. M. V. Deshpande, "Electrical Power System Design" Tata McGraw Hill.

Reference Books:

1. M. V. Deshpandey, "Elementsof Power System Design", Tata McGraw Hill.
2. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons.
3. S. L. Uppal, "Electric Power", Khanna Publishers.
4. S. N. Singh, "Electric Power Generation, Transmission & distribution", PHI Learning.

B.TECH. SEMESTER-V
POWER SYSTEM-I
EE-305T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:

Power System Components:

Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.

Supply System:

Different kinds of supply system and their comparison, choice of transmission voltage.

Transmission Lines:

Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect.

Unit-II:

Over Head Transmission Lines:

Calculation of inductance and capacitance of single phase, three phase, single circuit and double Circuit transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading.

Unit-III:

Corona and Interference:

Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines

Overhead line Insulators:

Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency

Unit-IV:

Mechanical Design of transmission line:

Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers.

Insulated cables:

Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.

Text Books:

1. W. D. Stevenson, "Element of Power System Analysis", McGraw Hill.
2. C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition.
3. Asfaq Hussain, "'Power System", CBS Publishers and Distributors.
4. B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
5. M. V. Deshpande, "Electrical Power System Design" Tata McGraw Hill.

Reference Books:

1. M. V. Deshpandey, "Elementsof Power System Design", Tata McGraw Hill.
2. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons.
3. S. L. Uppal, "Electric Power", Khanna Publishers.
4. S. N. Singh, "Electric Power Generation, Transmission & distribution", PHI Learning.

Subject: Microprocessor & their Applications **Code: EL-301T** **Credits: 4**
Branches: EE, EL, EC & CSIT **SEM: V Semester** **LPT: 310**

Course outcomes: At the end of the course, the student will have the ability to:

CO1: Describe the general architecture of 8085 microprocessor system and its memory organization.
CO2: Explore and categorize the instruction sets; and assembly language programming of 8085 by the use of different instructions.
CO3: Differentiate between various types of Interrupts and processes.
CO4: Understand and realize the Interfacing of various I/O devices with 8085 microprocessor and their use in industrial and non-industrial applications.
CO5: Understand the advance microprocessor and different communication standards.

Unit 1:- General features and Architecture of 8085 Microprocessor: Microprocessor architecture and its operation, Memory, Memory Organisation, Memory Mapped I/O mapped I/O Scheme, 8085 Microprocessor pin configuration, Internal architecture and its operation, Control signals, Flag register, Timing control unit, Decoding, Execution of an instructions and memory interfacing. Timing instruction cycle, Opcode Fetch, memory and input output read/write cycle of an instruction set.

Unit 2:- Programming Techniques of 8085 Microprocessor: How to write and execute a simple program timing and execution of the instructions, Addressing modes, programming techniques, programming technique for looping, counting and indexing, counter programs and timing delay program and timing calculations, stack operation and subroutine programs.

Unit 3:- Interrupts of 8085 Microprocessor: Hardware and software interrupts, interrupts call locations, RIM, SIM, RST 7.5, 6.5 and 5.5.

Unit 4:- Programmable interfaces of 8085 microprocessor and its Applications: Programmable peripheral interface 8255, programmable interval timer 8253/8254, DMA controller 8257, and interrupt controller 8259, Delay subroutine, seven segment display, water level indicator, microprocessor based traffic control.

Unit 5:- Introduction to 8086, other advance microprocessors and various IEEE communication standards: Internal Architecture organisation, Maximum mode and minimum mode, instruction set, initialization instructions, constructing the machine codes for 8086 instruction. Assembler directives, addressing modes, procedure and macros, re- entrant and recursive procedures, 8087 Coprocessor: Features and internal organization, Features and architecture of 80186, 80286, 80386 & 80486, RS232, RS-442, IEEE-488.

REFERENCE BOOKS:

1. Microprocessor Architecture programming and application with 8085/8080 by Ramesh S. Gaonkar.
2. Fundamentals of Microprocessor & Microcontroller by B. Ram.
3. Microprocessor and interfacing Programming and Hardware by Douglas V. Hall.
4. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386 80486, Pentium and Pentium pro-processor, Architecture, Programming and interfacing by Berry b. Bery.

Subject: Signals and Systems	***Code: EC-202T***	***Credits: 4***
Branch: EE	***SEM: V Semester***	***LPT: 310***

Unit 1:- Fourier analysis of signals, Amplitude, Phase and Power spectrum, Orthogonality of functions, Types of signals, Fourier transform of some useful functions, Singularity functions & its properties, Dirac Delta function & its properties, Sampling function, Laplace transform of some useful functions.

Unit 2:- Convolution of signals, Graphical & analytical methods of convolution, sampling theorem, Nyquist rate & Nyquist interval, Aliasing, Aperture effect, Recovery from sampled signal, natural sampling, flat top sampling. Time convolution theorem, Frequency convolution theorem.

Unit 3:- Power & Energy signals, Energy & Power spectral densities of signals, Cross correlation, Auto correlation.

Unit 4:- Systems & Filters: Linear system, Time invariant & LTI system, Impulse response, Causal systems, Filter characteristics of linear systems, Low pass filter High pass filters, Band pass filters, Band pass, Band stop filters.

Unit 5:- Random variables and probability theory, PDF, CDF and their properties, Normal and Gaussian distribution.

REFERENCES BOOKS

1. Modern Digital & Analog System by B. P. Lathi.
2. Communication systems by Singh & Spare.
3. Communication systems by Simon Haykins.
4. Digital communication systems by Taub & Schilling.
5. Probability theory and Queuing methods.

B.TECH. SEMESTER-V
INSTRUMENTATION
EE-307T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Get acquainted with the construction, working principle & the use of sensors identify their simulations & appraise with the recent advancements like micro & smart sensors.
CO.2	Identify transducers & other instruments in the formation of different instrumentation system (telemetry 7 data Acquisition System).
CO.3	Relate & compare their working under different experimental set-ups.
CO.4	Analyze the importance of process control & use of controllers in process instrumentation.

Unit-I:

Transducer- I: Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT, RVDT.

Unit-II:

Transducer- II: Capacitive, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquid level.

Unit-III:

Telemetry: General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter.

Data Acquisition System: Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

Unit-IV:

Display Devices and Recorders: Display devices, storage oscilloscope, spectrum analyzer, strip chart & x-y recorders, magnetic tape & digital tape recorders.

Recent Developments: Computer aided measurements, fibre optic transducers, microsensors, smart sensors, smart transmitters.

Unit-V:

Process Control: Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

Unit-VI: Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its components, application of CRO in measurement, Lissajous Pattern.

Text Books:

1. A. K. Sawhney, "Advanced Measurements & Instrumentation", Dhanpat Rai & Sons.
2. B.C. Nakra & K.Chaudhry, "Instrumentation, Measurement and Analysis", Tata Mc Graw Hill. 2nd Edition.
3. Curtis Johns, "Process Control Instrumentation Technology", Prentice Hall.

Reference Books:

4. E.O. Decblin, "Measurement System – Application & design", Mc Graw Hill.
5. W.D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International.
6. Rajendra Prasad,"Electronic Measurement and Instrumentation Khanna Publisher.
7. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHI Learning.

(DEPARTMENT ELECTIVE- I)
B.TECH. SEMESTER-V
INTRODUCTION TO ELECTRIC VEHICLES
EE-307N

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit I:
Introduction: Past, Present & Feature of EV, Current Major Issues, Recent Development Trends, EV Concept, Key EV Technology, State-of-the Art EVs & HEVs, Comparison of EV Vs IC Engine. EV System: EV Configuration: Fixed & variable gearing, single & multiple motor drive, In-wheel drives EV Parameters: Weight, size, force, energy & performance parameters.

Unit II:
Basics of electric motors: DC Motor: Type of wound-field DC Motor, Torque speed characteristics, DC-DC Converter, Two quadrant DC Chopper, two quadrant zero voltage transition converter-fed dc motor drive, speed control of DC Motor, Induction Motor Drive: Three Phase Inverter Based Induction Motor Drive, Equal Area PWM, Three Phase Auxiliary resonant snubber (ARS) Inverter Type (ZVC & ZCS), Single Phase ARS Inverter Topology, Speed Control of Induction Motor, FOC, Adaptive Control, Model Reference Adaptive Control (MARS), Sliding mode Control.

Unit III:
Understanding Batteries HEV: Configuration of HEV (Series, Parallel, Series-parallel & Complex), Power Flow control, Examples. Power flow control in all HEV configurations, Examples of HEV system performance Energy Sources: Different Batteries, Battery characteristics (Discharging & Charging)

Unit IV:
Battery management systems
Battery Chargers: Conductive (Basic charger circuits, Microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers), Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods.

