Narula Institute of Technology

Department of Electrical Engineering

Curriculum & Syllabus Booklet
of
Bachelor of Technology

Autonomy Regulation 2016

DEPARTMENT OF ELECTRICAL ENGINEERING

Departmental Vision

To develop responsible citizens who would 'think global and act local' and become the change agents of society to meet the challenges of future.

Departmental Mission

M1: To impart comprehensive and quality education and to develop innovative, entrepreneurial and ethical professionals, suitable for, sustainable environment.

M2: To develop a reservoir of experience and knowledge and to share it with the stake holders in education for mutual enrichment.

M3: To promote, product oriented and dedicated research for establishing a self-sustaining and wealth-creating centre to serve, the social needs.

M4: To prepare the students for new challenges in the field of electrical engineering.

M5: To create and sustain an environment, for critical thinking and problem solving.

M6: To strive to be at the forefront of Research and maintain intensive interaction with Industry and leading Research Centers, where students can be engaged in Projects, Training and Internships.

M7: To undertake collaborative projects which offer opportunities for long term interaction with academia and industry.

M8: To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

Program Educational Objectives (PEOs)

PEO 1: (Social contribution)

To train the students to solve real world problem through intensive practice, to guide the students to work on industry-oriented projects and to provide support for vocational training and visits to factories which will develop a sense of social contribution among the students and will motivate and inspire them for value addition to the society for each and every Endeavour.

PEO 2: (Tech and ICT skills)

To train the students on fabrication, assembly, operation, maintenance of all kinds of electrical machines and systems as well as on various programming languages as C, C++ so that they are able to develop suitable hardware and software interface to integrate electrical equipment.

PEO 3: (Communication and professional skills)

To develop competence in written communication, project documentation and paper writing as well as develop good verbal communication. To help them in developing public speaking skills along with accountability, profitability, values and ethics & professional behavior to survive in a multidisciplinary environment.

PEO 4: (Industry orientation with social awareness)

To provide the students with opportunities for vocational training, industry visits, to make them aware of the industry and accustoming them with social concerns and professional responsibility.

PEO 5: (Higher study and research with lifelong learning)

To create the opportunity to work in major or minor projects with reputed academicians as well as industry professionals and encourage them for research, continued professional training to make them aware and adaptive to changes in workplace through formal and informal training throughout their lifetime.

Program Outcomes (POs)

PO1. ENGINEERING KNOWLEDGE:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. PROBLEM ANALYSIS:

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. DESIGN/DEVELOPMENT OF SOLUTIONS:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. MODERN TOOL USAGE:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. THE ENGINEER AND SOCIETY:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Program Outcomes (POs)

PO7. ENVIRONMENT AND SUSTAINABILITY:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. ETHICS:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. INDIVIDUAL AND TEAM WORK:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. COMMUNICATION:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. PROJECT MANAGEMENT AND FINANCE:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. LIFE-LONG LEARNING:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO 1. Use engineering knowledge to model and analyze the components of electrical power systems.

PSO 2. Apply the knowledge of science and engineering to develop sustainable electrical systems for social and industrial need

CONTENTS

DEPARTMENT OF ELCTRICAL ENGINEERING

B.Tech First Semester Curriculum

Note: Under Autonomy (Gr A: ECE, EE, EIE; Gr B: CSE, IT, ME, CE)

Acronym	Department
ECE	Electronics and Telecommunication Engineering
EE	Electrical Engineering
EIE	Electronics & Instrumentation Engineering
CSE	Computer Science Engineering
IT	Information Technology
ME	Mechanical Engineering
CE	Civil Engineering

A. THEORY							
Sl. No.	Paper Code	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	M 101	Mathematics – I	3	1	0	4	4
2	CH 101 / PH 101	Chemistry – I (Gr. A) / Physics – I (Gr. B)	3	1	0	4	4
3	EE 101 / EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	1	0	4	4
4	HU 101	Communicative English	2	0	0	2	2
5	ME 101	Engineering Mechanics	3	1	0	4	4
Total of Theory						**18**	**18**

B. PRACTICAL							
Sl. No.	**Paper Code**	**Course Name**					**Credit Points**
			L	**T**	**P**	**Total**	
6	HU 191	Language Laboratory and Seminar Presentation	0	0	2	2	1
7	CH 191 / PH 191	Chemistry – I Laboratory (Gr. A) / Physics – I Laboratory (Gr. B)	0	0	3	3	2
8	EE 191 / EC 191	Basic Electrical Engineering Laboratory (Gr. A) / Basic Electronics Engineering Laboratory (Gr. B)	0	0	3	3	2
9	ME 191 / ME 192	Engineering Drawing and Graphics (Gr. A) / Workshop Practice (Gr. B)	0	0	3	3	2
Total of Practical						**11**	**7**
C. SESSIONAL							
10	XC 181	Extra-Curricular Activity (NSS / NCC)	0	0	2	2	**1**
Total of Theory, Practical & Mandatory Activities / Courses						**31**	**26**

B.Tech Second Semester Curriculum

Sl. No.	Paper Code	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
A. THEORY							
1	M 201	Mathematics – II	3	1	0	4	4
2	CH 201 / PH 201	Chemistry – I (Gr. B) / Physics – I (Gr. A)	3	1	0	4	4
3	EE 201 / EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	1	0	4	4
4	CS 201	Computer Fundamentals and Principle of Computer Programming	3	1	0	4	4
5	ME 201	Engineering Thermodynamics and Fluid Mechanics	3	1	0	4	4
Total of Theory						**20**	**20**
B. PRACTICAL							
6	CS 291	Computer Fundamentals and Principle of Computer Programming Laboratory	0	0	3	3	2
7	CH 291 / PH 291	Chemistry – I Laboratory (Gr. B) / Physics – I Laboratory (Gr. A)	0	0	3	3	2
8	EE 291 / EC 291	Basic Electrical Engineering Laboratory (Gr. B) / Basic Electronics Engineering Laboratory (Gr. A)	0	0	3	3	2
9	ME 291 / ME 292	Engineering Drawing and Graphics (Gr. B) / Workshop Practice (Gr. A)	0	0	3	3	2
Total of Practical						**12**	**8**
C. SESSIONAL							
10	MC 281	Soft Skill Development	0	0	2	2	0
Total of Theory, Practical & Mandatory Activities / Courses						**34**	**28**

B.Tech Third Semester Curriculum

A. THEORY							
Sl. No.	**Paper Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	M 301	Mathematics – III	3	1	0	4	4
2	EC(EE) 301	Digital Electronics	3	1	0	4	3
3	EC(EE) 302	Analog Electronic Circuits	3	0	0	3	3
4	EE 301	Circuits Theory and Networks	3	1	0	4	4
5	EE 302	Field Theory	3	0	0	3	3
6	ME(EE) 301	Thermal Power Engineering	2	0	0	2	2
Total of Theory						**20**	**19**
B. PRACTICAL							
7	EC(EE) 391	Analog and Digital Electronics Laboratory	0	0	3	3	2
8	EE 391	Circuit Theory and Network Laboratory	0	0	3	3	2
9	ME(EE) 391	Thermal Power Engineering Laboratory	0	0	2	2	1
10	HU 381	Technical Report Writing and Language Practice	0	0	2	2	1
Total of Practical						**10**	**06**
Total of Theory and Practical						**30**	**25**

B.Tech Fourth Semester Curriculum

Sl. No.	Paper Code	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
A. THEORY							
1	PH(EE) 401	Physics – II	3	0	0	3	3
2	EE 401	Electrical Machines – I	3	1	0	4	4
3	EE 402	Electrical and Electronics Measurement	3	0	0	3	3
4	M(CS) 401	Numerical Methods	3	0	0	3	2
5	CS(EE) 402	Data Structure	3	0	0	3	2
Total of Theory						**16**	**14**
B. PRACTICAL							
6	PH(EE) 491	Physics – II Laboratory	0	0	3	3	2
7	EE 491	Electrical Machines – I Laboratory	0	0	3	3	2
8	EE 492	Electrical and Electronics Measurement Laboratory	0	0	3	3	2
9	M(CS) 491	Numerical Methods Laboratory	0	0	2	2	1
10	CS(EE) 492	Data Structure Laboratory	0	0	2	2	1
Total of Practical						**11**	**08**
C. SESSIONAL							
11	MC 481	Technical Skill Development	0	0	2	2	0
Total of Theory, Practical & Mandatory Activities / Courses						**27**	**22**

Note: Numerical Methods and Computer Programming Lab [CS(EE) 491], and Technical Report Writing and Language Laboratory Practice [HU(EE) 481] together, will be treated as one laboratory.

B.Tech Fifth Semester Curriculum

A. THEORY							
Sl. No.	**Paper Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	HU 501	Environmental Science	2	0	0	2	2
2	EE 501	Electric Machine – II	3	1	0	4	4
3	EE 502	Power Systems – I	3	1	0	4	4
4	EE 503	Control Systems – I	3	1	0	4	4
5	EE 504	Microprocessor and Microcontroller	3	0	0	3	3
Total of Theory						**17**	**17**
B. PRACTICAL							
6	EE 591	Electric Machine – II Laboratory	0	0	3	3	2
7	EE 592	Power Systems – I Laboratory	0	0	3	3	2
8	EE 593	Control System – I Laboratory	0	0	3	3	2
9	EE 594	Microprocessor and Microcontroller Laboratory	0	0	3	3	2
10	EE581	Electrical System Design – I	0	1	3	4	2
Total of Practical						**16**	**10**
C. SESSIONAL							
11	MC 581	Group Discussion and Seminar	0	0	2	2	0
Total of Theory, Practical & Mandatory Activities / Courses						**35**	**27**

B.Tech Sixth Semester Curriculum

A. THEORY							
Sl. No.	**Paper Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	EE 601	Control System II	3	0	0	3	3
2	EE 602	Power System II	3	0	0	3	3
3	EE 603	Power Electronics	3	0	0	3	3
4	EC(EE) 604	Digital Signal Processing*	3	0	0	3	3
5	EE 605	A. Non-conventional Energy Sources andApplications B. Computational Intelligence C. Introduction to Robotics D. Mechatronics	3	1	0	4	4
6	CS(EE) 606	A. Introduction to Programming in JAVA B. Object Oriented Programming using C++ C. Computer Architecture and OperatingSystems D. Software Engineering	3	0	0	3	3
Total of Theory						**19**	**19**
B. PRACTICAL							
7	EE 691	Control System II Laboratory	0	0	3	3	2
8	EE 692	Power System II Laboratory	0	0	3	3	2
9	EE 693	Power Electronics Laboratory	0	0	3	3	2
10	CS(EE) 696	A. Introduction to Programming in JAVA Laboratory B. Object Oriented Programming using C++ Laboratory C. Computer Architecture and Operating Systems Laboratory D. Software Engineering Laboratory	0	0	2	2	1

Sl. No.	Paper Code	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
11	EE 681	Electrical System Design II	0	1	3	4	2
12	EE 671	Industrial Training	4 Weeks				2
Total of Practical						**15**	**11**
Total of Theory and Practical						**34**	**30**

B.Tech Seventh Semester Curriculum

A. THEORY							
Sl. No.	**Paper Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	HU 702	Values and Ethics in Profession	2	0	0	2	2
2	EE 701	Electric Drives	3	0	0	3	3
3	EE 702	A. Utilization of Electric Power B. Advanced Power Electronics C. Illumination Engineering	3	1	0	4	4
4	EE 703	A. Advanced Power Systems B. Power Generation and Economics C. High Voltage Engineering D. Advanced Electrical Measurement and Instrumentation	3	1	0	4	4
5	CS(EE) 705	A. Artificial Intelligence and Soft Computing B. Digital Image Processing C. Computer Networking D. Data Base Management System	3	0	0	3	3
Total of Theory						**16**	**16**
B. PRACTICAL							
7	EE 791	Electric Drives Laboratory	0	0	3	3	2
8	CS(EE) 795	A. Artificial Intelligence and Soft Computing Laboratory B. Digital Image Processing Laboratory C. Computer Networking Laboratory D. Data Base Management System Laboratory	0	0	2	2	1
9	EE 781	Assigned Project – I	0	0	6	6	4
10	EE 771	Seminar on Industrial Training and Report	0	0	0	0	1
Total of Practical						**11**	**08**

Sl. No.	Paper Code	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
11	MC 781	Entrepreneurship Development	0	0	0	2	0
Total of Theory, Practical & Mandatory Activities / Courses						29	24

B.Tech Eighth Semester Curriculum

Sl. No.	PaperCode	Course Name	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU 805	Industrial and Financial Management	2	0	0	2	2
2	EE 801	A. HVDC Transmission B. Energy Management and Audit C. Power Plant Engineering	3	0	0	3	3
3	EE 802	A. Sensors and Transducers B. Process Control and Instrumentation C. Electronic Instrumentation and Control	3	1	0	4	4
Total of Theory						**09**	**09**
B. PRACTICAL							
7	EE 881	Project and Thesis	0	0	12	12	6
8	EE 871	Grand Viva	0	0	0	0	3
Total of Practical						12	09
Total of Theory and Practical						21	18

SYLLABUS

OF

B.TECH FIRST SEMESTER COURSES

Paper Name: Mathematics – I
Paper Code: M 101
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Any introductory course on matrix algebra, calculus, geometry.

Course Objective: The purpose of this course is to provide fundamental concepts matrix algebra, Calculus of Single and Several Variables and Vector Analysis.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

- **M 101.1.** Recall the distinctive characteristics of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis.
- **M 101.2.** Understand the theoretical concept of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis.
- **M 101.3.** Apply the principles of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis to solve various problems.

Course Content

MODULE – I: Matrix Algebra [10L]
Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, Linear dependence and independence of vectors, Concept & Properties of different matrices (unitary, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian), Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Characteristic polynomials, Caley-Hamilton theorem and its applications, Reduction to diagonal form (upto 3rd order).

MODULE – II: Calculus – I (Functions of single variable) [10L]
Rolle's theorem, Mean value theorem- Lagrange & Cauchy, Taylor's and Maclaurin's theorems, Expansion of simple functions by Taylor's and Maclaurin's Theorems, Fundamental theorem of integral calculus, Evaluation of plane areas, volume and surface area of a solid of revolution and lengths, Convergence of Improper integrals, Beta and Gamma Integrals – Elementary properties and the Inter relations.

MODULE – III: Calculus – II (Functions of several variables) [12L]
Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives, Total Differentiation, Derivatives of composite and implicit functions, Euler's theorem on homogeneous functions, Chain rule, Maxima and minima of functions of two variables – Lagrange's method of Multipliers, Change of variables – Jacobians (up to three variables), Double and triple integrals.

MODULE – IV: Vector Calculus [8L]
Scalar and vector triple products, Scalar and Vector fields, Vector Differentiation, Level surfaces, Directional derivative, Gradient of scalar field, Divergence and Curl of a vector field and their physical significance, Line, surface and volume integrals, Green's theorem in plane, Gauss Divergence theorem, Stokes' theorem, Applications related to Engineering problems.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley, 1995.
5. G. Strang, Linear algebra and its applications (4th Edition), Thomson, 2006.

Reference Books:

1. S. Kumaresan, Linear algebra – A Geometric approach, Prentice Hall of India, 2000.
2. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. TG. B. Thomas and R. L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison- Wesley, 1998.
4. Hughes-Hallett et al., Calculus – Single and Multivariable (3rd Edition), John-Wiley and Sons, 2003.
5. J. Stewart, Calculus (5th Edition), Thomson, 2003.
6. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier, 2006.
7. L.Rade and B.Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
8. Murray R Spiegel and Seymour Lipschutz, Schaum's Outline of Vector Analysis. Richard Bronson, Schaum's Outline of Matrix Operations.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M 101.1	3	2	-	-	-	-	-	-	-	-	-	1
M 101.2	3	2	-	-	-	-	-	-	-	-	-	1
M 101.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Chemistry – I
Paper Code: CH 101
Contact: 3L:1T:0P
Credit: 4

Prerequisites: 10+2 science with chemistry.

Course Objective: Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers, fuels and alternative energy sources and their significance in petrochemical industries. Analyzing water quality for its various parameters and its significance in industries.

Course Outcome:

- **CH 101.1.** Able to apply fundamental concepts of thermodynamics in different engineering applications.
- **CH 101.2.** Able to analyze and design simple and technologically advanced electrical and energy storage devices.
- **CH 101.3.** Able to synthesize nanomaterials, composites, polymers.
- **CH 101.4.** Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries, and technical fields.
- **CH 101.5.** Able to apply the knowledge of different fuels and corrosion to different industries
- **CH 101.6.** Able to analyse water quality parameter for its various parameters & its significance in industries.

Course Content

Module 1 **[8L]**

Chemical Thermodynamics – I

1.1 Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.
Introduction to first law of thermodynamics: Different statements, mathematical form.
Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. 2L
1.2 Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.
Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.
Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.
Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. 3L
1.3 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas,

Concept of inversion temperature (brief).
Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. 3L

Module 2 **[7L]**
2.1 Reaction Dynamics: Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudounimolecular reaction, Arrhenius equation. 3L
Mechanism and theories of reaction rates (Content beyond the syllabus)
2.2 Solid state Chemistry: Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).
Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photo voltaic cell, fabrication of integrated circuits. 4L

Module 3 **[8L]**
Electrochemistry
3.1 Conductance: Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). 1L
3.2 Electrochemical cell: Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). 3L
3.3 Concept of battery: Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). 2L
3.4 Corrosion and its control: Introduction, cause and effect of corrosion, types of corrosion: dry, wet and other: Electrochemical corrosion, galvanic corrosion, passivation and protective measure. 2L

Module 4 **[12L]**
4.1 Structure and reactivity of Organic molecule: Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions. 3L
4.2 Polymers: Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI).
Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.
Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fibre (nylon 6, nylon 6,6), Vulcanization of rubber, Conducting polymers and bio-polymers. 7L
4.3 Nano material: Basic principles of nano science and technology, classification, preparation, properties and application of nano material. 2L

Module 5 **[5L]**
5.1 Industrial Chemistry Fuels: Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), proximate analysis of coal, Calorific value.

Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.
Gaseous fuels: Natural gas, water gas, Coal gas, bio gas, CNG, LPG 3L
5.2 Water: Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods. 2L
Short overview of water treatment plants (Content beyond the syllabus)

Reference Books:

1. Engineering Chemistry: Bandyopadhyay and Hazra Physical Chemistry: P.C. Rakshit
2. Organic Chemistry: Finar, vol-1
3. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
4. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
5. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH 101.1	3	1	-	-	-	-	-	-	-	-	-	-
CH 101.2	3	2	1	-	-	-	-	-	-	-	-	-
CH 101.3	-	-	2	-	2	-	-	-	-	-	-	1
CH 101.4	2	-	1	-	2	-	-	-	-	-	-	-
CH 101.5	2	-	-	-	-	-	2	-	-	-	-	1
CH 101.6	-	-	2	-	-	-	1	-	-	-	-	-

Paper Name: Basic Electrical Engineering
Paper Code: EE 101
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Basic 12th standard Physics and Mathematics.

Course Objective: Basic electrical engineering is an introductory course in electrical engineering. Students are introduced to simple applied electrical circuits, theories and practice to impart skill set to have visualization of electrical engineering applications. It is a course suitable for students pursuing electrical engineering as well as other related engineering disciplines.

Course Outcome: At the end of this course, students will able

EE 101.1. To understand and analyse basic electric and magnetic circuits.
EE 101.2. To understand and analysis the AC single phase and three phase circuit.
EE 101.3. To understand and analysis of the basic principles of various electrical machines.

Course Content

Module – 1: DC Circuits (7L)
Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

Module – 2: Magnetic Circuits (3L)
Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

Module – 3: AC Single-Phase Circuits (8L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R, L, C in AC series, parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

Module – 4: Three-Phase Circuits (3L)
Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

Module – 5: DC Machines (6L)
Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation, Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

Module – 6: Single-Phase Transformer (5L)
Constructional parts, Types of transformers, emf equation, No Load no load and on load operation,

phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

Module – 7: Three-Phase Induction Motor (6L)

Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter and (DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

Module – 8: General Structure of Electrical Power System (3L)

Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice.

Text Books:

1. V. Mittle and Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
3. Chakrabarti, Nath & Chanda, Basic Electrical Engineering, TMH
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference Books:

1. H. Cotton, Willey Press
2. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
3. Kothari and Nagrath, Basic Electrical Engineering, TMH

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 101.1	3	3	2	1	-	-	-	-	-	-	-	-
EE 101.2	2	2	1	-	-	-	-	-	-	-	-	-
EE 101.3	3	2	2	-	-	-	-	-	-	-	-	-

Paper Name: Communicative English
Paper Code: HU 101
Contact: 2L:0T:0P
Credit: 2

Prerequisites: Basic knowledge of high school English.

Course Objective: Designed to meet the basic survival needs of communication in the globalized workplace, including knowledge of and competency in the use of macro-skills in reading and writing proficiency, functional grammar and usage.

Course Outcome: At the end of this course, students will be

HU 101.1. Able to comprehend and communicate in English through exposure to communication skills theory and practice.
HU 101.2. Apply the basic grammatical skills of the English language through intensive practice.
HU 101.3. Able to develop reading and comprehension skills.
HU 101.4. Able to develop writing proficiency skills by writing Official Letters, Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.
HU 101.5. Able to apply/illustrate all sets of English language and communication skills in creative and effective ways in the professional sphere of their life.