Unit V:
Charging Infrastructures: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Moveand-chargezone.

Books:

1. C.C. Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

(DEPARTMENT ELECTIVE- I)
B.TECH. SEMESTER-V
ENERGY EFFICIENCY & CONSERVATION
EE-309N

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I: Energy conservation:
Principles of Energy Conservation, Energy conservation Planning, Energy conservation in small scale industries, Large scale industries and in electrical generation, transmission and distribution, Energy conservation Legislation.

Unit-II Energy Audit:
Aim of energy Audit, Strategic of Energy Audit, Energy management Team Consideration in implementing energy conservation Programme, Instruments for energy audit, Energy audit of Electrical Systems, HVAC, Buildings, Economic analysis.

Unit-III: Demand Side Management:
Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, Customer Acceptance & its implementation issues, National and International Experiences with DSM.

Unit-IV: Voltage and Reactive power in Distribution Systems:
Voltage and reactive power calculations and control, Voltage classes and nomenclature, voltage drop calculations, Voltage control, VAR requirements and power factor, Capacitors unit and bank rating, Protection of capacitors and switching, Controls for switched capacitors and fields testing.

Unit-V: Efficiency in Motors and Lighting system:
Load scheduling/shifting, Motor Drives-motor efficiency testing, energy efficient motors, and motor speed control. Lighting- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows, UPS selection, Installation operation and maintenance. Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003.

Text / Reference Books

1. Tripathy S.C., "Electric Energy Utilization and Conservation', Tata McGraw Hill.
2. Industrial Energy Conservation Manuals, MIT Press, Mass.
3. "The Efficient Use of Energy", Edited by I.G.C.Dryden, Butterworths, London.
4. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York.
5. L.C.Witte, "P.S.Schmidt, D.R.Brown, Industrial Energy Management and Utilization", Hemisphere Publ, Washington.
6. Power Capacitor Handbook, Butterworth & Co (Publishers) Ltd.
7. Electrical Systems Analysis and Design for Industrial Plants, Mcgraw-Hill Book Company.
8. IEEE Bronze Book, "Recommended Practice for Energy Conservation and cost effective planning in industrial facilities", IEEE Press.

(DEPARTMENT ELECTIVE- I)
B.TECH. SEMESTER-V
INTERNET OF THINGS (IoT)
EE-311N

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit I

IoT & Web Technology:

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit II

M2M to IoT A Basic Perspective:

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit III

IoT Architecture -State of the Art:

Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit IV

IoT Applications:

Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit V

Internet of Things Privacy Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities, Security.

Text Books/References:

1. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher.
2. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons.
3. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons.
4. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker.

Subject: Power Electronics Lab	**Code: EE-303P**	**Credits: 2**
Branches: EE, EL & EC	**Sem: V Semester**	**L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To study R- Firing circuit.
2. To study RC- Firing circuit.
3. To study the characteristics of SCR on CRO.
4. To study the UJT relaxation oscillator.
5. To study the UJT firing circuit.
6. To study the performance of AC phase control using TRIAC.
7. To study the performance of single phase half controlled converter.
8. To study the performance of single phase fully controlled converter.
9. To study the characteristics of FET.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Computer Simulation of Electrical Circuit Lab **Code: EE-305P**
Branches: EE **Sem: V Semester** **Credits: 2**
L T P: 0 0 3

LIST OF EXPERIMENT

1. Study of the operation of three phase diode rectifier for R and RL Load on Typhoon Hill Software.
2. Analysis of the output voltage and current of Single phase full wave diode rectifier for R and RL Load on Typhoon Hill Software.
3. Analysis of wave form for Series RLC circuit on Typhoon Hill Software.
4. Analysis of wave form for parallel RLC circuit on Typhoon Hill Software.
5. Response of LC circuit in Typhoon Hill Software.
6. Analysis of Single phase inverter using PSIM Software.
7. Obtain I-V Characteristics of solar module using PSIM Software.
8. Analysis of grid connected solar power system using PSIM Software.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Microprocessor Lab	**Code: EL-301P**	**Credits: 2**
Branches: EE, EL, EC, & CSIT	**SEM: V Semester**	**L T P: 0 0 3**

Course outcomes: At the end of this lab, the student will have the ability to:

CO1: Understand the general architecture of 8085 microprocessor system and its memory organization.

CO2: Explore and practice of various instructions and assembly language programming model of 8085.

CO3: Practice of arithmetical and logical operations with assembly language program.

CO4: Practice of interfacing of I/P and O/P peripherals with the help of assembly language program.

CO5: Practice and implementation of various applications by using 8085 programming models.

LIST OF EXPERIMENTS

1. Study of SDK -85 microprocessor trainer kit.
2. Study of the instructions set of the 8085 microprocessor.
3. Perform the basic logical/ arithmetic and data transfer operation.
4. WAP to add two 8-bits hexadecimal numbers and store the carry at given location.
5. WAP to add two 16-bits hexadecimal numbers and store the carry at given location.
6. WAP to add two BCD numbers of 8-bits.
7. WAP to perform subtraction of two 8-bits hexadecimal numbers.
8. WAP to perform multiplication of two hexadecimal numbers by addition method.
9. WAP to perform multiplication of two hexadecimal numbers by partial product method.
10. WAP to perform division of two hexadecimal numbers by subtraction method.
11. WAP to find a maximum number from a block of Data of 8-bites long.
12. WAP to find a minimum number from a block of Data of 8-bites long.
13. WAP to find number of ones “1” and number of zeros “0” in an 8-bit data.
14. WAP to sort block of Data of 8-bytes long in ascending order.
15. WAP to sort block of Data of 8-bytes long in descending order.
16. WAP to find factorial of number.
17. WAP to move / shift a block of Data of 8-bytes long to five location upward.
18. WAP to move /shift a block of Data of 8-bytes long to five location downward.
19. WAP to interface 8-bit ADC with microprocessor through 8255.
20. WAP to interface 8-bit DAC with microprocessor through 8255.
21. WAP to interface traffic light control model with microprocessor through 8255.

Note:-In addition, Institutes may include two more experiments based on the expertise.

B.TECH. SEMESTER-VI
POWER PLANT ENGINEERING
EE-304N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Illustrate planning of electricity supply.
CO.2	Impart the knowledge of thermal power plant.
CO.3	Analyze the concept of hydro power plant with different types of hydro power plant.
CO.4	Illustrate the concept and need of nuclear power plant with different types of nuclear reactors.

UNIT-I:

INTRODUCTION:

Planning of electricity supply, Maximum Demand, Demand Factor, Group Diversity Factor, Peak Diversity Factor, Types of Load, Chronological Load Curve, Load Duration Curve, Energy Load Curve, Mass Curve, Load Factor, Capacity Factor, Utilisation Factor, Base Load and Peak Load Plants, Load Forecasting Techniques: Short Term Load Forecasting, Long Term Load Forecasting.

UNIT-II:

THERMAL POWER STATION:

Coal Handling Plant, Pulverising Plant: Contact Mill, Ball Mill, Impact Mill, Draft System: Natural Draft, Mechanical Draft, Balanced Draft, Boiler: Fire Tube & Water Tube, Super Heater, Reheater, Economiser, Air-Preheater, Aish Handling Plant, Condenser, Cooling Tower and Ponds, Feed Water Heater, Steam Turbines, Detailed Layout of Thermal Power Plant.

***UNIT-III*:**

HYDRO POWER STATION:

Hyrdology: Run-Off, Stream Flow, Hydrograph, Flow Duration Curve, Storage Reservoir, Pondage, Advantage & Disadvantage of Hydro Power Plant, Site Selection Criteria, Classification of Hydro Power Plant: According to water flow regulation, Load & water head, Types of Dam: Masonary Dam, Earth Dam, Rock fill dam, Forebay, Spillway, Surge Tank, Penstock, Tailrace, Hydro Turbines: Pelton Turbine, Francis Turbine, Kaplan Turbine, Pumped Storage Plant, Detailed Layout of Hydro Power Plant. Problems in Hydro Power Development.

UNIT-IV:

NUCLEAR STATION:

Introduction, Layout of Nuclear Power Plant, Main Parts of Nuclear Power Plant, Site Selection of Nuclear Power Plant, Radioactivity, Mass Defect & Binding Energy, Fission & Fusion, Canning Materials, Coolant, Moderator Materials, Fissile and Fertile Materials, Nuclear Reactor Classification: Advanced Gas Cooled Reactor, Magnox Reactor, Pressurised Water Reactor, Boiling Water Reactor, Liquid Fuelled Reactor, Fast Breeder Reactor, Control of Nuclear Reactors, Disposal of Nuclear Waste.

UNIT-V:

ELECTRICITY TARIFF:

Introduction, General Tariff Form, Flat Demand Rate, Straight Meter Rate, Block Meter Rate, Hopkinson Demand Rate, Doherty Rate, Wright Demand Rate, Spot Pricing.

Text Books:

1. Power Plant Engineering by B.R.Gupta.
2. Power System analysis by W. D.Stevenson Granger MGH.
3. Power System Engineering by Nagrath and Kothari TMH.

B.TECH. SEMESTER-VI
POWER PLANT ENGINEERING
EE-304T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

UNIT-I:
INTRODUCTION:
Planning of electricity supply, prediction of load and energy demand forecast techniques.

UNIT-II:
THERMAL STATION:
Detailed description of thermal plant-coal handling plant, boiler, economizer, preheater, electrostatic precipitator, ash disposal.

UNIT-III:
HYDRO-STATION:
Types of turbines, types of dams, description of hydro plant.

UNIT-IV:
NUCLEAR STATION:
Nuclear fuels, nuclear reaction, types of reactors, description of nuclear plant.

Text Books:
1. Power Plant Engineering by B.R.Gupta.
2. Power System analysis by W.D Stevenson Granger MGH.
3. Power System Engineering by Nagrath and Kothari TMH.

B.TECH. SEMESTER-VI

COMPUTER SIMULATION OF POWER SYSTEM

EE-306N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Analyze symmetrical fault analysis in power system.
CO.2	Analyze short circuit faults in power system network using Z Bus method.
CO.3	Perform steady state power flow analysis of power system networks.
CO.4	To understand steady state stability analysis.

Unit-I:

Symmetrical fault analysis:

Per unit system changing the base of per unit quantities, Impedance and reactance diagram, Transformation techniques, Symmetrical components, Clark's components, Park's components, Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions.

Unit-II:

Unsymmetrical faults:

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Z_{BUS} using singular transformation, Primitive network and algorithm methods, nodal admittance matrix (Y_{BUS}), computer method for short circuit calculations.

Unit-III:

Load Flows:

Introduction, bus classifications, Development of load flow equations, load flow solution using Gauss-Siedel and Newton-Raphson method, Comparison of Gauss Siedel and Newton Raphson Method, approximation to N-R method, line flow equations and fast decoupled method.

Unit-IV:

Power System Stability:

Power flow through a transmission line, Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

Text Books:

1. Kothari & Nagrath, "Power System Engineering" Tata Mc. Graw Hill.
2. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International.

Reference Books:

1. Computer Methods in Power System Analysis by G.W. Stagg & Al. Abiad.
2. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.

B.TECH. SEMESTER-VI
COMPUTER SIMULATION OF POWER SYSTEM
EE-306T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions.

Unit-II:

Unsymmetrical faults:

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Zbus using singular transformation and algorithm, computer method for short circuit calculations.

Unit-III:

Load Flows:

Introduction, bus classifications, nodal admittance matrix (BUS Y), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

Unit-IV:

Power System Stability:

Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

Text Books:

1. Advanced Power System Analysis and Dynamics by L.P. Singh.
2. Computer Methods in Power System Analysis by G.W. Stagg & Al. Abiad.

B.TECH. SEMESTER-VI
ADVANCED CONTROL SYSTEM
EE-308N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Apply the fundamental knowledge of design of different controller .
CO.2	Analyze the methods to solve problems in optimal control system and the digital control.
CO.3	Design the control algorithms for making the control system stable.

Unit-I:

Design of Control System: Design of controllers for single loop systems in the frequency domain: Lag, lead, lag-lead networks as compensators – Design of P. PD, PI and PID controllers for first and second systems- Control loop with auxiliary feedback- Feed forward control- Multivariable control.

Unit-II:

Digital Control System: Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modelling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method. Bilinear transformation, Jury stability criterion

Unit-III:

Optimal Control: Optimal control formulation- Calculus of variations- Performance indices- Pontryagin‟s maximum principle- Time optimal control- principle of optimally- dynamic programming.

Unit _IV:

Stability Analysis: Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method.

Text Books:

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

Reference Books:

1. J. R. Leigh, "Applied Digital Control", Prentice Hall, International
2. C. H. Houpis and G.B.Lamont, "Digital Control Systems: Theory, hardware, Software", MGH.

B.TECH. SEMESTER-VI
DIGITAL & NON-LINEAR CONTROL SYSTEM
EE-308T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Apply the fundamental knowledge of Z transform and sample/hold operations in discrete control system.
CO.2	Analyze the methods to solve problems in discrete control system and the digital control algorithms.
CO.3	Design the digital control algorithms for making the discrete control system stability.

UNIT-I:

Signal Processing in Digital Control:

Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit, pulse transfer function, solution of difference equation by z-Transform method.

UNIT-II:

Design of Digital Control Algorithms:

Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

UNIT-III:

State Space Analysis and Design:

State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.

UNIT-IV:

Stability of Discrete System:

Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method.

Text Books:

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

Reference Books:

3. J.R. Leigh, "Applied Digital Control", Prentice Hall, International.
4. C.H. Houpis and G.B.Lamont, "Digital Control Systems: Theory, hardware, Software", MGH.

B.TECH. SEMESTER-VI
SPECIAL PURPOSE MACHINE
EE-310N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Understand the constructional features, basic theory and operating principle of single phase induction motor and its methods of starting.
CO.2	Acquire the knowledge of fundamentals, construction details of Linear Induction Motor (LIM).
CO.3	Learn about fundamentals, construction details and operating principles of reluctance motor, hysteresis motor, shaded pole motor, stepper motor, servomotor, switched reluctance motor, permanent magnet motor.
CO.4	Gain knowledge about the basic principles and classification of Cross field machines like amplidyne, metadyne, and commutator machines like universal motor, schrage motor and repulsion motor.

UNIT-I:

Single Phase IM: single phase induction motors-double field revolving theory & cross field theory, type s of single phase induction motor-capacitor start/run motor, shaded pole.

UNIT-II:

Stepper Motor: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multistack configurations, Torque equations, Characteristics and application.

UNIT-III:

Permanent Magnet Machine: Permanent Magnet synchronous generator, Permanent magnet DC motors, BLDC motor their Operating Principle, Equivalent Circuit, Characteristics and applications.

UNIT-IV:

Induction Motor: AC Servo Motor, Linear Induction Motor; Operational Principle, Types, Characteristics and applications.

UNIT-V:

Special Machines: Repulsion Motor, AC Series Motor, Universal Motor, switched reluctance motor, Hysteresis Motor; Operational Principle, Types, Characteristics and applications.

Text Books:

1. “Performance and Design of AC commutator motors” by O. E. Taylor, A H Wheeler.
2. “Generalized Theory of Electrical Machines” by P. S. Bimbhra, Khanna Pub.

B.TECH. SEMESTER-VI
SPECIAL PURPOSE MACHINE
EE-310T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

UNIT-I:
INDUCTION MOTOR:
Deep bar & double cage type three phase induction motor, single phase induction motors-double field revolving theory & cross field theory, types of single phase induction motor-capacitor start/run motor, shaded pole, hysteresis motor.

UNIT-II:
LINEAR INDUCTION MOTOR:
Principle , magnetic levitation, types of LIM.

UNIT-III:
COMMUTATOR MACHINES:
Universal motors-single phase and three phase, effect of motor EMF injection in induction motor, introduction to Schrage motor & repulsion motor.

UNIT-IV:
CROSS FIELD THEORY:
Cross field generator-Amplidyne and metadyne.

UNIT-V:
SPECIAL MACHINES:
Stepper motor-variable reluctance type and hybrid type, ac & dc servomotors, switched reluctance motor, permanent magnet motor.

Text Books:
1. “Performance and Design of AC commutator motors’’ by O.E.Taylor, A H Wheeler.
2. “Generalized Theory of Electrical Machines’’ by P.S.Bimbhra, Khanna pub.

Subject: Element of Communication Engineering ***Code: EC-312T*** ***Credits: 4***

Branch: EE ***SEM: VI Semester*** ***LPT: 310***

Unit 1:- Modulation Process: Definition of amplitude modulation, frequency modulation &phase modulation, DSB-AM, DSB-SC-AM, using linear modulation and non linear modulation.

Unit 2:- Linear Modulation: Collector modulator or plate modulator and base modulator.

Unit 3:- Non linear modulation: Balanced modeling & ring modulator.