Course Content

The proposed revised syllabus is as follows:

Module 1: Communication: Interface in a Globalized World [5L]

a. Definition of Communication and Scope of Communication
b. Process of Communication—Models and Types
c. Verbal—Non-Verbal Communication, Channels of Communication
d. Barriers to Communication & surmounting them

[to be delivered through case studies involving intercultural communication]

Module 2: Vocabulary and Reading [5L]

a. Word origin—Roots, Prefixes and Suffixes, Word Families, Homonyms and Homophones
b. Antonyms and Synonyms, One-word substitution
c. Reading—Purposes and Skills
d. Reading Sub-Skills—Skimming, Scanning, Intensive Reading
e. Comprehension Practice (Fiction and Non fictional Prose/Poetry)
   Texts:
   (i) Isaac Asimov, I Robot (―Robbie OR ―Little Lost Robot)
   (ii) George Orwell, ―Shooting an Elephant
   (iii) Ruskin Bond, ―The Cherry Tree OR ―The Night Train at Deoli
   (iv) Robert Frost, ―Stopping by the Woods on a Snowy Evening.
f. Precis Writing

(Use of daily newspapers for reading practice is recommended)

Module 3: Functional Grammar and Usage [6L]

a. Articles, Prepositions, Verbs

b. Verb-Subject Agreement
c. Comparison of Adjectives
d. Tenses and their Use
e. Transformation of Sentences (Singular-Plural, Active-Passive, Direct-Indirect, Degrees of Comparison)
f. Error Correction

Module 4: Business writing [10L]

a. Business Communication in the Present-day scenario
b. Business Letters (Letters of Inquiry, Sales Letters, Complaint and Adjustment Letters, Job Application Letters)
c. Drafting of a CV and Résumé
d. Memo, Notice, Advertisement, Agenda, Minutes of Meetings
e. E-mails (format, types, jargons, conventions)

References:

1. Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2. Seidl & McMordie. English Idioms & How to Use Them. Oxford:OUP, 1978.
3. Michael Swan. Practical English Usage. Oxford:OUP, 1980.
4. Simeon Potter. Our Language. Oxford:OUP, 1950.
5. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London: Longman, 2001.
6. IIT Kanpur, English Language & Communication Skills (ENG 112 C) syllabus.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 101.1	-	-	1	-	-	1	-	1	3	3	3	3
HU 101.2	-	-	-	-	-	2	-	-	2	3	3	3
HU 101.3	-	3	2	2	-	3	2	2	3	3	3	3
HU 101.4	-	-	-	2	-	2	-	-	3	3	2	3
HU 101.5	-	2	1	-	-	2	2	1	3	3	2	3

Paper Name: Engineering Mechanics
Paper Code: ME 101
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Higher Secondary with Physics, Chemistry and Mathematics.

Course Objective:

1. Understand the vector and scalar representation of forces and moments.
2. Describe static equilibrium of particles and rigid bodies in two dimensions and three dimensions including the effect of Friction
3. Analyze the properties of surfaces & solids in relation to moment of inertia.
4. Illustrate the laws of motion, kinematics of motion and their interrelationship.
5. Study the concepts of engineering mechanics on deformable materials under applied loads.

Course Outcome: Upon successful completion of the course, student should be able to:

ME 101.1. Construct free body diagram and calculate the reactions necessary to ensure static equilibrium.
ME 101.2. Study the effect of friction in static and dynamic conditions.
ME 101.3. Understand the different surface properties, property of masses and material properties.
ME 101.4. Analyze and solve different problems of kinematics and kinetics.

Course Content

Module 1:
Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector). 2L
Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications. 3L+1T
Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces. 4L+1T

Module 2:
Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium. 3L+1T
Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction. 3L+1T

Module 3:
Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadralateral, composite areas consisting of above figures. 4L+1T
Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone. 3L+1T
Principle of virtual work with simple application. 1L+1T

Module 4:
Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety. 2L+1T

Module 5:
Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation and acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. 3L+1T
Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). 2L+1T

Module 6:
Kinetics of particles: Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency. 3L+2T

Books Recommended:

1. Engineering Mechanics [Vol-I & II] by Meriam & Kraige, 5th ed. – Wiley India
2. Engineering Mechanics: Statics & Dynamics by I.H.Shames, 4th ed. – PHI
3. Engineering Mechanics by Timoshenko , Young and Rao, Revised 4th ed. – TMH
4. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P
5. Fundamentals of Engineering Mechanics by Debabrata Nag & Abhijit Chanda– Chhaya Prakashani
6. Engineering Mechanics by Basudeb Bhattacharyya– Oxford University Press.
7. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11th ed. – Pearson

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 101.1	3	3	2	2	-	-	-	-	1	-	-	-
ME 101.2	3	3	2	2	-	-	-	-	1	-	-	1
ME 101.3	3	2	3	2	1	-	-	-	1	-	-	1
ME 101.4	3	3	3	3	-	-	-	-	1	-	1	-

Paper Name: Language Laboratory and Seminar Presentation
Paper Code: HU 191
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focussing on skill acquisition techniques and error feedback.

Course Outcome:

- **HU 191.1.** Able to understand advanced skills of Technical Communication in English through Language Laboratory.
- **HU 191.2.** Able to apply listening, speaking, reading and writing skills in societal and professional life.
- **HU 191.3.** Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
- **HU 191.4.** Able to analyze communication behaviors.
- **HU 191.5.** Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Content

Module 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note taking
c. Contextualized Examples based on Lab Recordings

Module 3: Speaking

a. Speaking (Choice of words, Speech Syntax, Pronunciation, Intonation)
b. Language Functions/Speech Acts
c. Speaking using Picture Prompts and Audio Visual inputs
d. Conversational Role Plays (including Telephonic Conversation)
e. Group Discussion: Principles and Practice

Module 4: Lab Project Work

a. Keeping a Listening Log
b. Writing a Film Review/Advertisements

References:

1. IT Mumbai, Preparatory Course in English syllabus
2. IIT Mumbai, Introduction to Linguistics syllabus
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.

4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 191.1	-	3	-	-	-	3	2	1	3	3	3	3
HU 191.2	-	3	-	2	-	3	-	-	3	3	3	3
HU 191.3	-	3	-	-	-	3	-	-	3	3	3	3
HU 191.4	-	3	2	3	-	3	2	-	3	3	3	3
HU 191.5	-	3	2	2	-	2	-	3	3	3	3	3

Paper Name: Chemistry – I Laboratory
Paper Code: CH 191
Contact: 0L:0T:3P
Credit: 2

Prerequisites: 10+2 science with chemistry

Course Objective: Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcome:

CH 191.1. Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CH 191.2. Able to work as an individual also as an team member.
CH 191.3. Able to analyse different parameters of water considering environmental issues
CH 191.4. Able to synthesize nano and polymer materials.
CH 191.5. Capable to design innovative experiments applying the fundamentals of chemistry.

Course Content

List of Experiments:

1. To Determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
6. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
8. Determination of dissolved oxygen present in a given water sample.
9. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Innovative experiment: Preparation of silver nano-particles.

Note: From the list of 10 (Ten) experiments a minimum of 7 (seven) experiments shall have to be performed by one student of which Sl. No. 4 (Preparation of Bakelite) has to be mandatory.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH 191.1	3	2	1	1	1	1	-	-	2	-	-	-
CH 191.2	-	-	-	-	-	-	-	-	3	-	-	-
CH 191.3	-	-	-	-	-	2	3	-	-	-	-	1
CH 191.4	-	-	-	-	2	1	-	-	-	-	-	-
CH 191.5	2	-	2	-	1	-	-	-	-	-	-	1

Paper Name: Basic Electrical Engineering Laboratory
Paper Code: EE 191
Contact: 0L:0T:3P
Credit: 2

Pre requisites:
1. Basic Physics and applied physics.
2. Basic Mathematics.
3. Basic concept of Electric Circuit

Course Objective:
1. Provide knowledge for the analysis of basic electrical circuit.
2. To introduce electrical appliances, machines with their respective characteristics.

Course Outcome:
- **EE 191.1.** Identify common electrical components and their ratings.
- **EE 191.2.** Make Circuit connection by wires of appropriate ratings.
- **EE 191.3.** Understand the usage of common electrical measuring instruments
- **EE 191.4.** Understand the basic characteristics of transformers and electrical machines

Course Content

List of Experiments:
1. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition Theorem.
4. Calibration of Ammeter and Wattmeter.
5. Study of R-L-C series circuit.
6. Open circuit and short circuit test of a single phase Transformer.
7. Starting, Reversing of a and speed control of D.C shunt motor.
8. Test on single phase Energy Meter.
9. Familiarization of PMMC and MI type Meter.
10. Familiarization with house wiring practice.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 191.1	2	3	-	1	3	-	-	-	1	-	2	1
EE 191.2	2	-	2	1	3	-	-	-	1	1	-	-
EE 191.3	-	3	-	-	-	3	2	-	-	-	2	1
EE 191.4	3	-	-	-	-	-	1	-	-	2	2	2

Paper Name: Engineering Drawing and Graphics
Paper Code: ME 191
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To learn basics of drafting and use of drafting tools.
2. To know about engineering scales, dimensioning and various geometric curves.
3. To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
4. To acquire the knowledge of Computer Aided drafting using design software.

Course Outcomes: Upon successful completion of this course, the student will be able to

ME 191.1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.

ME 191.2. Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.

ME 191.3. Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

ME 191.4. Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

Course Content

List of Experiments:

1. Lines, Lettering, Dimensioning, Scales (Plain scale & diagonal Scale).
2. Geometrical Construction and Curves – Construction of Polygons, Parabola, Hyperbola & ellipse
3. Projection of Points, Lines and Surfaces – orthographic projection- first angle and third angle projection, projection of lines and surfaces- Hexagon
4. Projection of Solids – (Cube, Pyramid, Prism, cylinder and Cone
5. Sectional Views – for simple sold objects
6. Introduction to Computer Aided Drafting – using auto cad & / or similar software- Introduction to Cartesian and polar coordinate systems, absolute and relative coordinates; Basic editing commands: line, point, trace, rectangle, polygon , circle, arc, ellipse, polyline; editing methods; basic object selection methods – window and crossing window, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display command; zoom, pan, redraw, regenerate; simple dimensioning and text, simple exercises.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 191.1	2	-	1	2	-	1	-	-	1	-	-	1
ME 191.2	3	-	2	2	-	1	-	-	1	1	-	1
ME 191.3	2	2	2	1	-	1	-	-	1	-	-	1
ME 191.4	1	-	2	2	2	1	-	-	1	1	-	1

Paper Name: Extra-Curricular Activity (NSS / NCC)
Paper Code: XC 181
Contact: 0L:0T:2P
Credit: 1

Course Objective: The objectives of the course are as follows

1. To increase student awareness about the weaker and unprivileged sections of society.
2. To expose students to environmental issues and ecological concerns.
3. To make students self-aware about their participatory role in sustaining society and the environment.

Course Content

List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes

1. Adult education
2. Children's education

Proposal for local slum area development

One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

- Resource conservation – Awareness to be developed on water, energy,soil.
- Preservation of heritage monuments- Marches, poster campaigns
- Alternative energy consciousness amongst younger school-children.
- Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
- Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and

12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g. Assisting the authorities in distribution of rations, medicine, clothes etc.;
h. Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
i. Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
j. Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

SYLLABUS

OF

B.TECH SECOND SEMESTER COURSES

Paper Name: Mathematics-II
Paper Code: M 201
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Any introductory course on calculus.

Course Objective: The purpose of this course is to provide fundamental concepts Ordinary Differential Equations, Graph Theory and Laplace Transform.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

- **M 201.1.** Recall the distinctive characteristics of Ordinary Differential Equations, Graph Theory and Laplace Transform.
- **M 201.2.** Understand the theoretical workings of various algorithms related to graph theory and the theorems of differential equation and Laplace transforms.
- **M 201.3.** Apply the principles of differential equation, graph theory and Laplace transforms to solve various problems.

Course Content

Module I: Ordinary differential equations (First order) [10L]
First order and first degree Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation, General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation), Applications related to Engineering problems.

Module II: Ordinary differential equations (Higher order) [10L]
General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy- Eulerequations, Solution of simultaneous linear differential equations, Applications related to Engineering problems.

Module III: Basic Graph Theory [10L]
Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph, Walks, Paths, Circuits, Euler Graph, Cut-sets and cut-vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.Tree, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using Kruskal's and Prim's algorithm.
**** Extra lecture hours may be taken for this module**

Module IV: Laplace Transform (LT) [10L]
Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of t f (t), LT of f (t)/t , LT of derivatives of f (t), L.T. of $\int f(u)\,du$. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. Applications related to Engineering problems.

Beyond Syllabus:
Combinatorics: Fundamental Principles, Permutations, Combinations, Binomial Coefficients.

Text Books:
1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.

Reference Text Books:
1. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley, 2005.
2. R.K. Ghosh and K.C.Maity, An Introduction to Differential Equations, New Central Book Agency.
3. V. K. Balakrishnan,Graph Theory, Schaum's Outline, TMH.
4. J. Clark and D. A. Holton, A first course at Graph Theory,Allied Publishers LTD.
5. D. B. West, Introduction to Graph Theory,Prentice-Hall of India.
6. N. Deo, Graph Theory, Prentice-Hall of India.
7. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier, 2006.
8. L. Rade and B. Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
9. Murray R.Spiegel, Laplace Transform, Schaum's Outline Series, McGRAW-HILL.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M 201.1	3	2	-	-	-	-	-	-	-	-	-	1
M 201.2	3	2	-	-	-	-	-	-	-	-	-	1
M 201.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Physics – I
Paper Code: PH 201
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objective: The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome: At the end of the course students' should have the

PH 201.1. Ability to state and recall
De-Broglie hypothesis, and Heisenberg's Uncertainty Principle
Amplitude and Velocity Resonance
Malus's Law, Brewster's Law
Characteristics of LASER light

PH 201.2. Ability to understand and explain
Polarizer and analyzer
basic principles and different types of LASER and Optical Fibre structure of solids, Miller indices
theory of Matter Wave, equation of motion of Matter Wave
wave function and its role in representing wave nature of matter

PH 201.3. Ability to apply the knowledge of
mechanical vibration in electrical circuits
superposition principle in Newton's ring phenomenon, diffraction phenomenon
quantum nature of e.m. waves for production of laser
total internal reflection in transmitting light through optical fibres x-ray diffraction in crystal structure
probability interpretation in Heisenberg's uncertainty principle

PH 201.4. Ability to analyse
grating as many slit system
role of Q factor in a resonating circuit, conditions of different types of resonance
minimum requirements for lasing action
importance of light as a carrier of information
the failures of classical physics in microscopic situation and need of quantum physics
Einstein's A, B coefficient and predict the wavelength domain of Lasing action
Requirement of Miller indices for describing crystallographic planes

PH 201.5. Ability to evaluate / justify / compare
X-ray production process is inverse of the process of Photoelectric Effect.
different crystallographic structures according to their Co-ordination number and packing factors

the outcome of Photo-electric effect, Compton effect and Davission-Germer experiment to justify wave-particle duality of matter

Course Content

Module 1: Oscillations (8L)

1.1. Simple harmonic motion: Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous' figures, Engineering Applications and related Numerical problems 2L

1.2. Damped vibration: Differential equation and its solution, Logarithmic decrement, quality factor, Engineering Applications and related Numerical problems. 3L

1.3. Forced vibration: Differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance, relevant applications including LCR circuits, Numerical problems. 3L

Module 2: Classical Optics (10L)

2.1. Interference of light: Wave nature of light (Huygen's principle), Conditions of sustained interference double slit as an example; qualitative idea of spatial and temporal coherence, conservation of energy and intensity distribution; Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Fresnel's biprism (beyond the syllabus). 1L (ext)

2.2. Diffraction of light: Fresnel and Fraunhofer class, Fraunhofer diffraction for plane transmission grating (elementary treatment of intensity distribution for N-slits), single slit and double slits as examples, missing order, Rayleigh criterion, resolving power of grating and microscope (Definition and formula; no deduction required). Engineering Applications, Numerical Problems. 4L

2.3. Polarization: Definition, plane of polarization, plane of vibration, Malus law, fundamental concepts of plane, circular and elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: ordinary and extraordinary rays, Nicol's prism, Engineering applications, Numerical problems. 3L

Module 3: Quantum Physics (9L)

3.1. Quantum Theory: Inadequacy of classical physics; Planck's quantum hypothesis-Qualitative (without deductions), particle concept of electromagnetic wave (example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; de Broglie wave; Davisson and Germer experiment. 4L

3.2. Quantum Mechanics 1: Concept of wave function, Physical significance of wave function, Probability interpretation; wave function normalization condition and its simple numerical applications; uncertainty principle-applications, Schrödinger equation (no mathematical derivation). 4L

Module 4: X-ray & Crystallography (6L)

4.1. X-rays – Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination of lattice constant, Applications, Numerical problems. 2L

4.2. Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, fcc and bcc, hcp lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor, Applications, Numerical problems. 4L

Module 5: Modern Optics – I (8L)

5.1. Laser: Concepts of various emission and absorption process, working principle of laser, metastable state, Population Inversion, condition necessary for active laser action, optical resonator, ruby laser, He- Ne laser, semiconductor laser, Einstein A and B coefficients and equations, industrial and medical applications of laser. 5L

5.2. Fibre optics and Applications: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, V number, Types of optical fibres (material, refractive index, mode), Losses in optical fibre- attenuation, dispersion, bending, Numerical problems. 3L

Recommended Text Books for Physics – I:

Oscillations:

1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics – I:

13. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
14. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
15. Modern Optics-A. B. Gupta (Book & Allied Publisher)
16. Optics-Ajay Ghatak (TMH)
17. Optics-Hecht
18. Optics-R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E. Hecht (Optics)
21. E. Hecht (Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R. Dasgupta (Degree Physics Vol 3)

Quantum Physics:

24. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
28. Quantum Mechanics-Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics-A. Beiser (TMH)
30. Eisberg & Resnick is published by Wiley India
31. A.K. Ghatak and S Lokenathan
32. E.E. Anderson (Modern Physics)
33. 33 .Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
34. Binayak Dutta Roy [Elements of Quantum Mechanics]

X-ray & Crystallography:

35. Solid state physics-Puri & Babbar (S. Chand publishers)
36. Materials Science & Engineering-Kakani Kakani
37. Solid state physics- S. O. Pillai
38. Introduction to solid state physics-Kittel (TMH)
39. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)
40. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)

General Reference:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. Engineering Physics Vol: 1-Sudipto Roy, Tanushri Ghosh, Dibyendu Biswas (S. Chand).
5. Engineering Physics Vol:1-S. P. Kuila (New Central)
6. University Physics-Sears & Zemansky (Addison-Wesley)
7. B. Dutta Roy (Basic Physics)
8. R.K. Kar (Engineering Physics)
9. Mani and Meheta (Modern Physics)
10. Arthur Baiser (Perspective & Concept of Modern Physics)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 201.1	1	-	-	-	-	-	-	-	-	-	-	-
PH 201.2	-	2	-	-	-	-	-	-	-	-	-	-
PH 201.3	3	-	-	-	-	-	-	-	-	-	-	-
PH 201.4	-	1	-	-	-	-	-	-	-	-	-	-
PH 201.5	-	-	-	-	-	-	-	-	-	-	-	1

Paper Name: Basic Electronics Engineering
Paper code: EC 201
Contact: 3L:1T:0P
Credits: 4

Prerequisites: A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits , series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchoff's Law i.e. KVL,KCL, Ampere's Law etc.

Course Objective: Students will be able to Analyze the behaviour of semiconductor diodes in Forward and Reverse bias . To design a half wave and full wave rectifiers , Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations. To acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amps. Students will be able to explain feedback concept and different oscillators . They will also be familiar with the analysis of digital logic basics and measuring Electronic devices. Students will have knowledge about characteristics of FET.

Course Outcome:

- **EC 201.1.** Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
- **EC 201.2.** Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation on electronic signals.
- **EC 201.3.** Study the concepts of both positive and negative feedback in electronic circuits.
- **EC 201.4.** Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
- **EC 201.5.** Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course Content

Module – I: Basics of semiconductor 6L

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module – II: P-N Junction Diode and its applications 8L

p-n junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers circuits and operation (IDC , Irms , VDc , Vrms) , ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module – III: Bipolar junction transistor (BJT) 6L

Formation of PNP/NPN Transistors ,energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain α ,β and γ, early effect.
Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias , D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.
BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module – IV: Field effect transistor (FET) 4L

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems .

Module – V: Feedback and Operational Amplifier 10L

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op- amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non- inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .
Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module – VI: Cathode Ray Oscilloscope (CRO) 2L

Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Module – VII: Digital Electronics 4L

Binary numbers and conversion, Basic Boolean algebra, Logic gates (AND, OR, NOR, NOT, NAND, XOR) and realization of functions.

Text Books:

1. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.
4. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.