Unit 4:- Generation of frequency modulation: Indirect method of FM i.e. Armstrong method of frequency modulation direct method of FM: reactance modulator.

Unit 5:- Demodulation/detection process: Demodulation of AM waves, diode detection 1, average detection and 2. Envelop detection, superhetrodyne receiver.

Unit 6:- Demodulation of FM or frequency discriminators: Single tuned discriminators, double tuned discriminators, foster seely discriminators, ratio detectors, and phase locked loop (PLL) demodulator.

Unit 7:- Noise: SNR (signal to noise ratio), noise figure, noise temperature of a cascaded system, S/N in DSB-SC receiver, S/Nin SSB-SC receiver, S/N in FM receiver, pre-emphasis and de- emphasis.

Reference Books

1. Communication systems - B.P. Lathi
2. Communication system - Simon Haykin
3. Principles of communication - George Kennedy
4. Communication system - R.P. Singh & S.D. Spare
5. Principles of communication system- Taub Shilling

(DEPARTMENT ELECTIVE-II)
B.TECH. SEMESTER-VI
SCADA & ENERGY MANAGEMENT SYSTEM
EE-314N

Branch: EE

L T P	TOTAL
3 1 0	4

UNIT I

An Introduction to SCADA:

Purpose and necessity, general structure, data acquisition, transmission & monitoring, general power system hierarchical Structure. Overview of the methods of data acquisition system, transducers, RTUs, Master terminal unit, various communication channels- cables, telephone lines, power line, microwaves, optical fiber channels and satellites.

UNIT II

SCADA in Power System:

Tasks in power system operation, Operational tasks at various hierarchical levels, National load control center, regional load control center, generating station control management, SCADA types, Automatic generation control, SCADA in power distribution, SCADA in power grid, distribution substation and feeder automation.

UNIT III

Supervisory Power Management:

Energy Management system, power system operational states, security analysis, state estimation, load forecasting, classification of load forecast, effecting factors, methods of load forecasting, energy audit utility distributed system design, regulation and distribution automation, fault control management.

UNIT IV

SCADA System Component and Application:

Intelligent electronic device, SCADA server, Human-Machine interface, Components of control system, Programmable logic controllers, SCADA applications in various utilities, SCADA applications for transmission & Distribution sector, SCADA based Instrumentation. Case studies on SCADA.

Text Books/References:

1. “SCADA and Energy Management System” by Er. Tanuj Kumar Bisht, Publisher : S.K. Kataria & Sons.
2. “SCADA and Power Systems” by Praveen Arora.

(DEPARTMENT ELECTIVE-II)
B.TECH. SEMESTER-VI
ROBOTICS AND AUTOMATION
EE-316N

Branch: EE

L	T	P	TOTAL
3	1	0	4

Unit I:

Introduction to robotics: Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

Unit II:

Grippers and Sensors for Robotics: Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots- Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

Unit III:

Drives and Control for Robotics: Drive- Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control

Unit IV:

Programming and Languages for Robotics: Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines.
Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS.

Unit V: Related Topics in Robotics: Socio- Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.

Text Books/References:

1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014).
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006).
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).

(DEPARTMENT ELECTIVE-II)
B.TECH. SEMESTER-VI
FACTSs and DEVICES
EE-318N

Branch: EE	**L T P**	**TOTAL**
	3 1 0	**4**

Unit I:
Basic Concepts of Power Flow:
Transmission Interconnections, Active and Reactive Power Flow in AC System, Stability consideration; Dynamic and transient stability, Loading capability, Need of Compensation; Active and Reactive Compensation, Conventional compensation techniques; capacitive, inductive and synchronous condenser.

Unit II:
Introduction to FACTS:
Need of FACTS; Concept, general system consideration, advantages and disadvantages. Basic types of FACTS Controller: shunt, series, combined shunt-series and other controllers.

Unit III:
Shunt Compensation:
Static Shunt Compensators: Objectives of Shunt Compensation, Methods of Controllable VAR Generation, Static VAR Compensators: SVC and STATCOM, Comparison between STATCOM and SVC.

Unit IV:
Series Compensation:
Static Series Compensators: Objectives of Series Compensation, Variable Impedance type Series Compensators, Switching Converter type Series Compensators, External Control for Series Reactive Compensators.

Unit V:
Combined Compensation:
Combined Compensators: Unified power flow controller (UPFC) and Interline power flow controller (IPFC).

Text Books/References:

Essential Reading:

1. N. G.Hingorani & L.Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems,, IEEE Press, 1999.
2. Y. H. Song and A. T. Johns, Flexible AC Transmission Systems, IET, 1999. It is a good text book.

Supplementary Reading:

1. X.P. Zang, C. Rehtanz and B. Pal, Flexible AC Transmission Systems: Modeling and Control, Birkhauser, 2006.

Subject: Control System Lab **Code: EE-302P** **Credits: 2**
Branches: EE, EL & EC **Sem: VI Semester** **L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To study the transient and frequency response of a second order network.
2. To study the performance of analog PID Controller.
3. To study the performance of Synchro transmitter receiver pair.
4. To study the loading effect on the speed of DC motor in open loop.
5. To study the loading effect on the speed of DC motor in close loop.
6. To study the error variation with forward gain on the speed of DC motor.
7. To study the configuration and evaluation the performance characteristics of a feedback light intensity control system.
8. To study the performance of 8085 based Water level controller.
9. To study the performance of potentiometer error detector.
10. To obtain the step response, nyquist plot, impulse response, bode plot, and root locus of a given transfer function.
11. Write a program for given transfer function and obtain error constant Kv, Ka & Kp.
12. Write a program for given transfer function and obtain peak overshoot, peak time, rise time for step response.
13. Write a program for suitable cascade compensation for a given open transfer function and obtain bode plot.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Power System Lab	**Code: EE-304P**	**Credits: 2**
Branch: EE	**Sem: VI Semester**	**L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To study Earth Leakage Circuit Breaker (ELCB/RCCB).
2. To study the Performance of Long Transmission Line Under Different Load (Ferranti Effect).
3. To study Percentage Differential Relay.
4. To study AC Network analyzer for study of faults.
5. To study Megger for High Resistance Measurement.
6. To study fault location in cable by Murray Loop Test.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Communication Lab	**Code: EC-312P**	**Credits: 2**
Branch: EE	**Sem: VI Semester**	**L T P: 0 0 3**

Course Outcomes: After the end of this course, students will be able to:
CO1: Work in a team to demonstration various modulation techniques with the help of trainer kit.
CO2: Investigate the response of a given block for standard input signals.
CO3: Present the observation made by their team in record while avoiding plagiarism.

LIST OF EXPERIMENTS

1. To study the process of Amplitude modulation and Demodulation.
2. To study the process of Frequency modulation and Demodulation.
3. To study the process of Pulse Amplitude modulation and Demodulation.
4. To study the process of Pulse Width modulation and Demodulation.
5. To study the process of Pulse Position modulation and Demodulation.

Note:-In addition, Institutes may include more experiments based on the expertise.

B.TECH. SEMESTER-VII
PROTECTION AND SWITCHGEAR
EE-401N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Understand different protective equipments of power system.
CO.2	Know about various protective system how it works and where it works.
CO.3	Analyze oil circuit breaker, Air blast circuit breaker, SF6 circuit breaker.

Unit I:

Introduction to Protection System: Introduction of protection system and its elements, Need for Protective systems, Evolution of protective relays, Zones of protection, Primary and Back-up Protection, Essential qualities of Protection, Classification of Protective schemes, Basic terminology of protection system.

Unit-II:

Relays: Electromagnetic, Attracted and induction type relays, Thermal relay, Gas actuated relay, Design considerations of electromagnetic relay.

Relay Application and Characteristics: Amplitude and phase comparators, Over current relays, Directional relays, Distance relays, Differential relay.

Static Relays: Comparison with electromagnetic relay, Classification and their description, Over current relays, Directional relay, Distance relays, Differential relay.

Unit-III:

Protection of Transmission Line: Over current protection, Distance protection, Pilot wire protection, Carrier current protection, Protection of bus, Auto re-closing.

Apparatus Protection: Protection of Transformer, generator and motor.

Unit-IV:

Circuit Breaking: Properties of arc, Arc extinction theories, Re-striking voltage transient, Current chopping, Resistance switching, Capacitive current interruption, Short line interruption, Circuit breaker ratings.

Testing of Circuit Breaker: Classification, testing station and equipment, testing procedure, direct and indirect testing, and selection of circuit breakers.

Types of Circuit Breaker: Constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d.c. circuit breakers.

Text Books:

1. S. S. Rao, “Switchgear and Protection”, Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, iley Eastern Ltd.

Reference Books:

1. B. Ram and D. N. Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw Hill.
2. Y. G. Paithankar and S R Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India.
3. T.S.M Rao, “Power System Protection: Static Relays with Microprocessor Applications” Tata McGraw Hill”.
4. A.R. Van C. Warringtaon , “ Protective Relays- Their Theory and Practice, Vol. I & II” Jhon Willey & Sons.

B.TECH. SEMESTER-VII
PROTECTION AND SWITCHGEAR
EE-401T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

Unit I:

Introduction to Protection System: Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays: Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

Unit-II:

Relay Application and Characteristics: Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

Static Relays: Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Unit-III:

Protection of Transmission Line: Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing,

Unit-IV:

Circuit Breaking: Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.

Testing Of Circuit Breaker: Classification, testing station and equipments, testing procedure, direct and indirect testing

Unit-V:

Apparatus Protection: Protection of Transformer, generator and motor.

Circuit Breaker: Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

Text Books:

1. S. S. Rao, “Switchgear and Protection”, Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, iley Eastern Ltd.

Reference Books:

3. B. Ram and D. N. Vishwakarma, “Power System Protection and Switchgear”, Tata Mc. Graw Hill.
4. Y. G. Paithankar and S R Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India.
5. T.S.M Rao,“Power System Protection: Static Relays with Microprocessor Applications” Tata Macgraw Hill.
6. A.R. Van C. Warringtaon , “ Protective Relays- Their Theory and Practice, Vol. I & II” Jhon Willey & Sons.

B.TECH. SEMESTER-VII
ELECTRIC DRIVES & CONTROL
EE-402N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	To learn the structure of electric drives and different load torque.
CO.2	To calculate dynamics of motor load combination and stability of electric drives.
CO.3	To learn different electric braking and dynamics of motor during starting and braking operation.
CO.4	To understand the basic principles of power electronics in AC & DC Drives.

Unit-I:

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives Classification of electric drives Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation Types of load torque: components, nature and classification.

Unit-II:

Dynamics of Electric Drive: Dynamics of motor-load combination; Transient stability of electric Drive, Steady state stability of Electric Drive, Load equalization.

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty.

Unit-III:

Electric Braking: Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors.

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking.

Unit-IV:

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited dc motor and dc series motor.

Unit-V:

Power Electronic Control of AC Drives: Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and Cycloconverter based) static rotor resistance and slip power recovery control schemes.

Solar and Battery Powered Drives: Solar panels, Motors suitable for pump drives, Solar powered pump drives; Battery powered vehicles, Solar power electrical vehicles and boats.

Special Drives: Switched Reluctance motor, Brushless dc motor, Selection of motor for particular applications.

Text Books:

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. S.K.Pillai, “A First Course on Electric Drives”, New Age International.

Reference Books:

3. M.Chilkin, “Electric Drives”, Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K. Sen, “Electric Drives”, Prentice Hall of India Ltd.
6. V. Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

B.TECH. SEMESTER-VIII
ELECTRIC DRIVES & CONTROL
EE-402T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

Unit-I:

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives Classification of electric drives Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation Types of load, Load torque: components, nature and classification.

Unit-II:

Dynamics of Electric Drive: Dynamics of motor-load combination; Steady state stability of Electric Drive; Transient stability of electric Drive.

Selection of Motor Power rating:

Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty, Load equalization.

Unit-III:

Electric Braking:

Purpose and types of electric braking, braking of dc, three phase induction and synchronous Motors.

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

Unit-IV:

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited dc motor and dc series motor.

Unit-V:

Power Electronic Control of AC Drives: Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo-converter based) static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor:

Self controlled scheme.

Special Drives:

Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.

Text Books:

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. S.K.Pillai, “A First Course on Electric Drives”, New Age International.

Reference Books:

3. M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.
6. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
HIGH VOLTAGE ENGINEERING
EE-403N/ EE-403T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Acquire knowledge about various characteristics of solid, liquid and gaseous dielectrics; and understand the various mechanisms of breakdown in them.
CO.2	Acquire the knowledge about various circuits for generating high voltages and currents in laboratory.
CO.3	Gain knowledge and develop the understanding of various systems for measuring high voltages and currents in laboratory.
CO.4	To learn about testing of various power apparatus like insulator, circuit breaker, lightning arrester and transformer.

UNIT-I:

Breakdown in Gases:

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, breakdown in vacuum.

Breakdown in Liquid Dielectrics:

Classification of liquid dielectric, characteristic of liquid dielectric, breakdown in pure liquid and commercial liquid.

Breakdown in Solid Dielectrics:

Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

UNIT-II:

Generation of High Voltages and Currents:

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III:

Measurement of High Voltages and Currents:

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT-IV:

Non-Destructive Testing:

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing:

Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Book:

1. M. S. Naiduand V. Kamaraju, "High Voltage Engineering", Tata Mc-Graw Hill.

Reference Books:

2. E. Kuffel and W. S. Zacngal, "High Voltage Engineering", Pergamon Press.
3. M. P. Chaurasia, "High Voltage Engineering", Khanna Publishers.
4. R. S. Jha, "High Voltage Engineering", Dhanpat Rai & sons.
5. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
6. M. Khalifa, "High Voltage Engineering Theory and Practice", Marcel Dekker.
7. Subir Ray, "An Introduction to High Voltage Engineering" Prentice Hall of India.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII (New) / VIII (Old)
ELECTRICAL MACHINE DESIGN
EE-404N/ EE-404T (Old)

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Understand the basic concept of machine design & structural details of electrical machines.
CO.2	Design the electrical machine for the given parameters.
CO.3	Analyze different methods to write the algorithms for designing the machine using different computer language.

UNIT-I:

Basic Considerations:

Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Calculation of total mmf and magnetizing current. Transformer Design: Output equation design of core, yoke and windings, overall dimensions, Computation of no load current to voltage regulation, efficiency and cooling system designs.

UNIT-II:

Design of rotating machines-I:

Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size. Core and armature design of dc and 3-phase ac machines.

UNIT-III:

Design of rotating machines-II:

Rotor design of three phase induction motors. Design of field system of DC machine and synchronous machines. Estimation of performance from design data.

UNIT-IV:

Computer Aided Design:

Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure. Flow charts and ‘c’ based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines.

Text Books:

1. K. Sawhney, “A Course in Electrical Machine Design” Dhanpat Rai & Sons.
2. K. G. Upadhyay, “Conventional and Computer Aided Design of Electrical Machines” Galgotia Publications.

Reference Books:

1. M. G. Say, “The Performance and Design of AC Machines” Pitman & Sons.
2. A. E. Clayton and N. N. Hancock, “The Performance and Design of D.C. Machines” Pitman & Sons.
3. S. K. Sen, “Principle of Electrical Machine Design with Computer Programming” Oxford and IBM Publications.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII (New) / VIII (Old)
EHV AC & DC TRANSMISSION
EE-406N/ EE-406T

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	To understand the basic concept of EHV AC and HVDC transmission
CO.2	Analyze the effect of corona, electrostatic field of EHV AC lines.
CO.3	Analyze different converters and know the operation and control of various MTDC Systems.

UNIT-I:

Introduction: Need of EHV transmission, standard transmission voltage, comparison of EHV ac & dc transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission

UNIT-II:

EHV AC Transmission: Corona loss formulas, corona current, audible noise – generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

UNIT-III:

Extra High Voltage Testing: Characteristics and generation of impulse voltage, generation of high Ac and Dc voltages, measurement of high voltage by sphere gaps and potential dividers.

Consideration for Design of EHV Lines: Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

***UNIT-IV*:**

EHV DC Transmission- I: Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters. Principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

UNIT-V:

EHV DC Transmission- II: Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, ac and dc filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

Text Books:

1. R. D. Begamudre, "Extra High Voltage AC Transmission Engineering" Wiley Eastern.
2. K. R. Padiyar, "HVDC Power Transmission Systems: Technology and System Reactions" New Age International.
3. J. Arrillaga, "High Voltage Direct current Transmission" IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
4. M. S. Naidu & V. Kamaraju, "High Voltage Engineering" Tata McGraw Hill.

Reference Books:

5. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications" Prentice Hall of India.
6. S.Rao,"EHVACandHVDCTransmissionEngineeringandPractice"KhannaPublisher.
7. "EPRI, Transmission Line Reference Book, 345 KV and above" Electric Power Research Institute. Palo Alto, California, 1982.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII (New) / VIII (Old)
POWER QUALITY
EE-408N/ EE-408T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:

Introduction to Power Quality:

Terms and definitions of transients, Long Duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions; Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching D C offset, waveform distortion; voltage fluctuation; power frequency variations.