3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC 201.1	3	-	-	-	-	-	-	-	-	-	-	-
EC 201.2	2	3	-	-	-	-	-	-	-	-	-	1
EC 201.3	1	3	-	-	-	-	-	-	-	-	-	-
EC 201.4	1	2	3	-	-	-	-	-	-	-	-	1
EC 201.5	3	1	-	-	-	-	-	-	-	-	-	-

Paper Name: Computer Fundamentals and Principle of Computer Programming
Paper Code: CS 201
Contact: 3L:1T:0P
Credits: 4

Prerequisites:
1. Number system
2. Boolean Algebra

Course Objective:
1. To develop the programming skills of students
2. To know the principles of designing structured programs
3. To write basic C programs using
   i) Selection statements
   ii) Repetitive statements
   iii) Functions
   iv) Pointers
   v) Arrays
   vi) Strings

Course Outcome:
- **CS 201.1.** Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
- **CS 201.2.** Write, Compile and Debug programs in C language and use different data types for writing the programs.
- **CS 201.3.** Design programs connecting decision structures, loops and functions.
- **CS 201.4.** Explain the difference between call by value and call by address.
- **CS 201.5.** Understand the dynamic behavior of memory by the use of pointers.

Use different data structures and create / manipulate basic data files and developing applications for real world problems.

Course Content

Fundamentals of Computer: (10L)

History of Computer, Generation of Computer, Classification of Computers 1L

Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number Arithmetic – Addition and Subtraction (using 1's complement and 2's complement) 2L

Logic gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR - only truth tables, logic gate symbols and logic equations for gates only 1L

Assembly language, high level language, machine level language, compiler and assembler (basic concepts) 1L

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX 1L

Problem solving-Algorithm & flow chart 2L

C Fundamentals: (30L)

Variable and Data Types:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 3L

C Operators & Expressions:

Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields 5L

Branching and Loop Statements:

Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue 3L

Fundamentals and Program Structures:

auto, external, static and register variables

Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro 6L

Arrays, Strings and Pointers:

One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function Character array and string, array of strings, Passing a string to a function, String related functions

Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation 6L

Files handling with C:

formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function 4L

Structures and Unions:

Basic of structures, arrays of structures, structures and pointers, structures and functions 3L

Text Book:

1. Kerninghan B.W. & Ritchie D.M. - The C Programming Language
2. Gottfried - Programming with C Schaum
3. Kanetkar Y. - Let us C Balaguruswamy - Programming in C

Recommended Reference Books:

1. Pohl and Kelly - A Book on C
2. Kerninghan, B.W. - The Elements of Programming Style
3. Schied F.S. Theory and Problems of Computers and Programming Rajaraman V. Fundamental of Computers
4. M.M.Oka Computer Fundamentals,EPH Leon Introduction to Computers,Vikas
5. Leon- Fundamental of Information Technology,Vikas Ram B. Computer Fundamentals, New Age International
6. Ravichandran D. Programming in C, New Age International
7. Xavier C. Introduction to Computers, New Age International

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC 201.1	3	3	-	-	-	-	-	-	-	-	-	-
EC 201.2	-	2	-	-	-	-	-	-	-	-	-	-
EC 201.3	3	3	-	-	-	-	-	-	-	-	-	-
EC 201.4	-	-	-	-	-	-	-	-	-	-	-	-
EC 201.5	3	-	3	3	3	-	-	-	-	-	-	-

Paper Name: Engineering Thermodynamics and Fluid Mechanics
Paper Code: ME 201
Contact: 3L:1T:0P
Credits: 4

Prerequisites: Higher Secondary with Physics, Chemistry and Mathematics.

Course Objective:

1. To understand the basic principles of thermodynamics, heat and work transfer.
2. To acquire the knowledge of basic concepts of Heat Engine, Entropy from Second law of thermodynamics.
3. To get the knowledge of thermodynamic properties of a pure substance and inter-relationships between key properties of a system or state possessed by the substance.
4. To understand the basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations.

Course Outcome: Upon successful completion of this course, the student will be able to

ME 201.1. Know about thermodynamic equilibrium, heat & work transfer, First law and its application.
ME 201.2. Understand the basic concepts of Heat Engine, Entropy from Second law of thermodynamics.
ME 201.3. Know the thermodynamic characteristics of a pure substance and its application in power cycles (Simple Rankine cycles, Air Standard cycles).
ME 201.4. Knowledge of basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations.

Course Content

Module 1: **8L+3T**

Basic Concepts of Thermodynamics:

Introduction: Microscopic and Macroscopic viewpoints

Definition of Thermodynamic systems: closed, open and isolated systems Concept of Thermodynamics state; state postulate.

Definition of properties: intensive, extensive & specific properties. Thermodynamic equilibrium

Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles. Zeroth law of thermodynamics. Concept of empirical temperature.

Heat and Work:

Definition & units of thermodynamic work.

Examples of different forms of thermodynamic works; example of electricity flow as work. Work done during expansion of a compressible simple system

Definition of Heat; unit of Heat

Similarities & Dissimilarities between Heat & Work

Ideal Equation of State, processes; Real Gas:

Definition of Ideal Gas; Ideal Gas Equations of State.

Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes.

Equations of State of Real Gases: Van der Waal's equation; Virial equation of state.

Properties of Pure Substances:

p-v, T-s & h-s diagrams of pure substance like H2O

Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status.
Definition of dryness fraction of steam, degree of superheat of steam.

Module 2: **4L+3T**

1st Law of Thermodynamics:

Definition of Stored Energy & Internal Energy 1st Law of Thermodynamics for cyclic processes Non Flow Energy Equation.
Flow Energy & Definition of Enthalpy.
Conditions for Steady State Steady flow: Steady State Steady Flow Energy Equation.

Module 3: **6L+3T**

2nd Law of Thermodynamics:

Definition of Sink, Source Reservoir of Heat.
Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators
Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics Absolute or Thermodynamic scale of temperature, Clausius Integral Entropy
Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot efficiency PMM-2; definition & its impossibility

Module 4: **6L+3T**

Air standard Cycles for IC engines:

Otto cycle; plot on P-V, T-S planes; Thermal efficiency Diesel cycle; plot on P-V, T-S planes; Thermal efficiency

Rankine cycle of steam

Chart of steam (Mollier's Chart)
Simple Rankine cycle plot on P-V, T-S, h-s planes Rankine cycle efficiency with & without pump work (Problems are to solved for each module)

Module 5: **9L+3T**

Properties & Classification of Fluids:

Ideal & Real fluids
Newton's law of viscosity; Newtonian and Non-Newtonian fluids
Compressible and Incompressible fluids

Fluid Statics:

Pressure at a point

Measurement of Fluid Pressure:

Manometers: simple & differential U-tube
Inclined tube

Fluid Kinematics:

Stream line
Laminar & turbulent flow
external & internal flow
Continuity equation

Dynamics of ideal fluids:

Bernoulli's equation
Total head; Velocity head; Pressure
head Application of Bernoulli's equation

Measurement of Flow rate:
Basic principles
Venturimeter, Pilot tube, Orificemeter

(Problems are to be solved for each module)

Engineering Thermodynamics
Text:
1. Engineering Thermodynamics - P K Nag, 4th edn, TMH.

References:
1. "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.
2. Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP
3. Engineering Thermodynamics – Onkar Singhh, New Age International Publishers Ltd.
4. Basic Engineering Thermodynamics – R Joel, 5th Ed., Pearson

Fluid Mechanics
Text:
1. Fluid Mechanics and Hydraulic Machines - R Bansal

References:
1. Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2nd edn, TMH
2. Fluid Mechanics by A.K.Jain.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 201.1	3	3	2	2	-	1	1	1	1	-	1	2
ME 201.2	3	3	2	2	-	1	2	-	1	-	1	2
ME 201.3	2	2	1	1	-	2	1	-	-	-	-	1
ME 201.4	3	3	2	2	-	1	1	-	-	-	1	1

Paper Name: Computer Fundamentals and Principle of Computer Programming Laboratory
Paper Code: CS291
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Basic Computer Knowledge

Course Objective: To develop an understanding of the design, implementation, and compilation of a C program To gain the knowledge about pointers, a fundamental for understanding data structure issues To understand the usage of user defined data type for application development

Course Outcome:

- **CS 291.1.** Understanding the working of different operating systems like DOS, Windows, Linux.
- **CS 291.2.** Write, Compile and Debug programs in C language.
- **CS 291.3.** Design programs connecting decision structures, loops.
- **CS 291.4.** Exercise user defined functions to solve real time problems.
- **CS 291.5.** Inscribe C programs using Pointers to access arrays, strings, functions, structures and files.

Experiment should include but not limited to the following:

1. Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
2. Writing C Programs on variable, expression, operator and type-casting.
3. Writing C Programs using different structures of if-else statement and switch-case statement.
4. Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
5. Writing C Programs demonstrating concept of Single & Multidimensional arrays.
6. Writing C Programs demonstrating concept of Function and Recursion.
7. Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
8. Writing C Programs demonstrating concept of structures, union and pointer to structure.
9. Writing C Programs demonstrating concept of String and command line arguments.
10. Writing C Programs demonstrating concept of dynamic memory allocation.
11. Writing C Programs demonstrating concept of File Programming.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS 291.1	3	3	-	-	-	-	-	-	-	-	-	-
CS 291.2	-	2	-	-	-	-	-	-	-	-	-	-
CS 291.3	3	3	-	-	-	-	-	-	-	-	-	-
CS 291.4	-	-	-	-	-	-	-	-	-	-	-	-
CS 291.5	3	-	3	3	3	-	-	-	-	-	-	-

Paper Name: Physics – I Laboratory
Paper Code: PH 291
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Knowledge of Physics upto 12th standard.

Course Outcome: At the end of the course students' should have the

PH 291.1. Ability to define, understand and explain
Error estimation, Proportional error calculation
superposition principle in Newton's ring, Fresnel's biprism, laser diffraction
Basic circuit analysis in LCR circuits

PH 291.2. Ability to conduct experiments using
LASER, Optical fibre
Interference by division of wave front, division of amplitude, diffraction grating, polarization of light
Quantization of electronic energy inside an atom
Torsional pendulum

PH 291.3. Ability to participate as an individual, and as a member or leader in groups in laboratory sessions actively

PH 291.4. Ability to analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations & Elasticity:

1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:

5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment
8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:

9. Determination of Planck's constant using photoelectric cell.
10. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

**In addition it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS 291.1	2	-	-	-	-	-	-	-	-	-	-	-
CS 291.2	1	-	-	-	-	-	-	-	-	-	-	-
CS 291.3	-	-	-	2	-	-	-	-	-	-	-	-
CS 291.4	-	-	-	-	-	-	-	-	3	-	-	-

Paper Name: Basic Electronics Engineering Laboratory
Paper Code: EC 291
Contact: 0L:0T:3P
Credit: 2

Prerequisites: A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

Course Objective: Students will become familiar with the circuit design using semiconductor diodes in Forward and Reverse bias, They will also be able to design rectifiers like half-wave, full-wave rectifiers etc. using diodes. The ability of circuit design with Bipolar Junction Transistor in CB, CE & CC configurations will be improved. The students will acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amp. Basic concepts and Circuit design with logic gates will be developed in the students. The students will be able design circuit using FET.

Course Outcome:

- **EC 291.1.** Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
- **EC 291.2.** Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
- **EC 291.3.** Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
- **EC 291.4.** Able to know the application of Diode, BJT & OPAMP.
- **EC 291.5.** Familiarization and basic knowledge of Integrated Circuits

Course Contents

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC 291.1	3	3	-	-	-	-	-	-	-	-	-	-
EC 291.2	2	3	-	-	-	-	-	-	1	1	-	1
EC 291.3	1	3	3	-	-	-	-	-	-	2	-	-
EC 291.4	1	2	3	-	-	-	-	-	-	1	-	1
EC 291.5	3	1	2	-	-	-	-	-	-	-	-	-

Paper Name: Workshop Practice
Paper Code: ME 292
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To understand the basic knowledge of Workshop Practice and Safety.
2. To identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. To get hands on practice in various machining metal joining processes such as Welding, Brazing, Soldering, etc.

Course Outcome: Upon successful completion of this course, the student will be able to

ME 292.1. Gain basic knowledge of Workshop Practice and Safety useful for our daily living.

ME 292.2. Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes.

ME 292.3. Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

ME 292.4. Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

Course Content

List of Activities:

Sl. No.	Syllabus	Contact Hrs
Module 1	Pattern Making	6
Module 2	Sheet Metal Work	6
Module 3	Fitting	9
Module 4	Machining in Lathe	9
Module 5	Welding	6

Module – 1: Pattern Making

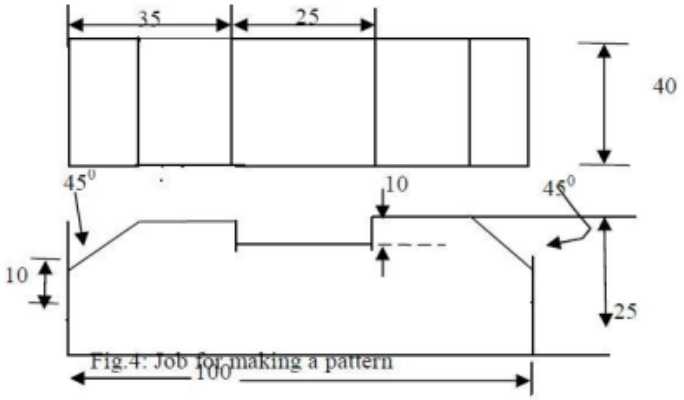
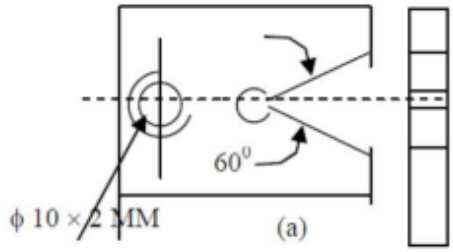
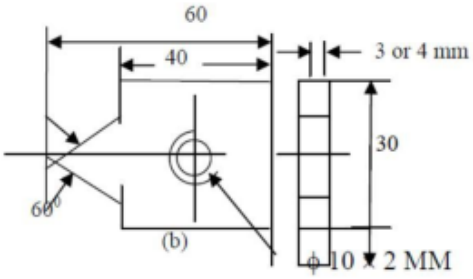


Fig.4: Job for making a pattern

Module – 3: Fitting Shop



OR



Module – 4: Machining In Lathe and Shaping M/C

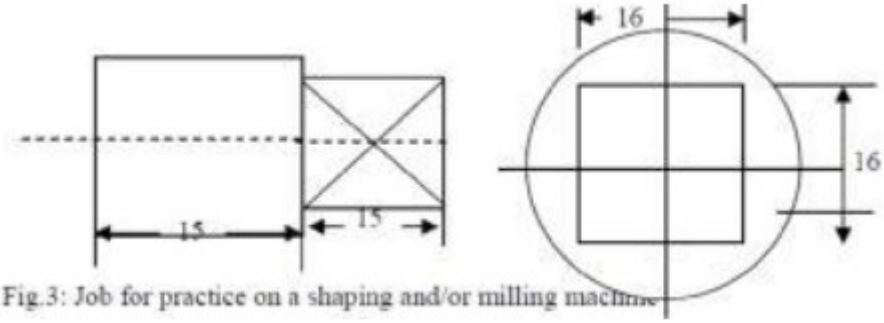
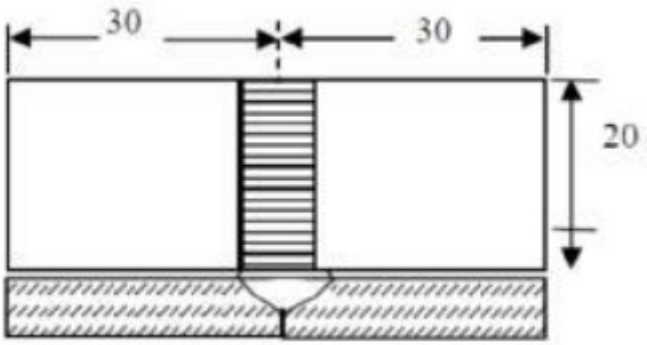


Fig.3: Job for practice on a shaping and/or milling machine

Module – 5: Welding



CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 292.1	2	-	-	-	-	2	-	1	-	-	1	-
ME 292.2	2	-	-	-	-	1	-	2	-	-	-	-
ME 292.3	2	-	-	-	-	1	-	1	-	-	-	-
ME 292.4	1	-	-	-	1	3	-	3	-	-	-	1

Paper Name: Soft Skill Development
Paper Code: MC 281
Contact: 0L:0T:2P

Course Objective: The objectives of this course are as follows:

1. To expose the students to different aspects of corporate life and workplace behavior To introduce workplace behavioral norms, etiquettes and standards
2. To equip students to face interviews, presentations and other professional interactions

Module	Content
One	Communication Training
Two	Communication Training (Accent Neutralization)
Three	Business Etiquette
Four	CV / Resume Writing
Five	Corporate Life and Protocols
Six	Group Discussion
Seven	Leadership Skill
Eight	Team Work
Nine	Public Speaking and Interview Basics
Ten	Business Telephone Etiquette
Eleven	Reading skill

Rearrange ?

Module 1: Communication Training (2L)

1. Organisational Communication and Structure.
2. Vocabulary related to Corporate Operation.
3. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.
4. Communication with Clients, Customers, Suppliers etc.
5. Verbal and Non-Verbal Communication, Proxemics and Para Language.
6. Vocabulary Building (Synonym / Antonym / One word Substitution etc.)

Module 2: Communication Training (Accent Neutralisation) (2L)

7. Mother Tongue Influence
8. Vowel Sounds and Consonantal Sounds
9. Pronunciation and Neutral Accent.
10. Intonation.
11. Rate of Speech, Pausing, Pitch Variation and Tone.

Module 3: Business Etiquette (2L)

12. Presenting oneself in the Business Environment.
13. Corporate Dressing and Mannerism.
14. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
15. Multi Cultural Etiquette.
16. Cultural Difference.
17. E-mail Etiquette.

Module 4: Job Application And CV / Video Resume (2L)

18. Format (Chronological, Skill Oriented, Functional etc.)
19. Style and Appearance.
20. Writing Tips and Video Content Presentation tips.
21. Types of Cover Letter or Job Application Letter.

Module 5: Introduction To Corporate Life And Protocols (2L)

22. Introduction of Companies (Domain Specific)
23. Opportunities and Growth Plan.
24. Performance and Corporate Behaviour.
25. Service Level Agreement and Corporate Jargon.
26. Networking and Adapting to Culture, Technology and Environment.

Module 6: Group Discussion (2L)

27. Introduction, Definition and Purpose.
28. Types of Group Discussion.
29. Strategies and Protocols of Group Discussion.
30. Skills and Parameters of Evaluation.
31. Practice Session and Video Viewing Task.

Module 7: Leadership Skill (2L)

32. Leadership Theories.
33. Traits and Skills of the Leader.
34. Roles, Duties and Responsibilities.
35. Case Study of Leaders.
36. Interpersonal relationship with Team.

Module 8: Team Work (2L)

37. Concept of Team Culture.
38. Stages of Team Development (Forming, Storming, Norming, Performing, Adjourning)
39. Team Working Agreement (Participation, Decision Making, Problem Solving.
40. Conflict Management, Flexibility, Negotiation Skill.
41. Team Building (Assess, Plan, Execute and Evaluate)

Module 9: Public Speaking and Interview Basics (2L)

42. Extempore.
43. JAM.
44. Interview Skill
45. Interview over Telephone, Video Conference Interview etc.

Module 10: Business Telephone Etiquette (2L)

46. Five Phases of a Business Call.
47. Pitch, inflection, Courtesy and Tone.
48. Understanding, Rate of Speech, Enunciation.
49. Hold Procedure.
50. Cold and Hot Transfer protocols.
51. Dealing with Different Types of Customers (Irate, Talkative, Turnaround etc.)

Module 11: Reading Skill

52. Vocabulary from context, speed reading, skimming, inferring, comprehension test etc.

ASSESSMENT		
1.	Viva	10
2.	Personal Skill Enhancement Log	25
3.	Movie Making: Video Resume	25
4.	Term End Project	40

List of Reference:

1. Effective Communication and Soft-Skills: Strategies for Success, Nitin Bhatnagar and Mamta Bhatnagar, Pearson, 2012.
2. Soft Skills: Know yourself and know the World, Dr. K.Alex, S Chand, 2009.
3. Soft Skills at Work: Technology for Career Success, Beverly Amer, Course Technology, 2009.
4. The Pronunciation of English, Daniel Jones, Cambridge University Press, 1998.
5. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger, 2012.
6. The CV Book: Your Definitive Guide to Writing the Perfect CV, James Innes, Pearson.
7. Understanding American Business Jargon: A Dictionary, W. Davis Folsom, Greenwood Press, 2005.
8. Navigating Corporate Life, Stanley Tyo.
9. Group Discussion: A Practical Guide to Participation and Leadership, Kathryn Sue Young, Julia T. Wood, Gerald M. Phillips and Douglas J. Pedersen, Waveland Press Inc., 2007.
10. The Leadership Skills Handbook, Jo Owen, KoganPage, 2006.
11. Teamwork Training, Sharon Boller, ASTD Press, 2005.
12. Public Speaking for Success, Dale Carnegie, Penguin, 2005.
13. Effective Interviewing Skills, Tracey A. Swift and Ivan T. Robertson, BPS Books, 2000.
14. Telephone Etiquette: Making Lasting First Impressions, Theo Gilbert-Jamison, Performance Solutions, 2013.
15. Reading Comprehension Strategies: Theories, Interventions and Technologies, Danielle S. McNamara, Lawrence Earlbaum Associates, 2007.
16. www.mindtools.com.