Unit-II:

Voltage Sag:

Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, Active Series Compensator.

Unit-III:

Electrical Transients:

Sources of Transient Over voltages- Atmospheric and switching transients- motor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.

Unit-IV:

Harmonics:

Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc. harmonic mitigation techniques.

Unit-V:

Measurement and Solving of Power Quality Problems:

Power quality measurement devices- Harmonic Analyzer, Transient Disturbance Analyzer, wiring and grounding tester, Flicker Meter, Oscilloscope, multimeter etc.

Introduction to Custom Power Devices:

Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner (UPQC).

Text Books:

1. Roger C Dugan, McGrahan, Santoso & Beaty, “Electrical Power System Quality” McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, “Power Quality Enhancement Using Custom Power Devices”Kluwer Academic Publishers
3. C. Sankaran, “ Power Quality” CRC Press.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII (New) / VIII (Old)
POWER SYSTEM OPERATION & CONTROL
EE-410N/ EE-410T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

UNIT-I:

Introduction:

Structure of power systems, Power system control center and real time computer control, SCADA system.Level decomposition in power system. Power system security. Various operational stages of power system. Power system voltage stability

UNIT-II:

Economic Operation:

Concept and problems of unit commitment. Input-output characteristics of thermal and hydro-plants. System constraints. Optimal operation of thermal units without and with transmission losses, Penalty factor, incremental. transmission loss, transmission loss formula (without derivation). Hydrothermal scheduling long and short terms. Concept of optimal power flow.

UNIT-III:

Load Frequency Control:

Concept of load frequency control, Load frequency control of single area system, Turbine speed governing system and modeling, block diagram representation of single area system, steady state analysis, dynamic response, control area concept, P-I control, load frequency control and economic dispatch control. Load frequency control of two area system: Tie line power modeling, block diagram representation of two area system, static and dynamic response

UNIT-IV:

Automatic Voltage Control:

Schematic diagram and block diagram representation, different types of Excitation systems & their controllers.

Voltage and Reactive Power control:

Concept of voltage control, methods of voltage control-control by tap changing transformer. Shunt Compensation, series compensation, phase angle compensation

UNIT-V:

State Estimation:

Detection and identification, Linear and non-linear models.

Flexible AC Transmission Systems:

Concept and objectives FACTs controllers: Structures & Characteristics of following FACTs Controllers. TCR, FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR, UPFC.

Text Books:

1. D.P. Kothari & I.J. Nagrath, “Modern Power System Analysis” Tata Mc Graw Hill, 3rd Edition.
2. P. S. R. Murty, “Operation and control in Power Systems” B. S. Publications.
3. N. G. Hingorani & L. Gyugyi, “ Understanding FACTs” Concepts and Technology of Flexible AC Transmission Systems”
4. J. Wood & B.F. Wollenburg, “ Power Generation, Operation and Control “ John Wiley & Sons.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
NON CONVENTIONAL ENERGY SOURCES
EE-411N

Branch: EE

L	T	P	TOTAL
3	1	0	4

After successful completion of this course, students will be able to:

CO.1	Critically examine the current thrust areas of non-conventional energy resources vis-a-vis fossil fuel based power generation methods.
CO.2	Interpret and illustrate different modes of power generation using solar, wind, tidal, thermal, geothermal & MHD based technologies.
CO.3	Apply the principles of physics & semiconductors to analyze wind, solar, thermal & PV technologies.
CO.4	Create awareness for sustainable development through environment friendly energy ecosystem.

UNIT I

Introduction:

Various non-conventional energy resources-importance, classification, relative merits and demerits.

UNIT II

Solar Energy:

Solar photovoltaics: Introduction, solar radiation & its relation with photovoltaic effect. Solar cell material; silicon mono & poly crystalline, raw material other than silicon. Different types of solar cell construction and design, flat plate arrays:-optimal system sizing & protection. Photovoltaic concentration, photovoltaic systems-standalone, PV-hybrid, grid-interactive. Stationary and tracking panels, maximum power point tracking, energy storage, converter & inverter systems & their control. Application-water pumping & power plants, cost & economics, recent developments.

UNIT III

Solar thermal:

Thermal characteristics of solar radiation, solar collectors: materials, types, focussing. Solar thermal power plant-layout and arrangement, solar cooling, recent Developments.

UNIT IV

Wind Energy:

Wind power and its sources, site selection criterion, wind characteristics, momentum theory, Classification of wind machines. Wind mills-different design & their control, wind generators-different types, wind farms & grid. Wind generation in India. Issues of wind integrations-intermittent supply, economics, governmental regulations & subsidies. Wind penetration & its effects, economic issues, recent developments, international scenario.

UNIT V

Other sources:

(a) Basic construction & principle of operation of fuel cell, Gibbs-Helmholtz equations, thermodynamic free energy and conditions of equilibrium, classification of fuel cell.

(b) Introduction of Geothermal Energy.

Reference Books:

1. F.C. Treble, "Generating electricity from sun", pergamon press, UK.
2. Tapan Bhattacharya, "Terrestrial solar photovoltaics", Narosa publishing house, New Delhi, 1998.
3. G. D. Rai, "Non-conventional energy resources", Khanna Publishers, New Delhi, 2003.
4. S. P. Sukhatme, "Solar energy principles of thermal collection and storage", McGraw-Hill publishing company, limited, New Delhi, 1984.

B.TECH. SEMESTER-VII
NON CONVENTIONAL ENERGY SOURCES
EE-411T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

UNIT-I:
INTRODUCTION:
Power Crisis, future energy demand, role of Private sectors in energy management.

UNIT-II:
MHD generation:
Working principle, open and closed cycles, MHD systems, advantages, parameters governing power output.

UNIT-III:
Solar power plant:
Conversion of solar heat to electricity, Solar energy collectors, Photovoltaic cell, power generation, future prospects of solar energy use.

UNIT-IV:
Wind Energy:
Windmills, power output with combined operation of wind turbine generation and isolated generating system, technical choices& economic size.

UNIT-V:
Geothermal Energy:
Earth energy, heat extraction, vapor turbine cycle, difficulties & disadvantages.

UNIT-VI:
Tidal energy:
Tidal phenomenon, tidal barrage, tidal power Schemes.

UNIT-VII:
Ocean Thermal Energy:
Introduction, energy conversion, problems.

UNIT-VIII:
Chemical Energy Sources:
Fuel cells, classifications, hydrogen production, hydrogen energy, utilization of hydrogen gas.

UNIT-IX:
Thermoionic generator:
Basic principle Thermoionic generator.

Text Books:
1. Non-conventional energy sources by G.D. Rai, Khanna Publisher.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
NEURAL NETWORKS & FUZZY LOGIC
EE-413N

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:
Neural Networks-1 (Introduction & Architecture):
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II:
Neural Networks-II (Back propagation networks):
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.

Unit-III:
Fuzzy Logic-I (Introduction):
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

***Unit-IV*:**
Fuzzy Logic–II (Fuzzy Membership, Rules):
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V:
Fuzzy Neural Networks:
L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propagation (BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

1. Kumar Satish, "Neural Networks" Tata McGraw Hill.
2. S. Rajsekaran & G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.

Reference Books:

3. Siman Haykin, "Neural Netowrks" Prentice Hall of India.
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
DIGITAL SIGNAL PROCESSING
EE-414N

Branch: EE

L	T	P	TOTAL
3	1	0	4

Unit-1 **Discrete Time Signals & Systems:** Basic discrete time signals, Basic operations on discrete time signals, Classifications of discrete time signals, Discrete time systems and its properties, Analysis of discrete time LTI systems, Techniques for the Analysis of LTI Systems.

Unit-2 **The Z- Transform:** The Z-transform, Region of convergence and its properties, Properties of Z-transform, Inversion of Z-transform, One sided Z-transform.

Unit-3 **Discrete Fourier Transform and it's efficient computations:** Discrete Fourier Transform, Its advantages & applications, properties of Discrete Fourier Transform, linear filtering methods based on DFT, Fast Fourier Transform, Its advantages & applications, FFT algorithms(Radix-2 & Radix-4 FFT algorithim), Application of FFT algorithms.

Unit-4 **Implementation of Discrete Time system (Filters):**

Structure Realization of Discrete time FIR Filters: Direct Form, cascade Form Structure, Linear Phase and Lattice structure Realization.

Structure Realization of Discrete time IIR Filters: Direct Form-I, II, cascade Form Structure, Parallel Form Structure, Transposed Direct Form Realization (Signal Flow Graph) Lattice & Lattice Ladder structure Realization.