SYLLABUS

OF

B.TECH THIRD SEMESTER COURSES

Paper Name: Mathematics – III
Paper Code: M 301
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Any introductory course on Calculus and Combinatorics.

Course Objective: The purpose of this course is to provide fundamental concepts of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

- **M 301.1.** Recall the distinctive characteristics of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.
- **M 301.2.** Understand the theoretical workings of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, and Partial Differential Equations to evaluate the various measures in related field.
- **M 301.3.** Apply various principles of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, Partial Differential Equations to solve various problems.

Course Content

MODULE I: Fourier Series and Fourier Transform [10L]

Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave.

Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period , Dirichlet's conditions, Sum of Fourier series. Examples. Theorem for the convergence of Fourier series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier series: Construction of Half range Sine Series, Construction of Half range Cosine Series.

Parseval's identity (statement only). Examples.

Fourier Transform:

Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

Discussions on application of the topic related to EE

MODULE II: Probability Distributions [10L]

Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its

properties (without proof).Examples. Definitions of Expectation & Variance, properties & examples. Some important discrete distributions: Binomial, Poisson. Continuous distributions: Normal. Determination of Mean, Variance and standard deviation of the distributions. Correlation & Regression analysis, Least Square method, Curve fitting.
Discussions on application of the topic related to EE

MODULE III: Calculus of Complex Variable [12L]
Introduction to Functions of a Complex Variable, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems.
Complex Integration:
Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples.Cauchy's theorem (statement only).Cauchy-Goursat theorem (statement only).Examples.Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function.Examples.Taylor's series, Laurent's series. Examples.
Zeros and Singularities of an Analytic Function & Residue Theorem:
Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, Introduction Conformal transformation, Bilinear transformation, simple problems.
Discussions on application of the topic related to EE

MODULE IV: Basic concepts of Partial differential equation (PDE) [12L]
Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transforms methods.
Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.
PDE I: One dimensional Wave equation.
PDE II: One dimensional Heat equation.
PDE III: Two dimensional Laplace equations.
Introduction to series solution of Ordinary differential equation (ODE): Validity of the series solution of an ordinary differential equation. General method to solve Po y"+P1 y'+P2 y=0 and related problems to Power series method. Brief review on series solution of Bessel & Legendre differential equation.
Concepts of generating functions.
Discussions on application of the topic related to EE

Text Books:

1. Rathor, Choudhari, Descrete Structure And Graph Theory.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical
3. Lipschutz S: Theory and Problems of Probability (Schaum's Outline Series) Book. Co.
4. Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.
5. Goon A.M., Gupta M K and Dasgupta B: Fundamental of Statistics - The World Press Pvt. Ltd.

6. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill Book Co.
7. Bronson R: Differential Equations (Schaum's Outline Series) - McGraw Hill Book Co.
8. Ross S L: Differential Equations - John Willey & Sons.

Reference Books:

1. West D.B.: Introduction to Graph Theory - Prentice Hall
2. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.
3. Grewal B S: Higher Engineering Mathematics (thirtyfifthedn) - Khanna Pub.
4. Kreyzig E: Advanced Engineering Mathematics - John Wiley and Sons.
5. Jana- Undergradute Mathematics
6. Lakshminarayan- Engineering Math 1.2.3 7.Gupta- Mathematical Physics (Vikas)
7. Singh- Modern Algebra
8. Rao B: Differential Equations with Applications & Programs, Universities Press
9. Murray: Introductory Courses in Differential Equations, Universities Press
10. Delampady, M: Probability & Statistics, Universities Press
11. Prasad: Partial Differential Equations, New Age International
12. Chowdhury: Elements of Complex Analysis, New Age International
13. Bhat: Modern Probability Theory, New Age International
14. Dutta: A Textbook of Engineering Mathematics Vol.1 & 2, New Age International
15. Sarveswarao: Engineering Mathematics, Universities Press
16. Dhami: Differential Calculus, New Age International

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M 301.1	3	2	-	-	-	-	-	-	-	-	-	1
M 301.2	3	2	-	-	-	-	-	-	-	-	-	1
M 301.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Digital Electronics
Paper Code: EC(EE) 301
Contact: 3L:1T:0P
Credit: 3

Prerequisites: Knowledge of Basic Electronics and mathematics.

Course Objective:

a. To perform decimal, octal, hexadecimal, and binary conversions.
b. To apply Boolean algebra to solve logic functions.
c. To analyze pulse and logic switching circuits.
d. To analyze digital decoding & multiplexing circuits.
e. To analyze logic family interfaces.
f. To analyze memory storage devices
g. To prepare Arithmetic Logic Unit
h. To apply logic design circuits with Programmable Logic Devices

Course Outcome: The students will be able to

EC(EE) 301.1. Acquired knowledge about solving problems related to number systems conversions and Boolean algebra and design logic circuits using logic gates to their simplest forms using De Morgan's Theorems; Karnaugh Maps.
EC(EE) 301.2. Design of combinational circuits
EC(EE) 301.3. Design of various synchronous and asynchronous sequential circuits using State Diagrams & Tables.
EC(EE) 301.4. Understand DAC & ADC technique and corresponding circuits
EC(EE) 301.5. Analyze logic family interfaces, switching circuits & memory storage devices to Plan and execute projects.

Course Content

Module – 1: **[12L]**

Binary, Octal and Hexadecimal number system representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Hamming Code. Signed binary number representation with 1's, 2's, 9's and 10's complement methods, Binary arithmetic.
Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method, Quine-McCluskey minimization technique (Tabular Method).

Module – 2: **[11L]**

Combinational circuits- Half Adder, Full Adder, Serial & Parallel Adder, Carry Look Ahead Adder, BCD Adder, Half Subtractor, Full Subtractor circuits, Adder-Subtractor Circuit. Encoder, Decoder, Multiplexer, De Multiplexer, Adder & Subtractor Design using decoder & multiplexer, Comparator and Parity Generator-Checker.

Module – 3: **[11L]**

Sequential Circuits- latch & Flip Flops-S-R, J-K, D and T, Conversion of Flip Flops, Various types of Shift Registers-SISO, SIPO, PISO,PIPO, Bidirectional & Universal Shift. Counters-Synchronous, Asynchronous, Irregular, Self Correcting Ring & Johnson Counter. Application of Counter (Stepper motor control.

Module – 4: **[6L]**

Parameters of D/A & A/D Converters. Different types of A/D -Flash Type, Successive Approximation and Dual Slope and D/A -R-2R Ladder.

Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. TTL Equivalent Circuit.

Text Books:

1. A. Anand Kumar, Fundamentals of Digital Circuits-PHI
2. Morries Mano- Digital Logic Design- PHI
3. S. Salivahanan & S.Arivazhagan, Digital Circuit & Design- Bikas Publishing
4. A. K. Maini- Digital Electronics- Wiley-India

Reference Books:

1. Floyed & Jain- Digital Fundamentals-Pearson.
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Kharate- Digital Electronics- Oxford
6. Tocci, Widmer, Moss- Digital Systems, 9/e- Pearson

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC(EE) 301.1	3	3	3	1	3	1	1	1	1	1	1	3
EC(EE) 301.2	3	3	3	1	3	1	1	1	1	1	1	3
EC(EE) 301.3	3	3	3	3	3	2	2	1	1	1	2	3
EC(EE) 301.4	3	3	3	3	3	2	2	1	1	2	1	3
EC(EE) 301.5	3	3	3	3	3	1	2	1	2	2	2	3

Paper Name: Analog Electronic Circuits
Paper Code: EC(EE) 302
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Basic knowledge about electronic components (R,L,C). Network Theorems (Kirchoffs law, Thevenin's theorem, Norton's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Diode, Transistor, JFET, MOSFET, etc.),Basic idea of integrated circuit, Voltage current equations. Basic knowledge of Differentiation, Integration, Differential equation, matrix etc.

Course Objective: Students will be able to design, test and examine simple circuits with diode, transistor, op-amp, etc. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to understand, modify and repair majority of circuits used in professional equipment design. They will also be able to take-up new design exercise.

Course Outcome:

EC(EE) 302.1. Students will be able to design D.C power supplies.
EC(EE) 302.2. Students will be able to analyze transistor amplifier circuit.
EC(EE) 302.3. Students will be able to understand effects of different feedback mechanism in amplifier circuit.
EC(EE) 302.4. Students will be able to analyze signal generator Circuit.
EC(EE) 302.5. Student will be able to design power amplifier circuit.
EC(EE) 302.6. Students will be able to understand linear and nonlinear applications of OPAMP (I.C-741).

Course Content

Module – 1: Filters and Regulators [4L]
Capacitor filter, π-section filter, ripple factor, series and shunt voltage regulator, line and load regulation, 78xx and 79xx series, concept of SMPS.

Module – 2: Transistor Biasing and Stability [4L]
Biasing technique, Q-point & its Stability, Self Bias-CE configuration, Bias Compensation techniques, h- parameter model of transistors, Expression for voltage gain, current gain, input and output impedance, power gain, Trans-resistance & Trans-conductance Emitter follower Circuit.

Module – 3: Transistor Amplifier [5L]
Different coupling techniques, RC coupled amplifier, functions of all components, derivation of voltage gain, current gain, input impedance and output impedance, High frequency model of transistors (hybrid-π model), frequency response characteristics, Expression for lower and upper half frequencies, bandwidth, and concept of wide band amplifier

Module – 4: Feedback Amplifier and Oscillators [5L]
Concept of feedback, negative & positive feedback, Voltage/Current & Series/Shunt Feedback Berkhausen criterion, RC Oscillators-Phase shift and Wein bridge oscillators, LC Oscillator-Colpitts, Hartley's and crystal oscillators.

Module – 5: Operational Amplifier [5L]
Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level Shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non- inverting amplifiers, Voltage follower/Buffer circuits,

Module – 6: Application of Operational Amplifiers [5L]
Adder & subtractor circuit, practical integrator & differentiator circuit, Instrumentation Amplifier, Log & Anti-log amplifiers, multipliers, Precision Rectifier, Comparator &Schmitt Trigger, Voltage to Current & Current to voltage converter.

Module – 7: Power Amplifier [3L]
Power amplifiers: Class A, B, AB, C, Conversion efficiency, Tuned amplifier.

Module – 8: Multivibrator [2L]
Multivibrators: Astable, Monostable, Bitable multivibrators; Astable and Monostable operation using 555 timers

Module – 9: Special Function Circuits [2L]
VCO, PLL

Text Books:

1. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI.
2. Gayakwad R.A -OpAmps and Linear IC's, PHI.
3. Sedra & Smith-Microelectronic Circuits- Oxford UP.
4. D. Roy Choudhury & B. Jain-Linear Integrated circuits, New Age Science Limited.
5. Franco-Design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGraw Hill.
6. J.B.Gupta- Electronic Devices and circuits, S.K. KATARIA & SONS.

Reference Books:

1. Millman & Halkias- Integrated El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysisand Design- Thomson (Cenage Learning)
3. Schilling &Belove-Electronic Circuit:Discrete& Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- Wiley
5. Malvino-Electronic Principles , 6/e , McGraw Hill
6. Horowitz & Hill- The Art of Electronics;Cambridge University Press.
7. Bell- Operational Amplifiers and Linear ICs- Oxford UP
8. Tobey &Grame-Operational Amplifier: Design and Applications, Mc GrawHill.
9. Coughlin and Driscol-Operational Amplifier and Linear Integrated Circuits – Pearson Education

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC(EE) 302.1	3	3	3	3	2	-	2	-	3	-	-	3
EC(EE) 302.2	3	3	3	3	2	-	2	-	3	-	-	3
EC(EE) 302.3	3	3	3	3	2	-	2	-	3	-	-	3
EC(EE) 302.4	3	3	3	3	2	-	2	-	3	-	-	3
EC(EE) 302.5	3	3	3	3	2	-	2	-	3	-	-	3
EC(EE) 302.6	3	3	3	3	2	-	2	-	3	-		3

Paper Name: Circuit Theory and Network
Paper Code: EE 301
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concepts of Basic Mathematics. Concepts of Basic Electrical Engineering

Course Objective: Finds utility in understanding the concepts in other electrical subjects such as Electrical Power System, Electrical Measurement and Instrumentation, & Electrical Machines, Control System etc.

Course Outcome:

EE 301.1. Know the basic concepts of electric & magnetic circuits and define associated terms

EE 301.2. Know operation of different OP-amp based filters

EE 301.3. Understand and analysis transient and steady-state response of any electrical circuit/network by applying different circuit analysis methods.

Course Content

MODULE – I: **[3L]**
Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks , Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals, Source transformation, KVL & KCL.

MODULE – II: **[5L]**
Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.

MODULE – III: **[8L]**
Definition of Laplace Transform, Advantages, Initial Value theorem and final value theorem, Poles, zeros, transfer function, Laplace Transform of different types of signals, Step & Impulse response of RL, RC,RLC circuits(series & parallel),Transient Analysis Of different Electric Circuits with & without initial conditions, using Laplace Transform, Laplace Transform of Periodic Functions.

MODULE – IV: **[9L]**
Loop variable analysis, Node variable analysis,Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem, Tellegen and Reciprocity Theorems, Compensation theorem Solution of Problems with DC & AC sources.

MODULE – V: **[5L]**
Concept of Tree, Branch, Tree link, Incidence Matrix, Cut Set Matrix, Tie Set Matrix, Formation of incidence, tie set, cut set matrices of electric circuits.

MODULE – VI: **[8L]**
Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions of Reciprocity And Symmetry, Interrelation between different parameters, Driving point impedance & Admittance. Interconnection of Two Port Networks.
Solution of problems.

MODULE – VII: **[4L]**

Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass Filters (first and second order only) using operational amplifier.

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 McGraw Hill Company.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 301.1	3	-	-	-	-	-	-	-	-	-	-	-
EE 301.2	3	-	-	-	-	-	-	-	-	-	-	-
EE 301.3	2	3	2	-	-	-	-	-	-	-	-	-

Paper Name: Field Theory
Paper Code: EE 302
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concept of Mathematics, Physics and Basic Electrical Engineering

Course Objective:

1. Provide knowledge electrostatics and electromagnetism for the analysis of electrical machine performance.
2. Finds usefulness in understating the concepts in electrical machine and power system.

Course Outcome:

EE 302.1. Know the orthogonal co-ordinates & their transformation to solve & analyze problems on vector calculus.
EE 302.2. Know the basic laws of electrostatics and electromagnetism and define associated terms.
EE 302.3. Understand Maxwell's equation in different forms.
EE 302.4. Understand the propagation of EM waves associated with power system transmission line.

Course Content

Module – 1: Co-ordinate systems [6L]
Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems.

Module – 2: Introduction to Vector Calculus [4L]
DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a Vector & Strokes theorem, Laplacian of a scalar, Solution of problems

Module – 3: Electrostatic Field [5L]
Coulomb's law, field intensity, Gauss's law, Electric potential and potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems.

Module – 4: Magneto-Static Fields [5L]
Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetization in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material, Magnetic friction, Solution of problems

Module – 5: Electromagnetic Fields [6L]
Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Solution of problems.

Module – 6: Electromagnetic Wave Propagation [6L]

Wave equation, Wave equation in conducting medium, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good and dielectric conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, Idea of diffraction, Polarisation, Solution of problems .

Module – 7: Transmission Line [3L]

Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions.

Text Books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4h edition, Oxford University press.
2. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2ndEdition, TMH
4. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
5. Elements of Electromagnetic Fields, S.P. Seth, Dhanpat Rai & Sons.

Reference Books:

1. Electromagnetic with application, Krause, 5th Edition, TMH.
2. Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Education

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 302.1	3	-	-	-	-	-	-	-	-	-	-	-
EE 302.2	3	-	-	-	-	-	-	-	-	-	-	-
EE 302.3	3	-	-	-	-	-	-	-	-	-	-	-
EE 302.4	3	-	-	-	-	-	-	-	-	-	-	-

Paper Name: Thermal Power Engineering
Paper Code: ME(EE) 301
Contact: 2L:0T:0P
Credit: 2

Prerequisites: Engineering Thermodynamics & Fluid Mechanics (ME201).

Course Objective: To learn minute details of thermal power generation systems based Vapor Power and Gas power and their components, working principle for solving industrial problems.

Course Outcome: Upon successful completion of this course, the student will be able to

ME(EE) 301.1. Get detailed knowledge on the working principle of mountings and accessories of fire tube and water tube boilers.

ME(EE) 301.2. Understand draught systems and carry out heat balance of a power plant to evaluate efficiency.

ME(EE) 301.3. Analyze the working of steam nozzles and variety of turbines to carry out design based project works and solution of industrial problems

ME(EE) 301.4. Evaluate the performance of I.C Engines and Gas turbines.

Course Content

MODULE – I: **[9L]**
Boilers – Its function, classification – Water tube and Fire tube boilers. Circulating principles – Natural and Forced circulation, Super critical boiler. Boiler accessories: Super heaters, Reheaters, Economiser, Air preheater. Boiler Performances analysis and heat balance, Draught Systems, Calculation of Chimney height.

MODULE – II: **[5L]**
Basics of steam nozzle, Isentropic flow through nozzle, Mass of Steam discharged, choked flow and critical pressure ratio, Use of Mollier Diagram

MODULE – III: **[6L]**
Steam turbines – Principle of operation, Classification, Optimum velocity ratio, Calculation of work and efficiency for Simple impulse turbine, Pressure & Velocity compounded impulse turbine, and Reaction Turbine, Turbine losses and Governing

MODULE – IV: **[6L]**
IC Engines – classifications, working principle, valve timings, and Engine performance: engine power, efficiency, mean effective pressure, Testing of IC engine, heat balance, engine exhaust emission and control

MODULE – V: **[4L]**
Gas Turbine–Closed and open cycle, efficiencies, Optimum pressure ratio, Use of regenerator, intercooling and reheating.

Text Books:

1. P.K.Nag- Engineering Thermodynamics – TMH ,2/e
2. P K Nag- Power Plant Engg. - TMH Pub

3. P.S. Ballaney- Thermal Engineering – Khanna Pub
4. Domkundwar & Arora- Power Plant Engineering –.Dhanpat Rai & Co.
5. A Text Book of Power Plant Engineering – R. K. Rajput – Laxmi Publications (P) Ltd

Reference Books:

1. Cengel --- Thermodynamics, 3/e, TMH
2. Et-Wakil—Power Plant Engineering, MH
3. M W Zemansky & R.H.Dittman -Heat and Thermodynamics – McGraw Hill, 7/e

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME(EE) 301.1	2	-	2		-	-	-	-	-	-	1	1
ME(EE) 301.2	2	3	2	2	-	1	2	-	-	-	-	1
ME(EE) 301.3	2	2	3	2	-	-	-	-	-	-	1	1
ME(EE) 301.4	3	2	1	2	-	1	2	-	-	-	-	1

Paper Name: Analog and Digital Electronics Laboratory
Paper Code: EC(EE) 391
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Knowledge in electrical circuits and electronic devices.

Course Objective:

1. To provide the basic skills required to understand, develop, and design of various engineering applications involving Digital Electronic & Circuits.
2. To provide basic laboratory exposures for Analog Circuits and applications.

Course Outcome:

EC(EE) 391.1. Able to understand the fundamental concepts and techniques used in digital electronics.
EC(EE) 391.2. Able to understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.
EC(EE) 391.3. Able to understand, analyse the analog circuits pertaining to applications like amplifier, oscillators and timer.
EC(EE) 391.4. Able to know how to interface digital circuits with ADC & DAC.

Course Content

1. Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.
2. Study of Zener diode as voltage regulator.
3. Construction of two stages R-C coupled amplifier & study of its gain and Bandwith.
4. Study of class A, C & Push pull amplifier.
5. Realizations V-I & I-V converter using Operational Amplifier.
6. Study of timer circuit using NE 555 and configuration of Monostable and Astable Multivibrator.
7. Study of DAC & ADC
8. Realisation of basic gates using Universal logic gates.
9. Realisation of RS-JK & D filpflop using logic gates.
10. Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.
11. Realisation of Synchronous Up/Down counter.
12. Construction of simple Decoder & Multiplexer circuits using logic gates.
13. Construction of adder circuit using Shift register & Full adder.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC(EE) 391.1	3	3	3	1	3	1	1	1	-	-	1	3
EC(EE) 391.2	3	3	3	1	3	1	1	-	1	1	1	3
EC(EE) 391.3	3	3	3	3	3	2	2	1	-	1	2	3
EC(EE) 391.4	3	3	3	3	3	2	2	1	-	2	1	3

Paper Name: Circuit Theory and Network Laboratory
Paper Code: EE 391
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concepts of Electrical Parameters Measurement.

Course Objective:

1. Provide knowledge for the analysis of basic electrical circuit.
2. Use the modern tools in analysis of electrical circuit.

Course Outcome:

EE 391.1. Demonstrate transient analysis of electric circuits frequency response characteristics of Filter circuits

EE 391.2. Simulate electric circuits, signals, algorithms using software simulator

Course Content

List of Experiments:

1. Transient response of R-L and R-C network: simulation with PSPICE/MATLAB /Hardware
2. Transient response of R-L-C series and parallel circuit: Simulation with PSPICE / MATLAB / Hardware
3. Study the effect of inductance on step response of series RL circuit in MATLAB / HARDWARE.
4. Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware.
5. Frequency response of LP and HP filters: Simulation / Hardware.
6. Frequency response of BP and BR filters: Simulation /Hardware.
7. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
8. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
9. Amplitude and Phase spectrum analysis of different signals using MATLAB.
10. Verification of Network theorem using SPICE/MATLAB

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 391.1	2	3	-	1	3	-	-	-	1	1	-	-
EE 391.2	2	-	2	1	3	-	-	-	1	1	-	-

Paper Name: Thermal Power Engineering Laboratory
Paper Code: ME(EE) 391
Contact: 0L:0T:2P
Credits: 1

Prerequisites: Engineering Thermodynamics & Fluid Mechanics (ME 201).

Course Objective: The main objective of this lab is to develop an idea of Boiler & IC Engine function with the cut model and fuel properties.

Course Outcome: Upon successful completion of this course, the student will be able to

ME(EE) 391.1. Understand operations of different type of Boilers, their mountings and accessories.

ME(EE) 391.2. Evaluate the performance of a four stroke engine with varying load and speed.

ME(EE) 391.3. Carry out the heat balance of an I C Engine for design and development of solution.

ME(EE) 391.4. Determine calorific value of a fuel useful for future project works.

Course Content

1. Study of Cut Models – Boilers Lancashire Boiler
   a) Babcock & Willcox Boiler
   b) Cochran Boiler
   c) Vertical Tubular Boiler
   d) Locomotive Boiler
2. Study of Cut Models –IC Engines
   a) 4S Diesel Engine
   b) 4S Petrol Engine
   c) 2S Petrol Engine
3. Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.
4. Load Test on 4 Stroke Diesel Engines by Rope Brake Dynamometer.
5. Heat Balance on 4 Stroke Diesel Engine by Rope Brake Dynamometer
6. Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model.
7. To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter.
8. To find the Flash Point & Fire Point of Petrol & Diesel Fuel

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME(EE) 391.1	2	-	2	-	-	-	-	-	1	-	1	2
ME(EE) 391.2	1	2	3	1	-	1	1	-	3	2	2	1
ME(EE) 391.3	1	2	2	1	-	2	2	-	3	2	1	1
ME(EE) 391.4	-	-	2	-	-	3	2	-	2	1	1	1

Paper Name: Technical Report Writing and Language Practice
Paper Code: HU 381
Contact: 0L:0T:2P
Credit: 1

Prerequisites: A basic knowledge of listening and speaking skills and the ability to infer meaning from audio- video/online lessons.

Course Objective: To maximize exposure and train students in the professional use of English in the globalized workplace.

Course Outcome: By the end of the course the student should be able to

- **HU 381.1.** Understand and make use of a wide taxonomy of listening skills & sub-skills for comprehending & interpreting data in English
- **HU 381.2.** Speak in English, using appropriate vocabulary and pronunciation in contextualized situations
- **HU 381.3.** Understand and put into effective practice the pragmatics of Group Discussion
- **HU 381.4.** Understand and write a detailed technical report as per organizational needs
- **HU 381.5.** Understand and interact in professional presentations and interviews

Course Content

Module 1: The Need for a Language Laboratory [2L+2P]

a) Introduction to the Language Lab
b) Skill-building exercises in the lab

Module 2: Power Listening [2L+3P]

a) Taxonomy of Listening Skills & Sub-skills [Aural Skimming, Scanning, Listening for Details, Note taking, Evaluative Listening, Empathetic Listening, Paralinguistic and Kinesic Inferencing]
b) Audio-based Lessons
c) Repairing Listening 'Gaps' through Learner Feedback

Module 3: Speaking Skills [2L+6P]

a) The Need for Speaking: Content and Situation-based speaking
b) Speaking Activities: [Just a Minute, Paired Role Play, Situational Speaking Exercises]
c) The Pragmatics of Speaking—Pronunciation practice and learner feedback.

Module 4: Group Discussion [2L+6P]

a) Teaching GD Strategies
b) In-house video viewing sessions
c) Group Activities [Topic Brainstorming, Situational Analysis, Frame Story]
d) Extended Practice and feedback

Module 5: Writing a Technical Report [2L+6P]

a) Organizational Needs for Reports and types
b) Report Formats
c) Report Writing Practice Sessions and Workshops

Module 6: SWOT Analysis [2L+3P]

a) SWOT Parameters
b) Organizational SWOT
c) Case Study

Module 7: Presentation [2L+6P]

a) Teaching Presentation as a Skill
b) Speaking Strategies and Skills
c) Media and Means of Presentation
d) Extended Practice and Feedback

Module 8: Personal Interview [2L+3P]

a) Preparing for the Interview: Interview Basics, Dressing and Grooming, Q & A
b) Mock Interview sessions and feedback

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 381.1	3	-	-	3	-	3	-	-	3	3	-	-
HU 381.2	2	3	2	3	-	3	-	-	2	3	-	1
HU 381.3	1	3	-	3	-	2	-	-	2	3	-	1
HU 381.4	1	2	3	3	-	2	-	-	2	3	-	-
HU 381.5	3	3	2	3	-	2	-	-	2	3	-	1

SYLLABUS

OF

B.TECH FOURTH SEMESTER COURSES

Paper Name: Physics – II
Paper Code: PH(EE) 401
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Knowledge of Physics up to B. Tech. 1st year Physics – I course

Course Objective: The Physics-II course will provide

1. exposure to the physics of materials that are applied in electrical engineering
2. an insight into the science & technology of next generation and related technicalities through quantum mechanics
3. advanced materials for electrical engineering
4. concept of fundamental particles and associated applications in semiconductors

Course Outcome:

PH(EE) 401.1. state

a) Basic postulates of Quantum Mechanics
b) Macro state and micro state for thermodynamic system.
c) Thermodynamic probability and phase space
d) Properties of Nano material.
e) Polarization
f) Bloch Theorem
g) Assumptions of Kronig-Penny Model

PH(EE) 401.2. explain

a) Energy levels and energy states.
b) Distribution functions of Classical and quantum statistics.
c) Concept of quantum well, quantum wire and quantum dots.
d) Quantum confinement.
e) Different types of polarizability.
f) Dielectric loss.
g) Ferroelectric and Piezoelectric materials.
h) Ferromagnetic Hysteresis Loop
i) E-k diagram and Brillouin zone and crystal momentum
j) Nuclear Binding Energy

PH(EE) 401.3. apply the knowledge of

a) Schrödinger equation in problems of junction diode, tunnel diode, 1-D potential box, 3-D potential box.
b) Nano-range and various types of nano materials.
c) Fermi Dirac statistics to metals and semiconductors.
d) Local electric field and Lorentz field in Clausius-Mossotti equation.
e) M, B , H and χ in realizing Curie law for different magnetic materials
f) Weiss molecular field theory in realizing Curie- Weiss law for Ferromagnetic materials Soft and hard ferromagnets in different storage devices and other applications.
g) Free electron theory in deriving Weidemann and Franz law,
h) Kronig-Penny Model to classify different solid materials (metal, semiconductor, and insulator) based on characteristics of allowed and forbidden energy band.
i) Hall Effect to interpret its application in various real life situations.
j) Liquid drop model in Nuclear Fission and Fusion

PH(EE) 401.4. Analyze

a) Behavior of dielectric under alternating field.
b) Hysteresis curve to describe properties of hard and soft ferromagnets.
c) Outcome of negative effective mass value to realize existence of both electron and holes in certain solids.

PH(EE) 401.5. to evaluate

a) Under certain conditions quantum statistics collapses to classical statistics
b) Diamagnetic, Paramagnetic and Ferromagnetic materials.
c) Sommerfeld's energy quantization theorem to overcome the limitations of classical free electron theory (Drude's Theory)

Course Content

Module 1: Electric and Magnetic properties of materials (8L)

Module 1.01: Insulating materials:

Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), behavior of Dielectric under alternating field (qualitative discussion only), Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability – Clausius-Mossotti equation (with derivation) ; Dielectric losses. ferroelctric and piezoelectrics (Qualitative study). 4L

Module 1.02: Magnetic materials and storage devices:

Magnetic Field & Magnetization M, relation between B, H, M. Bohr magneton, susceptibility, Diamagnetism - Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θp, Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) 4L

Module 2: Quantum Mechanics – II (7L)

Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation. 4L

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only E<V0). 3L

Module 3: Statistical Mechanics (6L)

Module 3.01: Basics of Statistical Mechanics:

Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. 4L

Module 3.02: Applications of Statistical Mechanics:

Qualitative study: Fermi level in metals, total energy at absolute zero and total number of particles. Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type). 2L

Module 4: Elements of solid state physics (6L)

Module 4.01: Free electron theory (qualitative):

Electronic conduction in solids : Drude's theory, Boltzmann equation, Wiedemann Frantz Law, Idea of quantization of energy-Sommerfeld theory. 3L

Module 4.02: Band theory of solids:

Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k) diagram, allowed and forbidden energy bands, Brillouin Zone (qualitative study), Concept of effective mass – electrons and holes, crystal momentum, Hall effect-applications. 3L

Module 5: Physics of Nanomaterials (3L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, grapheme, electronic, environment, medical). 3L

Module 6: Nuclear energy as future energy (3L)

Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energy output, Nuclear Reactor. 3L

Books:

1. Insulating Materials: Principles, Materials, Applications, Margit Pfundstein , Roland Gellert , Martin Spitzner & Alexander Rudolphi: Birkhauser Verlag AG; 1
2. High Voltage and Electrical Insulation Engineering, Ravindra Arora, Wolfgang Mosch: Online ISBN: 9780470947906 DOI: 10.1002/9780470947906 Series Editor(s): Mohamed E. El-Hawary
3. Physics-II, Sujay Kumar Bhattacharya and Soumen Pal, McGraw Hill Education Private Limited
4. Advanced Engineering Physics, S. P. Kuila, New Central Book Agency (P) Ltd.
5. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
6. Quantum Mechanics- Bagde Singh (S. Chand Publishers)
7. Principles of Engineering Physics Vol 1 and Vol 2; by Md. N. Khan and S. Panigrahi, Pub: Cambridge Univ. press
8. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
9. Quantum Computation and Quantum Information(10th Anniversary Edition)- Nielsen & Chuang (Cambridge University Press)
10. Fundamental of Statistical Mechanics: B Laud
11. Introduction to statistical mechanics : .Pathria
12. Fundamental of Statistical and Thermal Physics: F. Reif Advanced Engineering Physics-S. P. Kuila New Central Book Agency (P)Ltd.
13. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell
14. Introduction to Electrodynamics-Griffiths David J.
15. The Feynman Lectures on Physics. 2 (2nd ed.)., Feynman, Richard P Addison-Wesley. ISBN 978-0-8053-9065-0
16. Solid State Physics, A. J. Dekker, McMillan
17. Nanostructure and Nanomaterials, B.K. Parthasarathy
18. Introduction to Nanotechnology, B.K. Parthasarathy
19. Essentials of Nanotechnology, Rishabh Anand
20. Nanomaterials Handbook (Advanced Materials and Technologies)-YuryGogotsi (Editor) 1. Nuclear Physics, Irvin Keplan
21. Nuclear Physics, J. Pearson, University of Manchester, 2008
22. Nuclear and Particle Physics, Jenny Thomas - University College London , 2000.

23. Solid State Physics, S.O. Pillai.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH(EE) 401.1	3	1	-	-	-	-	-	-	-	-	-	1
PH(EE) 401.2	3	1	-	-	-	-	-	-	-	-	-	1
PH(EE) 401.3	3	2	-	-	-	-	-	-	-	-	-	1
PH(EE) 401.4	2	3	-	-	-	-	-	-	-	-	-	-
PH(EE) 401.5	2	3	-	-	-	-	-	-	-	-	-	1

Paper Name: Electrical Machines I
Paper Code: EE 401
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concept of Basic Electrical Engineering and Field Theory

Course Objective:

1. Provide knowledge to select the electrical machine for particular machine.
2. Study the performance and operation of d.c. machine, induction motor and transformer.

Course Outcome:

EE 401.1. Know the Electromechanical Energy Conversion principle and concept of magnetic to understand the basic principles of electrical machine and define terms associated with rotating electrical machine.

EE 401.2. Based on different type of requirement know the applications of d.c. machine, induction motor and transformer for a given application

EE 401.3. Understand the principle of operation and know performance of d.c. machine, induction motor and transformer.

EE 401.4. Know different tests on electrical machine and determine the performance of d.c. machine, induction motor and transformer.

Course Content

MODULE – I: General introduction to Electrical Machines 6L

Faraday's laws of electromagnetic induction, Fleming's rule and Lenz's Law. 1L

Electromagnetic energy conversion principle, singly and doubly excited magnetic system. Physical concept of torque production, electromagnetic and reluctance torque. 1L

Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, EMF polygon. 2L

Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding, MMF waveform of Commutator machines. 2L

MODULE – II: Single-Phase Transformers 6L

Core construction and different parts of transformer and their function, Materials used for core, winding and insulation, Transformer oil, Different types of cooling methods (in brief), Name plate rating. 1L

Equivalent circuit and per unit representation and its importance, Regulation, Efficiency and All day efficiency, Numerical. 3L

Single-phase Auto transformer – Comparison of weight, copper loss with 2- Winding transformer. 1L

Sumpner Test, Applications of 2-winding transformer & Auto transformer. 1L

MODULE – III: Three-Phase Transformers 11L

Types of three-phase transformer. Construction – Core type 3-limb, 5-limb and Shell type, Flux distribution, Different types of windings. 1L

Polarity of transformer, Vector groups for various connections. 2L

Parallel operation and load sharing, Numerical. 2L

Effect of unbalanced loading and neutral shifting, Harmonics production and its Suppression, Tertiary windings. 2L
Scott-connected transformer and open-delta connection – working principle, Connection diagram, practical application. 2L
Tap-changing methods, Tap changers – Off load and On-load type. 1L
Special Transformer: Pulse transformer, Grounding transformer. 1L

MODULE – IV: Three Phase Induction Motor 10L
Induction motor as a transformer, Power stages in 3-phase induction motor and their relation, power-slip characteristics, Losses, Efficiency, Numerical. 3L
Determination of equivalent circuit parameters, Separation of losses, Numerical. 2L
Effect of change in rotor resistance in slip-ring machine and slip power recovery. 1L
Concept of Deep bar and Double cage rotor. 1L
Starting and speed control of three phase induction motor. 1L
Space harmonics: Crawling and Cogging, Brief idea of braking of Induction Motor. 1L
Industrial applications of 3-phase induction motor. 1L

MODULE – V: D.C. Machine 7L
EMF generation in armature, Methods of building up of e.m.f, Significance of Critical resistance and Critical speed. 1L
Armature reaction and its effect, Function of Interpole and Compensating Winding. 1L
Commutation method, Concept of reactance voltage. 1L
Power flow diagram, Losses and efficiency, Numerical. 2L
Testing of dc machines – Hopkinson's, Swinburne's test, Brake test (Tests Specified as per standards). 1L
Amplidyne, Industrial applications of dc machine. 1L

Text Books:
1. Electrical Machinery, P.S. Bhimra, 6th Edition, Khanna Publishers.
2. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited.
3. Electrical Machines, P.K. Mukherjee & S. Chakrabarty, Dhanpat Rai Publication.

Reference Books:
1. Electric Machinery & Transformers, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electrical Machines, R.K. Srivastava, Cengage Learning
3. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition.
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.
5. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 401.1	3	-	-	-	-	-	-	-	-	-	-	-
EE 401.2	2	-	-	-	-	-	-	-	-	-	-	-
EE 401.3	3	-	-	-	-	-	-	-	-	-	-	1
EE 401.4	3	-	-	-	-	-	-	-	-	-	-	-

Paper Name: Electrical and Electronics Measurement
Paper Code: EE 402
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concepts of Basic Electrical Engineering.

Course Objective:

1. To provide the knowledge of different electrical parameters.
2. To become acquainted with different measuring instruments.

Course Outcome:

EE 402.1. Understand the basics of Electrical measuring system.
EE 402.2. Study the measurement of Resistance, Inductance, Capactance, Power, Energy, PF and Insulation resistance.
EE 402.3. Study different measuring instruments.

Course Content

Module – I:

Measurements: **(3)**
Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Errors in measurement.

Analog meters: **(3)**
General features, Construction, Principle of operation and torque equation of Moving coil and Moving iron, Electrodynamometer, Induction instruments,Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.

Galvanometer: **(1)**
Classification, Principle of operation, Advantage, Disadvantage, Error and Application.

Module – II:

Instrument Transformer: **(3)**
Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors.

Measurement of Power: **(3)**
Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.

Measurement of Resistance: **(3)**
Measurement of medium, low and high resistances, Megger.

Module – III:

Measurement of Energy: **(2)**
Construction, theory and application of AC energy meter. Testing of energy meters.

Potentiometer: **(3)**
Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application.

AC Bridges: **(4)**
Measurement of Inductance, Capacitance frequency

Measurement of power factor: **(1)**

Power Factor Meter, 1-ϕ & 3-ϕ dynamometer type power factor meter, 1-ϕ moving iron power factor meter.

Module – IV:

Cathode Ray Oscilloscope (CRO): **(2)**

Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.

Electronic Instruments: **(3)**

Digital voltmeter (Electronic), Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter.

Sensors & Transducers: **(4)**

Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

Text Books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

Reference Books:

1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
2. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
3. Instrument transducers, H.K.P. Neubert, Oxford University press.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 402.1	2	-	-	-	-	-	-	-	-	-	-	-
EE 402.2	3	-	-	-	-	-	-	-	-	-	-	-
EE 402.3	2	-	-	-	-	-	-	-	-	-	-	-

Paper Name: Numerical Methods
Paper Code: M(CS) 401
Contact: 3L:0T:0P
Credit: 3

Pre requisites: Concept of Calculus and Algebra.

Course Objective: The purpose of this course is to provide basic understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

- **M(CS) 401.1.** Recall the distinctive characteristics of various numerical techniques and the associated error measures.
- **M(CS) 401.2.** Understand the theoretical workings of various numerical techniques and to solve the engineering problems.
- **M(CS) 401.3.** Apply the principles of various numerical techniques to solve various problems.

Course Content

MODULE – I: Numerical Method I

Approximation in numerical computation: Truncation and rounding errors, Propagation of errors. Propagation of errors, Fixed and floating-point arithmetic. (2L)
Interpolation: Newton forward/backward interpolation, Stirling & Bessel's Interpolation formula, Lagrange's Interpolation, Divided difference and Newton's divided difference Interpolation. (7L)
Numerical integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Romberg Integration, Expression for corresponding error terms. (5L)
Numerical solution of a system of linear equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method. (6L)

MODULE – II: Numerical Method II

Solution of polynomial and transcendental equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method. (5L)
Numerical solution of ordinary differential equation:Taylor series method,Euler's method, Euler's modified method,fourth order Runge-Kutta method and Milne's Predictor-Corrector methods. (6L)
Numerical solution of partial differential equation: Finite Difference method, Crank– Nicolson method. (2L)

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Graw hill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta & Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books.

Reference Books:

1. Balagurusamy: Numerical Methods, Scitech. TMH
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, Oxford Universities Press.
5. Srimanta Pal: Numerical Methods, Oxford Universities Press.
6. Numerical Analysis, Shastri, PHI
7. Numerical Analysis, S. Ali Mollah. New Central Book Agency.
8. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI
9. NumericalAnalysis,G.S.Rao,New Age International
10. Programmed Statistics (Questions – Answers), G.S.Rao, New Age International
11. Numerical Analysis & Algorithms, PradeepNiyogi, TMH
12. Computer Oriented Numerical Mathematics, N. Dutta, VIKAS
13. Numerical Methods, Arumugam, Scitech Publication
14. Probability and Statisics for Engineers, Rao, Scitech Publication
15. Numerical Methods in Computer Application,Wayse, EPH

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M(CS) 401.1	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 401.2	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 401.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Data Structure
Paper Code: CS(EE) 402
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Familiarity with the fundamentals of C or other programming language. A solid background in mathematics, including probability, set theory.

Course Objective:
1. To learn the basics of abstract data types.
2. To learn the principles of linear and nonlinear data structures. To build an application using sorting and searching.

Course Outcome: On completion of the course students will be able to
- **CS(EE) 402.1.** Differentiate how the choices of data structure & algorithm methods impact the performance of program.
- **CS(EE) 402.2.** Solve problems based upon different data structure & also write programs.
- **CS(EE) 402.3.** Identify appropriate data structure & algorithmic methods in solving problem.
- **CS(EE) 402.4.** Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
- **CS(EE) 402.5.** Compare and contrast the benefits of dynamic and static data structures implementations.