Unit-5 **Design of Discrete Time system (Filters):**

Design of FIR Filter: Design of Symmetric & Asymmetric FIR Filters, Design of FIR Differentiators, Design Linear Phase FIR filters using (Fourier Series Method, Rectangular Window Method, Frequency Sampling Method).

Design of IIR Filter: Design of Low pass & High pass Digital Butterworth Filter, Low pass & High pass Digital Chebyshev Filter using Impulse Invariance Transform Method, Bilinear Transform Method.

Reference Books:

1. Digital signal processing (principles, algorithms and applications) by John G. Proakis & Dimitris G. Manolakis, PHI
2. Digital signal processing by Alan V. Oppenheim and Ronal W. Schafer.
3. Introduction to Digital System Processing by Roman Kook., McGraw hill international editions.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
UTILIZATION OF ELECTRICAL ENERGY & TRACTION
EE-415N/ EE-415T (Old)

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit-I:
Electric Heating:
Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating

Unit-II:
Electric Welding:
Electric Arc Welding, Electric Resistance welding, Electronic welding control.
Electrolyte Process:
Principles of electro deposition, Laws of electrolysis, applications of electrolysis.

Unit-III:
Illumination:
Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems

Unit-IV:
Electric Traction-I
Types of electric traction, systems of track electrification Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

Unit-V:
Electric Traction-II
Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energy saving Power Electronic control of dc and ac traction drives Diesel electric traction.

TextBooks:
1. H. Partab, “Art and Science of Electrical Energy” Dhanpat Rai & Sons.
2. G. K. Dubey, “Fundamentals of Electric Drives” Narosa Publishing House.

ReferenceBooks:
3. H. Partab, “Modern Electric Traction” Dhanpat Rai & Sons.
4. C. L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy” New Age International Publications.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
HUMAN VALUES AND ETHICS
EE-416N

Branch: EE	**L**	**T**	**P**	**TOTAL**
	3	**1**	**0**	**4**

Unit -1
The value-crisis in the contemporary Indian Society. The nature of values; the value spectrum for a good life.

Unit -2
The Indian system of values, Material development and its values: the challenge of science and technology. Psychological values: integrated personality; mental health.

Unit -3
Societal values: the modern search for a good society; justice, democracy rule of law; values in the Indian constitution, Aesthetic values: perception and enjoyment of beauty.

Unit -4
Moral and ethical values; nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics or responsibility; work ethics; professional ethics.

Unit- 5
Spiritual values; different concepts; secular spirituality, Relative and absolute values, Human values: humanism and human values; human rights; human values as freedom, creativity, love and wisdom.
Management by values: professional excellence; inter-personal relationships at work place; leadership and team building; conflict resolution and stress management; management of power.

Text Books:
1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.

References:
1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

(DEPARTMENT ELECTIVE-III)
B.TECH. SEMESTER-VII
ARTIFICIAL INTELLEGENT AND MACHINE LEARNING
EE-418N

Branch: EE

L	T	P	TOTAL
3	1	0	4

Unit 1:

Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Unit 2:

Idea of Machines learning from data, Classification of problem–Regression and Classification, Supervised and Unsupervised learning.

Unit 3:

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

Unit 4:

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Over fitting.

Unit 5:

Discussion on clustering algorithms and use-cases cantered around clustering and classification.

Text Books/ References:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, “Practical Work book Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-Xteam Publisher.
3. Yuxi (Hayden) Liu, “Python Machine Learning by Example”, Packet Publishing Limited, 2017.
4. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
6. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Corresponding Online Resources:

1. Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

Subject: Polymeric Materials and Their Applications **Code: CY-401T**
Semester: VII (Open Elective) **Credit-4** **L T P: 3 1 0**

1. **Basic Polymer Chemistry:** Definition, Classification, Types of polymerization.

2. **Resins and Plastics:** Thermoplastic and thermosetting resins, constituents of plastics, fabrication of plastic materials, Important resins, Cellulose derivatives, Polyethylene, Teflon, Polystyrene, Polyvinylacetate, PVC, Nylons, Phenolic resins Phenol- Formaldehyde, Urea and Malamine-Urea and melamine-Formaldehyde resins, Epoxy resins, Polyester, Silicones, Lon exchange resins.

3. **Rubbers/Elastomers:** Natural rubber, compounding of rubber, Properties, uses, reclaimed rubber, Synthetic rubber, Buna-S, Nitrile rubbers, Fibre reinforced plastics (FRP).

4. **Biopolymers:** Importance and applications of few important biopolymers eg. Proteins, carbohydrates etc.

Subject: Operations Research **Code: MA-491T** **Credits: 4**
Semester: VII (Open Elective) **L T P:310**

UNIT 1: Introduction: Definition of O.R. and it's scope, modeling in O.R. General methods for solving O.R. models. The Monte-carlo technique, main characteristic of O.R. main phases of O.R. Linear programming problems. Graphical method for solve L.P.P., Two phase Method, Big-M Method, problems of tie.

UNIT 2: Assignment Model: Mathematical formulation of assignment model, Reduction theorem, problems of maximization & minimization. Hungarian process, travelling salesman problems.

UNIT 3: Transportation Model: Mathematical formulation of transportation problem. Definition of BFS, IBFS, Optimum solution. Algorithms of N-W rule, Least-cost & VAM and their problem.

UNIT 4: Sequencing: Introduction, principle assumptions processing of jobs through two, three & m machine's.

UNIT 5: Game Theory: Characteristic of Games. Basic definitions, minimax criterion and optimal strategy. Equivalence of rectangular Games, Dominance process, Arithmetic method for solving zero-sum-two person Games. Graphical and simplex methods for solving the games.

UNIT 6: Replacement: Replacement of item that fail completely.

UNIT 7: Inventory: Elementry Inventory Models, Inventory models with price breaks.

Reference Books:

1. G. Hadley: Linear programming, Narosa Publishing house, 1995.
2. Mokhtar, S. Bazara, John, J. Jarn‟s and Hanif, D. Sherali: Linear Programming and network flows, John Wiley & Sons, New York 1990.
3. H.A.Taha: Operations Research-An Introduction, Macmillan Publishing Co. Inc. New York.
4. Kantiswarup, P.K. Gupta and Man Mohan: Operations Research, Sultan Chand & Sons, New York.

Subject: Futuristic Materials **Code: PH -419T** **Credit-4**
Semester: VII (Open Elective) **L T P: 3 1 0**

Semiconductors:
Introduction of semiconductors, intrinsic and extrinsic, II-VI and IIIV semiconductors and its alloys, Advantages and necessity of the tailoring of semiconductor, Semiconductors and it alloys used of LED and other devices, Utility of semiconducting alloys like GaAIAs, GaAIN, GaAIP etc.

Superconductors:
Fundamental Phenomenon associated with superconductors. Type I & II superconductors, Meissner Ochenfeld effects, Josephon effects, fundamental of BCS theory. Novel High Temperature Superconductors. Hole superconductors, TIBaCaCuO single and bilayer. Electron superconductors NdCuO etc. Doping effects in superconductors, Organic superconductors, fullerenesl. Application of the superconductors in science, medical and commercial sectors.

Material for Magnetic media:
Material useful for magnetic recording head, magnetic disk, magnetic tape media, Magneto optic recording materials. Holography, data storage materials.

Holography:
Fundamentals of holography, Difference between conventional photography and holography. Techniques to make a hologram. Advantages of holography over other techniques**.**

Introduction of following with applications:
Fibre optics, Lasers, Ceramics, Dielectric Characterization of Materials.

Books: 1) Superconductivity Today: T.V. Ramakrishna & C.N.R. Rao Wiley astern Pvt. Ltd, New Delhi, 1992
2) Solid State Physics: Ashcrost/Mervin.

Subject: Material Imperfection and Their Application Code: PH-429T Credit-4
Semester: VII (Open Elective) L T P: 3 1 0

Structure of Crystalline Solids: Fundamental concepts, unit cell, crystallographic directions and planes, Crystal systems, Metallic crystal structures.

Imperfections in Solids: Introduction, Point defects: Vacancies and self-interstitials colour centres, in purities is solids, Linear defects dislocations, Interfacial defects, Bulk or volume defects.

Diffusion in Solid: Diffusion, diffusion Mechanisms: vacancy diffusion, interstitial diffusion, steady state diffusion: Fick‟s first law, non-steady state diffusion: Fick‟s second law, Factors that influence diffusion, Applications.

Amorphous Materials: Definition, types, structure, methods of preparation of amorphous materials, Applications: optical fibers, amorphous semi-conductor, optical memories, solar cells.