Course Content

Module I: Linear Data Structure [10L]
Introduction: **(2L)**
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code (1L)
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations (1L)
Array: **(2L)**
Different representations – row major, column major (1L)
Sparse matrix - its implementation and usage, Array representation of polynomials (1L)
Linked List: **(6L)**
Singly linked list – operations, Doubly linked list – operations (4L)
Circular linked list – operations, Linked list representation of polynomial and applications (2L)

Module II: Linear Data Structure [6L]
Stack and Queue: **(4L)**
Stack and its implementations (using array and linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue de-queue (1L)
Implementation of queue- linear and circular (using array and linked list) (1L)
Recursion: **(2L)**
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi, Eight Queens Puzzle (1L)

Module III: Nonlinear Data structures [12L]

Trees: **(8L)**
Basic terminologies, forest, tree representation (using array and linked list) (1L)
Binary trees - binary tree traversal (pre-, in-, post- order) (1L)
Threaded binary tree (1L)
Binary search tree- operations (creation, insertion, deletion, searching) (1L)
Concept of Max-Heap and Min-Heap (creation, deletion) (1L)
Height balanced binary tree – AVL tree (insertion with examples only) (1L)
Height balanced binary tree – AVL tree (deletion with examples only) (1L)
m –Way Search Tree, B+ Tree – operations (insertion, deletion with examples only) (1L)
Graphs: **(4L)**
Graph theory review (1L)
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

Module IV: Searching, Sorting **[8L]**
Sorting Algorithms: **(4L)**
Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)
Quick sort, Merge sort – with complexity (2L)
Radix sort – with complexity (1L)
Searching: **(2L)**
Sequential search – with complexity (1L)
Binary search, Interpolation Search– with complexity (1L)
Hashing: **(2L)**
Introduction to Hashing and Hashing functions (1L)
Collision resolution techniques (1L)

Recommended Books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed "Data Structures in C" by Aaron M. Tenenbaum
2. "Data Structures" by S. Lipschutz
3. "Data Structures Using C" by Reema Thareja
4. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 402.1	3	3	2	2	3	2	2	3	3	3	2	3
CS(EE) 402.2	3	2	2	2	2	2	3	2	2	3	3	2
CS(EE) 402.3	3	3	3	2	3	3	3	2	2	3	3	2
CS(EE) 402.4	3	3	3	3	3	3	3	3	3	3	3	3
CS(EE) 402.5	3	3	3	3	3	3	3	3	3	3	3	3

Paper Name: Physics – II Laboratory
Paper Code: PH(EE) 491
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Knowledge of Physics up B. Tech. 1st year Physics-I course

Course Objective: The Physics – II course will provide

1. exposure to the physics of materials that are applied in electrical engineering
2. an insight into the science & technology of next generation and related technicalities through quantum mechanics
3. advanced materials for electrical engineering
4. concept of fundamental particles and associated applications in semiconductors

Course Outcome:

PH 491.1. demonstrate
- a) Dipolar magnetic behavior
- b) Action of capacitors
- c) Fermi levels and band gap in a semiconductor
- d) Function of Light emitting diode
- e) Magnetic and semiconductor storage devices
- f) Motion of electron under cross fields

PH 491.2. conduct experiments using
- a) Insulators, Semiconductors (extrinsic and intrinsic), Light emitting diodes
- b) Cathode ray oscilloscope
- c) Various types of magnetic materials

PH 491.3. Function effectively as an individual, and as a member or leader in laboratory sessions

PH 491.4. communicate effectively, write reports and make effective presentation using available technology
- a) on presentation of laboratory experiment reports
- b) On presentation of innovative experiments

Course Content

Module 1: Electric and Magnetic properties of materials (8L)

1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup. Measurement of Curie temperature of the given sample.
4. Determination of dielectric constant of given sample (frequency dependent)/Measurement of losses in a dielectric using LCR circuits.

Module 2: Quantum Mechanics – II (6L)

1. Determination of Stefan's radiation constant.
2. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
3. Measurement of specific charge of electron using CRT.

Module 3: Solid state physics (9L)

1. Determination of band gap of a semiconductor.
2. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor

In addition to regular 7 experiments it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method. Determination of thermal conductivity of a good conductor by Searle's mothod.
2. Study of I-V characteristics of a LED. Study of I-V characteristics of a LDR
3. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH(EE) 491.1	3	2	-	-	-	-	-	-	-	-	-	1
PH(EE) 491.2	1	2	-	3	-	-	-	-	-	-	-	1
PH(EE) 491.3	1	2	-	-	-	-	-	-	3	-	-	1
PH(EE) 491.4	1	2	-	-	-	-	-	-	-	3	-	1

Paper Name: Electrical Machines – I Laboratory
Paper Code: EE 491
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concepts of Electrical Machines.

Course Objective: Provide the knowledge of d.c. machine, induction motor and transformer performance.

Course Outcome:

EE 491.1. Perform different tests on d.c. machine, induction motor and transformer
EE 491.2. Interpret the observed result using theoretical knowledge and hence calculate unknown parameters

Course Content

List of Experiments:
At least ten experiments to be performed

1. Heat-run test of a single-phase transformer.
2. Regulation and Efficiency of single-phase transformer by direct loading method.
3. Parallel operation of two single-phase transformer and find out the load sharing between them.
4. Efficiency of a single-phase transformer by Back-to-Back test.
5. Polarity test and vector grouping of a three-phase transformer.
6. Swinburne test of a D.C. shunt motor.
7. Brake test of D.C. series motor
8. Voltage build-up of a D.C. shunt generator and find out critical resistance and critical speed.
9. Circle diagram of a three-phase Induction Motor.
10. Speed control of three-phase Induction Motor by V/f constant.
11. Separation of losses in three-phase Induction Motor.
12. Load test of a three-phase wound rotor Induction Motor.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 491.1	2	-	-	3	-	-	-	-	3	2	-	1
EE 491.2	2	-	-	3	-	-	-	-	3	2	-	1

Paper Name: Electrical and Electronics Measurement Laboratory
Paper Code: EE 492
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concepts of different measuring system.

Course Objective: Familiarization with different electrical measuring system

Course Outcome:

EE 492.1. Conduct experiment to measure of Resistance, Inductance, Capacitance, Power, and Energy.

Course Content

1. Instrument workshop – Observe the construction of PMMC, Dynamometer, Electro-thermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.
4. Calibrate AC energy meter.
5. Application of Kelvin double bridge by using D' Arsonval Galvanometer.
6. Measurement of power using Instrument transformer.
7. Measurement of power in Polyphase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.
12. Testing of Energy Meter
13. Calibration of Electronic Volt meter
14. F/V and V/F converter application

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 492.1	2	-	-	3	-	-	-	-	3	2	-	1

Paper Name: Numerical Methods Laboratory
Paper Code: M(CS) 491
Contact: 0L:0T:2P
Credit: 1

Prerequisite: Any introductory course on C/ Matlab.

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

M(CS) 491.1. Apply the programming skills to solve the problems using multiple numerical approaches.

M(CS) 491.2. Analyze if the results are reasonable, and then interpret and clearly communicate the results.

Course Content

1. Assignments on Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule and Romberg Integration.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank– Nicolson method.
7. Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group/Python.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M(CS) 491.1	2	1	-	-	3	-	-	-	-	-	-	1
M(CS) 491.2	2	1	-	-	3	-	-	-	-	-	-	1

Paper Name: Data Structure Laboratory
Paper Code: CS(EE) 492
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Familiarity with the fundamentals of C or other programming language. A solid background in mathematics, including probability, set theory.

Course Objective:

1. To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
2. To write and execute write programs in C to implement various sorting and searching methods.

Course Outcome: On completion of the course students will be able to

CS(EE) 492.1. Choose appropriate data structure as applied to specified problem definition.
CS(EE) 492.2. Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.
CS(EE) 492.3. Have practical knowledge on the applications of data structures.
CS(EE) 492.4. Able to store, manipulate and arrange data in an efficient manner.
CS(EE) 492.5. Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

Course Content

Module 1:

1. Write a C program that uses functions to perform the following:
   a) Create a singly linked list of integers.
   b) Delete a given integer from the above linked list. Display the contents of the above list after deletion.
2. Write a C program that uses functions to perform the following:
   a) Create a doubly linked list of integers.
   b) Delete a given integer from the above doubly linked list. Display the contents of the above list after deletion.
3. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
4. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.
5. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

Module 2:

6. Write a C program that uses functions to perform the following:
   a) Create a binary search tree of characters.
   b) Traverse the above Binary search tree recursively in Postorder.
7. Write a C program that uses functions to perform the following:
   a) Create a binary search tree of integers.
   b) Traverse the above Binary search tree non recursively in inorder.

Module 3:

8. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a) Insertion sort
   b) Merge sort
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a) Quick sort
   b) Selection sort
10. Write C programs for implementing the following searching methods:
   a) Linear Search
   b) Binary Search
11. Write a C program to implement all the functions of a dictionary (ADT) using hashing.

Module 4:

12. Write C programs for implementing the following graph traversal algorithms:
   a) Depth first search
   b) Breadth first search

Text Books:

1. C and Data Structures, Third Edition, P.Padmanabham, BS Publications.
2. C and Data Structures, Prof. P.S.Deshpande and Prof. O.G. Kakde, Dreamtech Press.
3. Data structures using C, A.K.Sharma, 2nd edition, Pearson.
4. Data Structures using C, R.Thareja, Oxford University Press.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand.
6. C Programming and Data Structures, P.Radha Krishna, Hi-Tech Publishers.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 492.1	3	3	2	2	2	2	1	1	-	1	-	-
CS(EE) 492.2	3	2	2	-	2	2	1	-	-	1	-	2
CS(EE) 492.3	2	1	1	-	-	-	-	1	-	-	-	-
CS(EE) 492.4	3	2	-	2	-	1	1	-	1	-	1	-
CS(EE) 492.5	1	-	2	1	2	-	-	1	1	-	1	2

Paper Name: Technical skill Development
Paper Code: MC 481
Contact: 0L:0T:2P
Credit: 2 Units

Prerequisites: Knowledge of electrical circuit and component.

Course Objective: To develop confidence among the young learners to approach and complete a mini project.

Course Outcome: On completion of the course students will be able to

MC 481.1. Prepare lists of material for a mini project.

MC 481.2. Design an electric circuit as per the requirement of application.

Course Content

1. Voltage regulator for household appliances.
2. Solar Mobile Charger.
3. Electric field Detector
4. Power Bank
5. Level control mechanism.
6. Op-amp trainer kit
7. Modern dielectric power plant
8. Power Generation by wind mill
9. Smoke detector/Clap switch.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC 481.1	3	3	2	2	2	2	1	1	-	1	-	-
MC 481.2	3	2	2	-	2	2	1	-	-	1	-	2

SYLLABUS

OF

B.TECH FIFTH SEMESTER COURSES

Paper Name: Environmental Science
Paper Code: HU 501
Contact: 2L:0T:0P
Credit: 2

Prerequisites: Qualified B.Tech 1st year

Course Objective:

1. Be able to understand the natural environment and its relationships with human activities.
2. Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3. Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4. Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:

HU 501.1. Student will be able

- To understand the natural environment and its relationships with human activities.
- To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
- Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content

Module – 1: General **6L**

1.1. Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy
1.2. Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography
1.3. Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
1.4. Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems
1.5. Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module – 2: Air Pollution and Control **7L**

2.1. Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant
2.2. Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

2.3. Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion
2.4. Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion
2.5. control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module – 3: Water Pollution **7L**

3.1. Classification of water (Ground & surface water)
3.2. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.
3.3. Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD
3.4. Lake: Eutrophication [Definition, source and effect].
3.5. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)
3.6. Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride
3.7. Layout of waste water treatment plant (scheme only).

Module – 4: Land Pollution **2L**

4.1. Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste
4.2. Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).
4.3. Waste management: waste classification, waste segregation, treatment & disposal

Module – 5: Noise Pollution **2L**

5.1. Definition of noise, effect of noise pollution on human health,
5.2. Average Noise level of some common noise sources
5.3. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) .
5.4. Noise pollution control.

Text Books:

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

Reference Books:

1. Environmental Studies, Dr. J P Sharma, University Science Press
2. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 501.1	2	2	3	-	-	2	3	3	-	-	1	2

Paper Name: Electric Machine – II
Paper Code: EE 501
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concept of Basic Electrical Engineering and Field Theory.

Course Objective:

1. Provide knowledge to select the electrical machine for particular machine.
2. Study the performance and troubleshoot the operation of synchronous machine and fractional kW motors.

Course Outcome:

EE 501.1. Based on different type of requirement know the applications of synchronous machine and fractional kW motors for a given application

EE 501.2. Understand the principle of operation and know performance of synchronous machine and fractional kW motors.

EE 501.3. Know different tests on electrical machine and determine the performance of synchronous machine.

Course Content

MODULE – I: Synchronous Machines 23L

Construction of 3-phase Synchronous Machines, Description of salient & non-salient rotor, Advantages of Stationary armature and Rotating field system, Name plate rating. 2L
Methods of excitation systems: Static excitation, Brushless excitation, DC generator. 1L
Armature reaction at various p.f, concept of Synchronous reactance. 2L
Phasor diagrams of alternator at lagging, leading and unity p.f. loads. 1L
Voltage regulation of alternator by synchronous impedance method, Numericals. 2L
Open circuit characteristics, Short circuit characteristics of alternator and determination of synchronous reactance. 1L
Theory for salient pole machine, Two reaction theory, phasor diagram at different loads. 2L
Power angle characteristics of Synchronous machines, Numericals. 2L
Short circuit ratio (SCR) – concept and significance. 1L
Method of control of Active & Reactive Power of an alternator. 1L
Reasons and advantages of Parallel operation. 1L
Synchronization of two or more alternators: Three lamps method, Synchroscope. 1L
Parallel operation of (i) an alternator and infinite bus and (ii) Between two alternators and Load sharing between them. Numericals. 2L
Methods of starting of Three-Phase Synchronous Motor: by auxiliary motor and Damper winding. 1L
Effect of variation of excitation at infinite bus (over and under excitation) – V curves and inverted V- curves. 1L
Hunting and its prevention. 1L
Applications of synchronous motor, Synchronous condenser. 1L

MODULE – II: Single-Phase Induction Motor 12L

Construction, Concept of Pulsating Torque. 1L
Double-revolving field theory and Cross-Field Theory. 2L

Development of equivalent circuit, Determination of equivalent circuit parameters, Numericals. 2L
Methods of starting using auxiliary winding, Selection of capacitor value during starting and running, Numericals. 2L
Speed-Torque characteristics, Phasor diagram, Condition of Maximum torque. 2L
Constructional features and performance characteristics of Universal Series Motors, Compensated and uncompensated motors. 2L
Testing of Single phase motors and Applications. 1L

MODULE – III: Special Machines 5L
Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper Motor. 3L
Construction and Operational characteristics of Induction generator and Linear Induction motor. 2L

Text Books:
1. Electrical Machinery, P.S. Bhimra, Khanna Publishers.
2. Electrical Machines, Ashfaq Husain, Dhanpat Rai & Co.
3. Electrical Machines, S.K.Bhattacharya, T.M.H Publishing Co. Ltd.

Reference Books:
1. Electrical Machines, Nagrath & Kothary, TMH
2. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI
3. The performance and design of Alternating Current machines, M.G.Say, C.B.S Publishers & Distributors
4. Electrical Technology, H.Cotton, C.B.S. Publisher New Delhi
5. Electric Machinery & Transformes, Irving L. Kosow, PHI
6. Electric Machinery, A.E.Fitzgerald, Charles Kingsley, Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
7. Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers & distributors.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 501.1	1	-	-	-	-	-	-	-	-	-	-	-
EE 501.2	3	2	-	-	-	-	-	-	-	-	-	1
EE 501.3	3	-	-	2	-	-	-	-	-	-	-	-

Paper Name: Power Systems – I
Paper Code: EE502
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concepts of Basic Electrical Engineering, Circuit Theory and Electrical Machine.

Course Objective:

1. To teach and learn basic structure of power system networks and generation of power.
2. To teach and learn of different power system components and stability analysis.

Course Outcome:

EE 502.1. Understand the concept of power system, know various power system components and define associated terms.
EE 502.2. Know different type of power generation
EE 502.3. Understand basic performances of power system

Course Content

Module – 1: Basic Concept of Electrical Supply System 2L
Structure of Power system, basic idea of transmission, distribution, tie lines, Grid networks etc.

Module – 2: Generation of Electric Power 6L
General layout of a typical coal fired power station, Hydroelectric power station, and Nuclear power station, their components and working principles, comparison of different methods of power generation, Introduction to Solar & Wind energy system.

Module – 3: Mechanical Design of Overhead Transmission Line 6L
Design of Conductors, Line supports:- Towers, Poles, Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators Sag, Tension and Clearance, Effect of Wind and Ice on Sag, Stringing Chart Dampers.

Module – 4: Electrical Design of Overhead Transmission Line 8L
Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phases' symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of Earth on conductor capacitance.

Module – 5: Corona 4L
Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.

Module – 6: Cables 4L
Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.

Module – 7: Performance of Lines 8L
Short, medium (nominal, T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.

Module – 8: Tariff **2L**

Introduction of Economics of power. Guiding principle of Tariff, different types of tariff. Indian Electricity Rule-1956 & 2003: General Introduction

Text Books:

1. Electrical Power System, Subir Roy, Prentice Hall
2. Power System Engineering, Nagrath & Kothery, TMH
3. Elements of Power System Analysis, C.L. Wadhwa, New Age International.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors
5. Principles of Power System, V.K.Mehta and Rohit Mehta, S.Chand.

Reference Books:

1. Electric Power Transmission & Distribution, S.Sivanagaraju, S.Satyanarayana, Pearson Education.
2. A Text book on Power system Engineering, Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.
3. Power System Protection and Switchgear, Badri Ram, TMH
4. Electric Power Distribution System Engineering, 2nd Edition, T. Gonen, CRC Press.
5. www.powermin.nic.in/acts_notification/pdf/ier1956.pdf

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 502.1	3	-	-	-	-	-	-	-	-	-	-	1
EE 502.2	2	-	-	-	-	-	-	-	-	-	-	-
EE 502.3	2	-	-	-	-	-	-	-	-	-	-	-

Paper Name: Control Systems – I
Paper Code: EE 503
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concept of Basic Electrical Engineering, Circuit Theory and Engineering Mathematics.

Course Objective: Find the utility to understand the concept of advance control system.

Course Outcome:

EE 503.1. Get knowledge of basic structure of control systems, define basic terminologies, components

EE 503.2. Modeling physical systems using transfer function to analyze system dynamic and steady state behavior

EE 503.3. Understand the concept of feedback system and controllers, design compensators in frequency domain

Course Content

Module – 1: Introduction to Control System [2]
Concept of feedback and Automatic control, Types and examples of feedback control systems, Definition of transfer function. Poles and Zeroes of a transfer function.

Module – 2: Mathematical Modeling of Dynamic Systems [6]
Writing differential equations and determining transfer function of model of various physical systems including -Translational & Rotational mechanical systems, Basic Electrical systems & transfer function , Liquid level systems, Electrical analogy of Spring–Mass- Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula.

Module – 3: Control System Components [2]
Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tacho- generators. Actuators.

Module – 4: Time Domain Analysis [8]
Time domain analysis of a standard second order closed loop system. Determination of time-domain specifications of systems. Step and Impulse response of first and second order systems. Stability by pole location. Routh-Hurwitz criteria and applications. Control Actions: Basic concepts of PI, PD and PID control, Steady-state error and error constants.

Module – 5: Stability Analysis by Root Locus Method [4]
Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros.

Module – 6: Frequency Domain Analysis of Linear System [8]
Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria and Nyquist plots, measure of relative stability, phase and gain margin. Determination of margins in Bode plot.

Module – 6: Control System Performance [4]
Improvement of system performance through compensation. Lead, Lag and Lead- lag compensation.

Module – 7: Control System Performance [4]
Case-studies: Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator.

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.
2. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
3. Control System Engineering, D. Roy Choudhury, PHI
4. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI Reference Books:
5. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
6. Control systems, K.R. Varmah, Mc Graw hill
7. Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
8. Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, Pearson Education.

Reference Books:

1. Matlab & Simulink for Engineers, Agam Kumar Tyagt, Oxford
2. Modeling & Simulatrion using Matlab-Similink, Dr. S. Jain, Wiley India
3. Matlab & its application in Engineering, Raj K Bansal, A.K. Goel & M.K. Sharma, Pearson
4. MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 503.1	3	-	-	-	-	-	-	-	-	-	-	-
EE 503.2	2	-	-	-	-	-	-	-	-	-	-	-
EE 503.3	3	2	1	-	-	-	-	-	-	-	-	1

Paper Name: Microprocessor and Microcontroller
Paper Code: EE 504
Contact: 3L:0T:0P
Credits: 3

Prerequisites: Knowledge in Digital Electronics.

Course Objective: To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Course Outcome:

- **EE 504.1.** Able to correlate the architecture , instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085
- **EE 504.2.** Able to interprete the 8086 microprocessor-Architecture, Pin details, memory segmentation, addressing modes, basic instructions, interrupts
- **EE 504.3.** Recognize 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts
- **EE 504.4.** Apply instructions for assembly language programs of 8085, 8086 and 8051
- **EE 504.5.** Design peripheral interfacing model using IC 8255, 8253, 8251 with IC 8085, 8086 and 8051.

Course Content

Module – 1: 8085 Microprocessor **12L**

Introduction to Microcomputer based system, Evolution of Microprocessor and microcontrollers and their advantages and disadvantages, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing, Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions, Memory interfacing , IO interfacing, ADC / DAC interfacing, Stack and Subroutine, Delay Calculation, Interrupts of 8085 processor, classification of interrupts, Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085.

Module – 2: Assembly Language Programming with 8085 **2L**

Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc. Programming using interrupts (programming using INTR is not required).

Module – 3: 8086 Microprocessor **5L**

8086 Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts, Memory interfacing, ADC / DAC interfacing.

Module – 4: Assembly Language Programming with 8086 **2L**

Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc.

Module – 5: 8051 Microcontroller **4L**

8051 architecture, hardware, input/output pins, ports, internal and external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts, Memory interfacing, ADC / DAC interfacing.

Module – 6: Assembly Language Programming using 8051 3L

Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges; Logical operations: Byte-level, bit-level, rotate and swap operations; Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns.

Module – 7: Support IC Chips 6L

8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051.

Module 8: Brief introduction to PIC microcontroller (16F877) 1L

Architecture, PIN details, memory layout.

Text Books:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. The 8051 microcontroller - K. Ayala ,Thomson
3. Microprocessors & interfacing – D. V. Hall ,Tata McGraw-hill
4. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley, Pearson An Introduction to Microprocessor and Applications –Krishna Kant, Macmillan

Reference Books:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. The 8051 microcontrollers – Uma Rao and Andhe Pallavi, Pearson

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 504.1	3	3	2	2	-	2	-	-	-	-	-	3
EE 504.2	3	3	2	2	-	2	-	-	-	-	-	3
EE 504.3	3	3	2	2	-	2	-	-	-	-	-	3
EE 504.4	3	3	3	3	-	2	-	-	-	-	-	3
EE 504.5	3	3	3	3	-	2	-	-	-	-	-	3

Paper Name: Electric Machine – II Laboratory
Paper Code: EE 591
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concepts of Electrical Machine.

Course Objective: Provide knowledge to select the fractional kW motors for particular machine. Study the performance of synchronous machine.

Course Outcome:

EE 591.1. Perform different tests on synchronous machine and single phase induction motor
EE 591.2. Interpret the observed result using theoretical knowledge and hence calculate unknown parameters

Course Content

List of Experiments:

1. To observe the effect of excitation and speed on induced e.m.f of a 3-phase alternator and plot the O.C.C. of the alternator.
2. Determination of regulation of Synchronous machine by
    a) Potier reactance method.
    b) Synchronous Impedance method
3. To determine the direct axis resistance [Xd] and quadrature reactance [Xq] of a 3-phase synchronous machine by slip test.
4. Parallel operation of 3 phase Synchronous generators.
5. V-curve of Synchronous motor.
6. Determination of equivalent circuit parameters of a single phase Induction motor.
7. Load test on single phase Induction motor to obtain the performance characteristics.
8. To study the performance of Induction generator.
9. To study the effect of capacitor on the starting and running condition of a single-phase Induction motor, and to determine the method of reversing the direction of rotation.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 591.1	3	-	-	3	-	-	-	-	3	2	-	-
EE 591.2	2	-	-	3	-	-	-	-	3	2	-	-

Paper Name: Power Systems – I Laboratory
Paper Code: EE 592
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concept of Power System.

Course Objective: To allow student to practically verify several concepts and procedures learn in power system modelling and analysis.

Course Outcome:

EE 592.1. Able to estimate performance of Transmission Line and Distribution line
EE 592.2. Able to select line support for a particular Transmission Line
EE 592.3. Able to explain methods of active and reactive power control.
EE 592.4. Able to test the reliability of different components of Transmission Line and Distribution Line

Course Content

1. Draw the Schematic diagram of structure of power system and power transmission line and Symbol of Electrical Equipments.
2. Simulation of DC distribution by network analyzer.
3. Measurement of earth resistance by earth tester.
4. Dielectric strength test of insulating oil, solid Insulating Material.
5. Different parameter calculation by power circle diagram
6. Study of different types of insulator.
7. Determination of the generalized constants A.B, C, D of long transmission line.
8. Active and reactive power control of alternator.
9. Study and analysis of an electrical transmission line circuit with the help of software.
10. Dielectric constant, tan delta, resistivity test of transformer oil.
11. Any Innovative experiment according to knowledge of Power Systems – I.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 592.1	3	-	-	3	-	-	-	-	3	2	-	-
EE 592.2	2	-	-	3	-	-	-	-	3	2	-	-
EE 592.3	2	-	-	3	-	-	-	-	3	2	-	-
EE 592.4	2	-	-	3	-	-	-	-	3	2	-	-

Paper Name: Control System – I Laboratory
Paper Code: EE 593
Contact: 0L:0T:3P
Credit: 2

Prerequisite: Concept of Simulation Software and control system.

Course Objective: Provide knowledge of basics of control system and learning of different systems with their stability analysis.

Course Outcome:

EE 593.1. Simulate, analyze system behavior using software simulator/hardware
EE 593.2. Design compensators, controllers to meet desired performance of system.

Course Content

1. Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2. Determination of Step response for first order & Second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot.
5. Determination of PI, PD and PID controller action of first order simulated process.
6. Determination of approximate transfer functions experimentally from Bode plot.
7. Evaluation of steady state error, setting time , percentage peak overshoot, gain margin, phase margin with addition of Lead

Reference Books:

1. Matlab & Simulink for Engineers, Agam Kumar Tyagt, Oxford
2. Modeling & Simulatrion using Matlab-Similink, Dr. S. Jain, Wiley India
3. Matlab & its application in Engineering, Raj K Bansal, A.K. Goel & M.K. Sharma, Pearson
4. MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 593.1	2	-	-	3	-	-	-	-	3	2	-	-
EE 593.2	2	-	-	3	-	-	-	-	3	2	-	-

Paper Name: Microprocessor and Microcontroller Laboratory
Paper Code: EE 594
Contact: 0L:0T:3P
Credits: 2

Prerequisites: Knowledge in Digital Electronics

Course Objective: To apply ALP Programming for arithmetic-logical solutions and also to interpret the interfacing programming by conducting experiments.

Course Outcome:

EE 594.1. Able to solve small assignments using the 8085 basic instruction sets and memory mapping through trainer kit and simulator.

EE 594.2. Able to write 8085 assembly language programs like Addition, Subtraction, Multiplication, Square, Complement, Look up table, Copying a block of memory, Shifting ,Packing and unpacking of BCD numbers, Ascending order, Descending order etc. using trainer kit.

EE 594.3. Able to validate the interfacing technique using 8255 trainer kit through subroutine calls and IN/OUT instructions like glowing LEDs accordingly, stepper motor rotation etc.

EE 594.4. Able to test fundamental of 8051 programs using the trainer kit.

Course Content

1. Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including the memory map.
2. Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.
3. Programming using 8085 kit and simulator for:
   Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, Look up table, Copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Addition of BCD numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.
5. Program for serial communication between two trainer kits.
6. Interfacing of 8255: Keyboard, Stepper motor rotation.
7. Study of 8051 Micro controller kit and writing programs.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 594.1	2	2	1	1	1	1	1	1	3	1	1	3
EE 594.2	3	3	3	3	2	1	1	1	3	2	2	3
EE 594.3	3	3	3	3	2	2	1	1	3	2	2	3
EE 594.4	3	3	2	2	2	1	1	1	3	1	2	3

Paper Name: Electrical System Design – I
Paper Code: EE 581
Contact: 0L:1T:3P
Credits: 2

Prerequisites: Knowledge of applications of Electrical Circuit, devices and machines

Course Objective: To develop confidence in young professionals in electrical system design.

Course Outcome:

EE 581.1. Able to design Electrical Systems.
EE 581.2. Able to develop an idea of preparing bill of materials for a particular design.

Course Content

List of Experiments:

1. Familiarization of synchronous machine, single phase and three phase induction machine, DC machine, single phase and three phase transformers with the help of cut section models.
2. Design and fabrication of air and iron cored inductor.
3. Designing a heating element with specified wattage, voltage and ambient temperature.
4. Designing a split phase squirrel cage induction motor for a ceiling fan or domestic pump.
5. Design and fabrication of small single phase transformer, 100VA, 220/12V
6. Wiring and installation design of multistoried residential building (G+4, not less than 16 dwelling flats with lift and common pump)
7. Designing of power distribution system for a small township.
8. Designing of a substation.
9. Introduction to computer aided machine design.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 581.1	2	2	1	1	1	1	1	1	3	1	1	3
EE 581.2	3	3	3	3	2	1	1	1	3	2	2	3

SYLLABUS

OF

B.TECH SIXTH SEMESTER COURSES

Paper Name: Control System II
Paper Code: EE 601
Contact: 3L:0T:0P
Credit: 3

Prerequisite: Any introductory course on matrix algebra, calculus, Engineering Mechanics.

Course Objective: The purpose of this course is to provide

1. Fundamental concepts of State Variable Model of Continuous Dynamic System.
2. Knowledge of sampled data systems using Z transform, inverse z transform and stability in z domain. Basic knowledge of nonlinear systems with stability analysis using different methods.

Course Outcome:

EE 601.1. Students will be able to express and solve system equations in state-variable form (state variable models).

EE 601.2. Students will be able to analyze and design of discrete time control systems using z transform.

EE 601.3. Students will be able to examine the stability of nonlinear systems using appropriate methods.

Course Content

Module – I: State Variable Model of Continuous Dynamic Systems [15L]
Converting higher order linear differential equations into state variable form. Obtaining SV model from transfer functions. Obtaining characteristic equation and transfer functions from SV model. Obtaining SV equations directly for R-L-C and spring-mass-dashpot systems.
Concept and properties associated with state equations. Linear Transformations on state variables. Canonical forms of SV equations. Companion forms. Solutions of state equations, state transition matrix, properties of state transition matrix.
Controllability and Observability. Linear State variable feedback controller, the pole allocation problems. Linear system design by state variable feedback.

Module – II: Analysis of Discrete Time (Sampled Data) Systems using Z-Transform [10L]
Difference Equations. Inverse Z transform. Stability and damping in z-domain. Practical sampled data systems and computer control. Practical and theoretical samplers. Sampling as Impulse modulation. Sampled spectra and aliasing. Anti-aliasing filters. Zero order hold. Approximation of discrete (Z- domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Digital compensator design using frequency response.

Module – III: Introduction to Non-Linear Systems [15L]
Block diagram and state variable representations. Characteristics of common nonlinearities. Phase plane analysis of linear and non-linear second order systems. Methods of obtaining phase plane trajectories by graphical method – isoclines method. Qualitative analysis of simple control systems by phase plane methods. Describing Function method. Limit cycles in non-linear systems. Prediction of limit cycles using describing function.Stability concepts for nonlinear systems. BIBO vs. State stability. Lyapunov's definition. Asymptotic stability, Global asymptotic stability. The first and second methods of Lyapunov methods to analyze nonlinear systems.

Text Books:

1. Gopal M : Digital Control and State Variable Methods, 2e, – TMH
2. Roy Choudhuri, D., Control System Engineering, PHI
3. Nagrath I J & Gopal M : Control Systems Engg. - New Age International
4. Anand,D.K, Zmood, R.B., Introduction to Control Systems 3e, (Butterworth-Heinemann) Asian Books

Reference Books:

1. Goodwin, Control System Design, Pearson Education
2. Bandyopadhyaya, Control Engg.Theory and Practice, PHI
3. Kuo B.C. : Digital Control System- Oxford University Press.
4. Houpis, C.H, Digital Control Systems, Mc Graw Hill International.
5. Ogata, K., Discrete Time Control Systems, Prentice Hall, 1995
6. Jury E.I. : Sampled Data Control System- John Wiley & Sons Inc.
7. Umez-Eronini, Eronini., System Dynamics and Control, Thomson
8. Dorf R.C. & Bishop R H : Modern Control System- Pearson Education.
9. Ramakalyan, Control Engineering, Vikas
10. Natarajan A/Reddy, Control Systems Engg., Scitech
11. Lyshevski, Control System Theory with Engineering Applications, Jaico
12. Gibson J E: Nonlinear Control System - McGraw Hill Book Co.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 601.1	3	1	-	-	-	1	-	-	-	-	-	2
EE 601.2	3	2	-	-	-	-	-	-	-	-	-	1
EE 601.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Power System II
Paper Code: EE 602
Contact: 3L:0T:0P
Credit: 3

Prerequisite: Power System 1, Machine-I, Basic Electrical, Circuit theory.

Course Objective: The purpose of this course is to provide knowledge of advance structure of power and power network and analysis of complex power network by different load flow methods and get a clear idea about different types of power system faults and protection schemes. By end of the course, the students should be able to gather high quality of electrical power system engineering in above mentioned fields.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 602.1. Understand and explain the balanced three phase networks, per unit (PU) system, representation of one-line diagram, power system stability

EE 602.2. Apply the knowledge of load flow solution technique and solve problem load flow analysis using Gauss-Siedel method, Newton-Raphson method under loaded and unloaded conditions and analyse different power system faults(Symmetrical and unsymmetrical)

EE 602.3. Understand and explain the principle of operation and performance of different types of relay, circuit breakers and implies it in different protection scheme.

Course Content

Module – 1: Representation of Power system components [6L]
Single-phase representation of balanced three phase networks, the one-line diagram and the Impedance or reactance diagram, per unit (PU) system.
Distribution substation: Types of substations, location of substations, substation equipments and accessories, Earthling (system & equipment), feeder and distributors, radial and loop systems.

Module – 2: Basic Idea of Real and Reactive Power Control [2L]
Introduction to Real and Reactive Power Control (SMIB) Single machine connected to Infinite Bus.

Module – 3: Load Flow Studies [8L]
Network model formulation, formation of Ybus, load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies with flowchart, comparison of load flow methods.

Module – 4: Power System Stability [4L]
Steady state stability, transient stability, equal area criteria, swing equation, multi machine Stability concept, Introductory idea of Voltage Stability and Voltage Collapsed

Module – 5: Faults in Electrical Systems [8L]
Transient on a transmission line, short circuit of a synchronous machine under no load and Loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line-to –ground fault, line to-line fault, double line-to-ground fault.

Module – 6: Power System Protection [16L]

i) Operating Principles and Relay Constructions:

Functions of protective Relaying, different terminologies used in protective relaying, Basic Operation of relay, Electromagnetic Attraction Relays (Plunger type, Hinged armature type, Balanced beam type, Polarized moving iron type) advantages, disadvantages, applications of Electromagnetic attraction relays. Electromagnetic Induction type relays, theory of Induction relay torque, Induction Type Over current relay (non-directional), Induction Type Directional Power Relay, Directional over current relay. Distance Relay(Impedance relays, Reactance relay, MHO relay),Differential relay(Current differential relay, Voltage Balance Differential relay) Tran slay relay, Directional relay(Single phase directional relays),Negative Sequence Relays, Under Frequency Relays, over current Relays, Static Relays(Transductor relays, rectifier bridge relays, Transistors relays, Hall effect relays, Gauss effect relays).Over current Relays(Static time over current relays, Directional Static over current relay, static differential relay, static distance relays, Microprocessor Based relays, Universal relay torque equations, protection scheme for transformer, generators , motors, Bus Zone Protection, Protection of Transmission lines, C.T s and P.T s and their applications in the protective Schemes .Static Relays and Numerical Protections.

ii) Construction and operating principle of circuit Breaker:

Brief description of Circuit Breakers, Operating principle of Circuit breaker, Arc Phenomenon, principles of Arc Extinction, methods of arc Extinction, Voltage breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and Operating mechanism, advantages and disadvantages of different types of circuit breaker. Testing of Circuit Breakers.

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Electrical Power System, Subir Roy, Prentice Hall
2. Power System Engineering, Nagrath & Kothery, TMH
3. Elements of power system analysis, C.L. Wodhwa, New Age International.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors
5. Principles of Power System .V.K.Mehta and Rohit Mehta ,S.Chand.

Reference Books:

1. Electric Power transmission & Distribution, S.Sivanagaraju, S.Satyanarayana, Pearson Education.
2. A Text book on Power system Engineering, Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.
3. Power System Protection and Switchgear, Badri Ram,TMH
4. Electric Power distribution system Engineering, 2nd Edition, T. Gonen, CRC Press.
5. www.powermin.nic.in/acts_notification/pdf/ier1956.pdf

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 602.1	3	-	-	3	-	-	-	-	-	-	-	1
EE 602.2	-	3	2	3	-	-	-	-	-	-	-	1
EE 602.3	3	-	2	-	-	2	-	-	-	-	-	1

Paper Name: Power Electronics
Paper Code: EE 603
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concept of Basic Electronics Course Objective

Course Objective:

1. Ability to understand and explain the principle of operation and performance of different power electronics devices.
2. Ability to prepare the students to analyze and design different power converter circuits. Ability to troubleshoot the operation of different power semiconductor devices.
3. Ability to study the various applications of power electronics to practical industrial applications, home appliances, power supply and controlling the flow of power.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 603.1. Acquire knowledge about fundamental concepts and techniques used in power electronics.
EE 603.2. Analyze various single phase and three phase power converter circuits and understand their applications.
EE 603.3. Identify basic requirements for power electronics based design application.
EE 603.4. Develop skills to build, and troubleshoot power electronics circuits.
EE 603.5. Understand the use of power converters in commercial and industrial applications.

Course Content

Module – 1: Introduction [4L]
Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors.

Module – 2: Advances in Power Electronics Power Semiconductor Switches [7L]
Rectifier diodes, fast recovery diodes, Schottky barrier diode, BJT, Power MOSFET, SCR, TRIAC, IGBT, IGCT and GTO. Ratings, Static and Dynamic Characteristics, triggering and switching characteristics and cooling. SCR turn –on and turn - off methods, Triggering circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit.

Module – 3: Phase Controlled Converters [7L]
Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of freewheeling diodes and source inductance on the performance of converters. Performance parameters of converters, Dual converters.

Module – 4: DC-DC Converters [5L]
Principle of operation, control strategies, Step up and Step down choppers, Buck, Boost, Buck - Boost and Cuk Converters, Concept of Resonant Switching.

Module – 5: Inverters [6L]

Principle of operation of single phase inverter, 120º and 180° conduction mode of operation of three phase inverter, performance parameters of inverters, PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM - multiple PWM Voltage and harmonic Control, introduction to Space vector modulation method, Series resonant inverter-Current Sources Inverter.

Module – 6: AC Controllers **[5L]**

AC Voltage Controllers, Single phase and three phase Cycloconveters – Power factor control and Matrix Converters.

Module – 7: Applications **[6L]**

Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.

Text Books:

1. P.C. Sen, Power Electronics.
2. M.H. Rashid, Power Electronics, PHI/ Pearson Education.
3. P.S. Bhimra, Power Electronics, Khanna Publications.
4. K. Hari Babu: Power Electronics

Reference Books:

1. C.W. Lander, Power Electronics, McGraw Hill.
2. B.K.Bose, Modern Power Electronics, JAICO.
3. Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 603.1	3	2	-	-	-	-	-	-	-	-	-	-
EE 603.2	2	3	1	-	-	-	-	-	-	-	-	-
EE 603.3	-	-	2	-	1	-	-	-	-	-	-	-
EE 603.4	-	-	2	2	-	-	-	-	-	-	-	-
EE 603.5	2	-	2	2	1	-	-	-	-	-	-	-

Paper Name: Digital Signal Processing
Paper Code: EC(EE)604
Contact: 3L:0T:0P
Credits: 3

Prerequisites: Prerequisites for Digital signal Processing are required a thorough understanding of various signals, systems, and the methods to process a digital signal and also the knowledge of arithmetic of complex numbers and a good grasp of elementary calculus. The questions reflect the kinds of calculations that routinely appear in Signals. The candidates are expected to have a basic understanding of discrete mathematical structures.

The candidates required the concept of Z-transform, Relation between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Initial value theorem and final value theorem, stability considerations for LTI systems using Z-transform, Perseval's relation, Inverse Z-transform by Residue method, power series & partial-fraction expansions.

Course Objective:

1. To study the z-transform, convolution, correlation and applications of z -transform.
2. To introduce students with transforms for analysis of discrete time signals and systems.
3. To understand the digital signal processing, sampling and aliasing.
4. To use and understand implementation of digital filters. To study filter design techniques.
5. To study Discrete Fourier Transforms. To study Fast Fourier Transforms.
6. To study fixed point and floating point digital signal processors.

Course Outcome:

EC(EE) 604.1. Able to define discrete systems in the Frequency domain using Fourier analysis tools like DFT, FFT.
EC(EE) 604.2. Able to interpret the properties of discrete time signals in time domain and frequency domain.
EC(EE) 604.3. Able to describe finite word length effects and digital filters.
EC(EE) 604.4. Able to analyse convolution for long sequences of data.
EC(EE) 604.5. Able to implement digital filters.

Course Content

Module – 1: Discrete Fourier Transform and Fast Fourier Transform

Definition of DFT and IDFT, Twiddle factors and their properties, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, aliasing error, filtering of long data sequences using Overlap-Save and Overlap-Add methods.
Difference between DFT and FFT. Radix-2 algorithm, Decimation-In-Time, Decimation-In-Frequency algorithms, signal flow graphs Butterflies, Bit reversal.

Module – 2: Filter Design

Basic concepts of IIR and FIR filters, difference equations, Realization of Filters using Direct form – I, II & Cascade Form Design of IIR Filter using impulse invariant and bilinear transforms, approximation & Design of analog Butterworth Filter, Design of linear phase FIR filters, Concept of Symmetric & anti- Symmetric FIR Filter, Various kinds of Window: Rectangular, Hamming and Blackman windows.