Plastic deformation & Strengthening Mechanisms: Plastic deformation, the tensile stress-strain curve, modes of plastic deformation-slip and twinning, the shear strength of perfect and real crystals, the stress to move a dislocation, mechanisms of strengthening in metals by grain size reduction, solid solution strengthening, strain hardening.

Lasers: Principle, population inversion, Einstein's and B coefficients, types: Ruby laser, he-Ne laser, semi conductor lasers.

Books:

1. Non Crystalline materials: by Davis & Mott.
2. Amorphous Solids: by S.R. Elliot.
3. Solid State Physics: by M.A. Wahab.

Subject: Engineering Economics **Code: HU-402T** **Credit-4**
Sem: VII (Open Elective) **L T P: 3 1 0**

UNIT I: Concepts of Engineering Economics.

- Nature, scope and importance of engineering economics.
- National Income – meaning and concept. Definition of national income, Gross National Product (GNP) and Net National Product (NNP).

UNIT II: Theory of Employment.

- Classical theory of employment – Say's Law.
- Keynesian theory of employment- Effective demand, Aggregate demand, Aggregate supply, Underemployment equilibrium.

UNIT III: Consumption Function.

- Keynes‟ law of consumption
- Marginal Propensity to Consume (MPC) Marginal Propensity to Save (MPS).

UNIT IV: Monetary Economics.

- Functions of money
- Gresham‟s Law of Money
- Quantity Theory of Money (QTM) – Fisher‟s Version of QTM.
- Cash Balance Approach – Cambridge Equations. Comparison of Fisher equation and Cambridge equation ; Superiority of Cambridge over Fisher.

  Inflation- Definition of inflation, Demand pull inflation, Cost push inflation, Measures to control inflation.

  Deflation- Definition of deflation, Impact of deflation on different sections of society, Measures to control deflation.

UNIT V: Economic Development.

- Definition of Economic Development , obstacles to economic development.
- Definition of Economic Growth , determinants of economic growth, difference between economic development and economic growth.
- Human Development Index (HDI). Gender Inequality Index (GII).

Reading list:

1. Edward Shapiro, Macroeconomics, Galgotia Publication Ltd. , New Delhi.
2. R Dornbusch, S Fisher and R Startz, Macroeconomics, McGraw Hill, New York. D M Mithani,
3. Macroeconomics, Himalaya Publishing House, New Delhi.

Subject: Foreign Trade **Code: HU-407T** **Credit-4**

Semester: VII (Open Elective) **L T P: 3 1 0**

UNIT:1 **Nature of foreign Trade:** Meaning, Nature, Scope and Distinct Features of International Tansactions.

UNIT:2 **Theories of International Trade:** The Classical Theory:-Absolute Advantage Model of Adam Smith, comparative Advantage Model of David Ricardo, the Neo-classical Analysis:-International trade Equilibrium under Constant cost, Increasing Cost and Decreasing cost conditions.

UNIT:3 **Tariffs and Quota:** types and Effect of tariffs and Quotas, Quota vs. Tariff.

UNIT:4 **International Monetary fund (I.M.F.):** Nature, Objectives and functions of I.M.F. International Monetary System, since the demise of Bretton Woods System.

UNIT:5 **International Financial Institutions:** World Bank (IBRD, International Financial Corporation (I.F.C.), International Development Association (I.D.A.).

UNIT:6 **India's Trade Policy:** Trends of Exports and Imports of India since independence, Composition o India's Foreign Trade.

Subject: Quantitative Methods in Economics **Code: HU-409T** **Credit-4**

Semester: VII (Open Elective) **L T P: 3 1 0**

UNIT:1 **Statistics:** Definition, Importance, Scope and Limitations of statistics, primary and secondary data. Classification of Meaning: objectives and types of classification. Frequency Distribution: Discrete, Grouped and continuous frequency distributions. Fundamentals of frequency distribution.

UNIT:2 **Measures of Central Tendencies:** arithmetic mean, Median, Mode, Geometric Mean and Harmonic Mean, Demerits and Uses of all methods.

UNIT:3 **Measures of Dispersion:** Mean deviation Method about Mean, Median and Mode, Merits and Demerits of Mean Deviation. Coefficient of M.D. Standard Deviation (S.D.) Method with simple short-cut and step deviation methods.Merits and Demerits of S.D. Coefficient of S.D.

UNIT:4 **Correlation:** Introduction, Types of Correlation, Karl Pearson‟s Coefficient of Correlation. Interpretation of 'r'. Probable Error, Uses of Probable Error.

UNIT:5 **Linear Regression Analysis:** Introduction, Two method of Linear Regression Analysis:- (1) Line of Regression of Y on X and (2) Line of Regression and X on Y. Why two lines of regression Coefficient of Regression. Relation between the coefficient of correlation and Regression.

UNIT:6 **Index Number:** Definition, Uses and Types of Index Numbers, Methods of Construction Index Numbers- (1) Simple Aggregate Method (2) Weighted Aggregate Method (3) Fisher's Ideal Index Numbers (4) const of living Index Numbers (5) Chain Base Index Numbers. Base Shifting. Limitations of Index Numbers.

Subject: Principle of Management **Code: HU-449T** **Credits: 4**
Semester: VII (Open Elective) **L T P: 3 1 0**

UNIT 1: Management as a discipline: Definition, nature, scope, functions, managerial Skills, Management. Thought- Historical Prospective, Social Responsibility, of Business.

UNIT 2: Planning: Concept and purpose, planning process, Management, By Objectives (MBO), Decision making.

UNIT 3: Organization: Concept and purpose of organisation, types of organisation, bases of Departmentation, concept of Authority and Responsibility, Span of Management, Line and Staff Authority, Functional Authority, Delegation of Authority, Centralization and Decentralization of Authority, Coordination Staffing.

UNIT 4: Directing: Leadership Concept, Ingredients, Traits, Styles, Roles Communication Concept. Types, Process Barriers, Making Communication effective, Importance.

UNIT 5: Controlling: Concept, Provides, Requirements, for adequate control, controlling and earning, Budgeting control Importance, Management Audit, Management in future.

Subject: Protection & Switchgear Lab **Code: EE-401P** **Credits: 2**
Branches: EE **Sem: VII Semester** **L T P: 0 0 3**

LIST OF EXPERIMENTS

1. To study Buchholz Relay.
2. To study the characteristics of MCB and Fuse.
3. Transformer Oil Testing.
4. To study IDMT (Inverse Definite Minimum Time) Relay.
5. To study Instantaneous Over Current Relay.
6. To Study Earth Fault Relay.

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Industrial Automation & PLC Lab **Code: EE-403P** **Credits: 2**
Branches: EE **Sem: VII Semester** **L T P: 0 0 3**

LIST OF EXPERIMENT

A) Industrial Automation:

1. Study hardware and software platforms for DCS.
2. Simulate analog and digital function blocks.
3. Study, understand and perform experiments on timers and counters.
4. Logic implementation for traffic Control Application.
5. Logic implementation for Bottle Filling Application.
6. Tune PID controller for heat exchanger using DCS.
7. FBD for auto-clavable laboratory fermenter.
8. Develop graphical user interface for the fermenter plant.

B) PLC:

1. Study hardware and software used in PLC.
2. Implementation Logic Gates.
3. Implementation of DOL Starter.
4. Implementation of On-Delay Timer.
5. Implementation of Off-Delay Timer.
6. Implementation of Up-Down Counter.
7. Implementation of PLC Arithmetic Instructions.
8. Implementation of PID Controller.

Note: - virtual lab links:

For Industrial Automation:
http://ial-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering

For PLC:
http://plc-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering

Note:-In addition, Institutes may include more experiments based on the expertise.

Subject: Major Project	**Code: EE-410P**	**Credits: 12**
Branches: EE	**Sem: VIII Semester**	**L T P: 0 0 3**

Course outcomes: At the end of the course, the student will have the ability to:
CO1: Understand the final design of project in a team spirit.
CO2: Implement the literature survey in her/his project.
CO3: Learn technical interaction with her/his project supervisor.
CO4: Finalize and validation of her/his project.
CO5: To present her/his work to any national/international conference or Journal.

The objective of the Major Project is to enable the students to work in groups of not more than Four members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide or co-guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem.

Under the major project, student will do the project work in our university or any other identified industry/research institute/University/ of repute. The students will devote his/her 8th Semester for this project work and prepare a comprehensive project report whose evaluation will be done by the department.

In the middle of the project work, student has to deliver a progress report presentation in the department. On the basis of progress report presentation and a confidential report from the concerned guide, the project work will be evaluated.