Module – 3: Finite word Length Effects in Digital Filters
Input Quantization error, Product Quantization error, Coefficient, Quantization error, Zero- input Limit cycle Oscillations, Dead band, limit cycle Oscillations.

Module – 4: Application of DSP
Introduction to DSP Hardware TMS320C 5416/6713 processor. Concept of Sub-band coding, Speech analysis etc.

Text Books:
1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
3. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.

Reference Books:
1. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
2. Texas Instruments DSP Processor user manuals and application notes.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC(EE) 604.1	3	3	1	1	-	2	-	2	2	2	2	3
EC(EE) 604.2	3	2	2	1	2	3	-	2	2	1	2	3
EC(EE) 604.3	3	3	1	3	2	3	1	2	2	1	2	3
EC(EE) 604.4	3	2	1	3	-	3	1	3	1	1	1	3
EC(EE) 604.5	3	2	-	1	-	-	1	1	1	2	2	1

Paper Name: Non-conventional Energy Sources and Applications
Paper Code: EE 605A
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Any introductory course on non-conventional energy resources and their application.

Course Objective: The purpose of this course is to provide knowledge on different renewable energy sources for energy production for future growth and development.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 605A.1. Student will be able to understand the importance of Renewable energy over conventional process and learn different methods of Power generation from the Non- conventional sources like Solar, Wind Energy, Biomass, Geothermal energy, OTEC, Tidal energy, MHD Power generation schemes.

EE 605A.2. Students will be able to analyze the different techniques of grid integration of the power generated from renewable energy sources with the initiation of power electronic converters and drives.

EE 605A.3. Students will be able to design different hybrid energy systems and energy storage systems.

Course Content

Module – 1: Introduction to Energy Sources **2L**

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.

Module – 2: Solar Energy **10L**

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length.

Solar Thermal Systems: Flat plate collectors, Concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings,

Solar Photovoltaic Systems: Theory of solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Concept of module, array. Classification of PV systems, Advantages and limitations. Efficiency and cost of PV systems & its applications in battery charging, and Lighting.

Module – 3: Wind Energy **6L**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output from wind turbine; wind data and site selection considerations, characteristics of different types of wind generators used with wind turbines.

Module – 4: Biomass Energy **5L**

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas, Biodiesel

Module – 5: Geothermal Energy **3L**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo- pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Module – 6: Energy from Ocean **4L**

Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Ocean Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

Module – 7: Magneto Hydrodynamic Power Generation **3L**

Principle of MHD power generation, Classification of MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.

Module – 8: Hydrogen Energy **3L**

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.

Module – 9: Fuel Cell **2L**

Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells, limitations and application of fuel cells.

Module – 10: Hybrid Systems **2L**

Introduction to hybrid systems, Need for Hybrid Systems, Different type of Hybrid systems like Diesel- PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems.

Text Books:

1. Non Conventional Energy Resources by S Hasan Saeed, D K Sharma
2. Non conventional Energy sources, G.D. Rai, Khanna Publishers
3. Non Conventional Energy Resources,B.H Khan, Mc Graw Hill Education (Chennai)

Reference Books:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi.
2. Non Conventional Energy Resources And Utilisation. Er R.K Rajput, S Chand Publishers.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 605A.1	3	3	3	1	1	2	3	-	-	-	3	3
EE 605A.2	3	1	2	2	1	3	3	-	-	-	3	2
EE 605A.3	2	2	2	-	-	2	3	-	-	-	3	2

Paper Name: Computational Intelligence
Paper Code: EE 605B
Contact: 3L:1T:0P
Credit: 4

Prerequisites: High-level programming language using C, C++ or Java.

Course Objective:

1. To develop the student's knowledge in various robot structures and their workspace
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To provide the student with some knowledge and skills associated with robot control.

Course Outcome: On successful completion of this course, students should have the skills and knowledge to

EE 605B.1. Describe a basic exposition to the goals and methods of Computational Intelligence.

EE 605B.2. Apply the Intelligent techniques for problem solving.

EE 605B.3. Express problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning.

Course Content

Module 1: Introduction to Computational Intelligence 3L

This unit will lead students to go through several important overview literatures regarding the fundamental ideas and researches of computational intelligence. Moreover, the unit will point out the key conferences, journals and societies related to computational intelligence.

Module 2: Artificial Neural Networks 9L

This unit will lead students to go through several important literatures on the topic of artificial neural networks (ANN). Students will learn about the general concept of ANN, different types of ANN, different types of learning (supervised and unsupervised learning), and applications of ANN algorithms in real world. At the end of the unit, students will be asked to reflect about what they have learned and discuss about questions related to ANN with each other in a discussion forum as part of their participation marks.

Module 3: Genetic Algorithms 9L

This unit will lead students to go through several important literatures on the topic of genetic algorithms (GA). Students will learn about the general concept and features of GAs, different types of GAs, different strategies of using GA features, and applications of GA algorithms in real world. At the end of the unit, students will be asked to reflect about what they have learned and discuss about questions related to GA with each other in a discussion forum as part of their participation marks.

Module 4: Swarm Optimization 9L

This unit will lead students to go through several important literatures on the topic of swarm optimization. Students will learn about the general concept and features of swarm optimization, different types of swarm optimization algorithms and their concepts/features, and applications of

swarm optimization algorithms in real world. At the end of the unit, students will be asked to reflect about what they have learned and discuss about questions related to swarm optimization with each other in a discussion forum as part of their participation marks.

Module 5: Fuzzy Systems 9L

This unit will lead students to go through several important literatures on the topic of fuzzy systems. Students will learn about the general concept and features of fuzzy systems, different strategies for using features of fuzzy systems, and applications of fuzzy systems in real world. At the end of the unit, students will be asked to reflect about what they have learned and discuss about questions related to fuzzy systems with each other in a discussion forum as part of their participation marks.

Module 6: Hybridization of CI Algorithms 9L

This unit will lead students to go through several important literatures on the topic of hybridization of computational intelligence algorithms. Students will learn about why such hybrid algorithms can be beneficial, the general concepts of how to combine algorithms, different types of hybrid algorithms and their benefits, and applications of such hybrid algorithms in real world. At the end of the unit, students will be asked to reflect about what they have learned and discuss about questions related to hybridization of CI algorithms with each other in a discussion forum as part of their participation marks.

Text Books:

1. Stuart Russell, Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Third Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Third Edition, Tata McGraw-Hill, 2010.

Reference Books:

1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2. Dan W.Patterson, ―Introduction to Artificial Intelligence and Expert Systems‖, PHI, 2006.
3. Nils J. Nilsson, ―Artificial Intelligence: A new Synthesis‖, Harcourt Asia Pvt. Ltd., 2000.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 605B.1	3	3	3	2	-	-	-	-	-	-	-	2
EE 605B.2	3	3	3	3	3	2	-	-	-	-	1	3
EE 605B.3	3	3	3	3	3	2	-	-	-	-	1	3

Paper Name: Introduction to Robotics
Paper Code: EE 605C
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Computer Programming and Problem Solving

Course Objective:

1. To develop the student's knowledge in various robot structures and their workspace
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To provide the student with some knowledge and skills associated with robot control.

Course Outcome: On successful completion of this course, students should have the skills and knowledge to

- **EE 605C.1.** Demonstrate the basics knowledge and skills in practical robotics applications
- **EE 605C.2.** Ability to apply mechanical structures of industrial robots and their operational workspace characteristics
- **EE 605C.3.** Students will demonstrate knowledge of robot controllers.
- **EE 605C.4.** Understand and demonstrate an ability to simulate, program, and control commercial Robots through hands-on experiments
- **EE 605C.5.** Understand industrial environment for robotics system

Course Content

Module – 1: Introduction [3L]
Introduction to Robotics, brief history, types, classification and usage, The Engineering Design Process, Science and Technology of robots, Some useful websites, textbooks and research journals.

Module – 2: Elements of Robots [2L]
Joints, links - Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms,

Module – 3: Actuators and Sensors [4L]
Different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Module – 4: Introduction to Robot Mechanics [4L]
Power and torque, Acceleration and velocity, Design models for ground mobile robots, Design models for mechanic arms and lifting systems

Module – 5: Fundamentals of Kinematics [4L]
Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and

experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.

Module – 6: Velocity and Statics of Robot Manipulators [6L]
Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.

Module – 7: Motion Planning and Control [6L]
Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators

Module – 8: Advanced Topics in Robotics [5L]
Sensing distance and direction, Line Following Algorithms, Feedback Systems, Other topics on advance robotic techniques

Text Books:
1. John J. Craig: Mechanics and Control (3rd Edition) 3rd Edition
2. Schilling: Fundamentals of Robotics - Analysis And Control Paperback – 2006
3. Frank Casale (Author), Rebecca Dilla (Author): Introduction to Robotic Process Automation: a Primer Kindle Edition

Reference Books:
1. Robotics: Fundamental Concepts and Analysis, Oxford University Press, Second reprint, May 2008.
2. Material from other textbooks and robotics journals as mentioned.

All modules have Additional Material for self-study and reference.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 605C.1	3	-	2	1	-	-	-	-	-	-	-	-
EE 605C.2	3	3	2	-	-	-	-	-	-	-	-	1
EE 605C.3	2	-	-	-	2	-	-	-	-	-	-	1
EE 605C.4	2	2	-	2	-	1	-	-	-	-	-	-
EE 605C.5	2	-	2	-	-	-	1	-	-	-	-	1

Course Name: Mechatronics
Course Code: EE 605D
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Electronics, Basics of Electrical & Mechanical Engineering, Control System – I.

Course Objective:

1. To provide with basic knowledge of sensors, actuators, their control and robotics.
2. To make students understand about the process of integration of sensors & actuators, control system, signal processing, power electronics to perform complex tasks.
3. To make students familiar with real time controller operation.

Course Outcome: After successful completion of the course students

EE 605D.1. can realize the importance of mechatronic system to perform complex tasks, can elaborate the step wise integration of sensors & actuators, control system, signal processing, power electronics.

EE 605D.2. will be able to demonstrate basic operations of PLC, different control theory and understand mechatronic applications.

Course Content

Module – 1: Introduction (2)
Introduction to Mechatronic & measurement systems, Evolution, Scope, components of mechatronic systems, advantages & disadvantages,examples, Control Systems, open and close loop systems, sequential controllers, microprocessor based controllers, mechatronics approach.

Module – 2: Review of Basic Electronics (4)
Review of fundamentals of electronics, logic gates and their operations, Data conversion devices, electrical contacts, actuators, and switches, contactless input devices, signal processing devices, Data Acquisition systems.

Module – 3: Sensors and Transducers (6)
Introduction, performance terminology - Displacement, Position and Proximity, Velocity and motion, force, flow sensor, Temperature Sensors-Light Sensors, LVDT, Strain gauge load cell, Selection of Sensors-Signal Processing.

Module – 4: Actuation System (6)
Pneumatic and Hydraulic Systems – Directional Control Valves, Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – relays. Construction and working principle of DC and AC Motors. Speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors

Module – 5: Controllers (6)
Continuous and discrete process Controllers– Control Mode – Two – Step mode –Proportional Mode – Derivative Mode– Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control. Microprocessor based Temperature control, Stepper motor control, Traffic light controller.

Module – 7: Programmable Logic Controller (5)
Introduction, Basic structure, Input/ Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Data handling, Analog Input/Output, Selection of a PLC.

Module - 8: Application of Robots and Other Mechatronic Applications (5)
Handling, loading, & unloading, Welding, Spray painting, Assembly, Machining, Inspection, Rescue robots, Underwater robots, Parallel robot, and Medical robot. Electronic Thermostat, Automatic Camera, Air fuel ratio controller in Automobiles, Digital Engine Control, Vehicle Motion Control, Mobile robots etc.

Text/Reference Books:

1. Bolton W., "Mechatronics", Longman, Second Edition, 2004.
2. Histand Michael B.& Alciatore David G., "Introduction to Mechatronics & Measurement Systems", McGraw Hill, 2003.
3. HMT Ltd., "Mechatronics", Tata McGraw Hill Publishing Co. Ltd., 1998.
4. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts * Applications", TMH 2003.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 605D.1	3	-	2	1	-	-	-	-	-	-	-	-
EE 605D.2	3	3	2	-	-	-	-	-	-	-	-	1

Course Name: Introduction to Programming in JAVA
Course Code: CS(EE) 606A
Contact: 3L:0T:0P
Credit: 3

Prerequisites:

1. Computer Fundamentals.
2. Basic understanding of Computer Programming and related Programming Paradigms.
3. Problem Solving Techniques with proper logic Implementation.
4. Basic Computer memory architecture with data accession.

Course Objective:

1. It allows to map with real world Object (Object orientation) rather than action (Procedure) that comes to produce softwares as separated code modules which rise up decoupling and increases code re-usability.
2. It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
3. It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
4. It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
5. It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance).

Course Outcome:

CS(EE) 606A.1. Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
CS(EE) 606A.2. Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
CS(EE) 606A.3. Analyze various activities of different string handling functions with various I/O operations.
CS(EE) 606A.4. Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface.
CS(EE) 606A.5. Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Content

Module – 1: Introduction [5L]

Object Oriented Analysis & Design-Concepts of object oriented programming language, Object, Class. [1L]; Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. [1L]; Object Oriented Programming concepts - Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, Method. [1L]; Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction. [1L]; Difference between different OOPs Languages. [1L]

Module – 2: Java Basics [9L]

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables. [1L]; Access specifiers, Operators, Control statements & loops. [1L]; Array. [1L]; Creation of class, object, method. [1L]; Constructor- Definition, Usage of Constructor, Different types of Constructor. [1L]; finalize method and garbage collection, Method & Constructor overloading. [1L]; this keyword, use of objects as parameter & methods returning objects. [1L]; Call by value & call by reference. [1L]; Static variables & methods. Nested & inner classes. [1L].

Module – 3: Basic String handling & I/O [4L]

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). [1L]; toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). [1L]; ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). [1L]; Command line arguments, basics of I/O operations – keyboard input using BufferedReader& Scanner classes. [1L].

Module – 4: Inheritance and Java Packages [8L]

Inheritance - Definition, Advantages, Different types of inheritance and their implementation. [1L]; Super and final keywords, super() method. [1L]; Method overriding, Dynamic method dispatch. [1L]; Abstract classes & methods. [1L]; Interface - Definition, Use of Interface. [1L]; Multiple inheritance by using Interface. [1L]; Java Packages -Definition, Creation of packages. [1L]; Importing packages, member access for packages. [1L]

Module – 5: Exception handling, Multithreading and Applet Programming [10L]

Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception. [1L]; Try & catch related case studies. [1L]; Throw, throws & finally. [1L]; Creation of user defined exception. [1L]; Multithreading - Basics, main thread, thread life cycle. [1L]; Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().[1L]; Thread priorities, thread synchronization.[1L]; Interthread communication, deadlocks for threads[1L]; Applet Programming - Basics, applet life cycle, difference between application & applet programming[1L]; Parameter passing in applets. [1L]

Text Books:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 606A.1	3	3	2	-	-	-	-	-	-	-	-	-
CS(EE) 606A.2	3	2	-	-	-	-	-	-	-	-	-	-
CS(EE) 606A.3	3	3	3	-	-	-	2	-	2	-	-	-
CS(EE) 606A.4	-	-	2	-	-	-	-	-	-	-	-	-
CS(EE) 606A.5	-	-	-	-	2	-	-	-	2	2	2	-

Paper Name: Object Oriented Programming using C++
Code: CS(EE) 606B
Contact: 3L:0T:0P
Credit: 3

Prerequisites:
1. Computer Fundamentals and Principle of Computer Programming.
2. Basic Understanding of C++.

Course Objective:
1. Provide flexible and powerful abstraction
2. Allow programmers to think in terms of the structure of the problem rather than in terms of the structure of the computer.
3. Decompose the problem into a set of objects
4. Objects interact with each other to solve the problem
5. Create new type of objects to model elements from the problem space

Course Outcomes: On successful completion of the course, the student will able to

CS(EE) 606B.1. Demonstrate the fundamental principles of OO programming and key principles in OO analysis, design, and development.

CS(EE) 606B.2. Apply the knowledge of Unified Modeling Language (UML) towards analysis and design.

CS(EE) 606B.3. Implement common patterns in OO design.

Course Content

Module 1: Principles of Objective Oriented Programming 6L
Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming, Begining with C++.

Module 2: Token Expressions and Control Structures 6L
Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++,Implicit Conversions, Operator Overloading, Operator Precedence, Control Structures.

Module 3: Functions in C++, Classes and Objects 10L
The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects, Friendly Functions.

Module 4: Constructors and Destructors, Operator Overloading, Inheritance 10L
Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Type Conversions

Module 5: Pointers, Virtual Functions and Polymorphism, Working with Files, Exception handling 10L

Pointers, Pointers to Objects, this pointer, Pointer to Derived, Classes, Virtual Functions, Classes for File Stream Operations, Opening and Closing a File, File Modes, File Pointers, Input Output Operations, Updating a File.

Module 6: An Object Oriented Approach in Real Life Problems 6L

Object Orientation O Development O Themes, Modelling, Abstraction Models

Text Books:

1. Object Oriented Design by Rumbaugh, Pearson publication.
2. Object-oriented programming in Turbo C++ By Robert Lafore, Galgotia Publication.
3. Object-oriented programming with C++ by E. Balagurusamy, 2nd Edition, TMH.

Reference Books:

1. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, 5th Edition, Pearson India.
2. D. Ravichandran, Programming with C++, 2nd Eedition, Tata McGraw- Hill.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 606B.1	3	3	3	3	2	-	-	-	1	-	2	2
CS(EE) 606B.2	3	3	3	3	2	-	-	-	2	-	2	2
CS(EE) 606B.3	3	3	3	3	2	-	-	-	2	-	2	2

Paper Name: Computer Architecture and Operating Systems
Code: CS(EE) 606C
Contact: 3L:0T:0P
Credit: 3

Prerequisites:
1. Microprocessors and Microcontrollers
2. Knowledge of C
3. Elementary data structures and algorithms

Course Objective: The overall objective of this course is to provide a comprehensive overview of the basic features of a computer. It puts together basic computer organization, systems software and operating systems. The course lays the basis for more advanced topics in computer science, both hardware and software.

Course Outcomes:

CS(EE) 606C.1. Recognise the main components of a typical computer, analyse and communicate their individual behaviour, as well as their interactions.

CS(EE) 606C.2. Identify the main components of an operating system (OS), analyse and communicate the structure and behaviour of OS components in isolation, as well as their interactions.

CS(EE) 606C.3. Apply the principles of resource management and concurrency to analyse the main design problems at the Operating System level, and critically evaluate the approaches taken by modern-day operating systems in solving them.

CS(EE) 606C.4. Critically evaluate security risks in operating systems and the role operating systems can and should play in establishing security.

Course Content

Module 1: Fundamentals of Computer Architecture **3L**
Information coding, Boolean functions, arithmetic.

Module 2: Digital Design **4L**
Combinational circuits, sequential circuits, special purpose architectures (control unit + data path), programmable units.

Module 3: Computer Architecture **3L**
Basic principles, instruction set, processor, memory hierarchy, I/O organization.

Module 4: Operating Systems **3L**
Evolution and role of the operating system. Architectural concepts. Organization and functionality of an operating system.

Module 5: Process Management **5L**
Processes. Process status. Context switch. Process creation and termination. Thread. User-level threads and kernel-level threads. Process cooperation and communication: shared memory, messages. Direct and indirect communication.

Module 6: Scheduling **5L**

CPU and I/O burst model. Long term, short term and medium term scheduling. Preemption. Scheduling criteria. Scheduling algorithm: FCFS, SJF, priority-based, RR, HRRN, multiple queues with and without feedback. Algorithm evaluation: deterministic and probabilistic models, simulation.

Module 7: Process Synchronization **4L**

Data coherency, atomic operations. Critical sections. SW approaches for mutual exclusion: Peterson and Dekker's algorithms, baker's algorithm. HW for mutual exclusion: test and set, swap. Synchronization constructs: semaphores, mutex, monitor.

Module 8: Deadlock **3L**

Deadlock conditions. Resource allocation graph. Deadlock prevention. Deadlock avoidance. Banker's algorithm. Deadlock detection e recovery.

Module 9: Memory Management **9L**

Main Memory:

Logical and physical addressing. Relocation, address binding. Swapping. Memory allocation. Internal and external fragmentation. Paging. HW for paging: TLB. Page table. Multi-level paging. Segmentation. Segment table. Segmentation with paging.

Virtual Memory:

Paging on demand. Page fault management. Page substitution algorithms: FIFO, optimal, LRU, LRU approximations. Page buffering. Frame allocation: local and global allocation. Thrashing. Working set model. Page fault frequency.

Secondary Memory:

Logical and physical structure of disks. Latency time. Disk scheduling algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK. RAID.

Module 10: File System **5L**

File, attributes and related operation. File types. Sequential and direct access. Directory structure. Access permissions and modes. Consistency semantics. File system structure. File system mounting. Allocation techniques: adjacent, linked, indexed. Free space management: bit vector, lists. Directory implementation: linear list, hash table.

Module 11: I/O Subsystem **4L**

I/O Hardware. I/O techniques: programmed I/O, interrupt, DMA. Device driver and application interface. I/O kernel services: scheduling, buffering, caching, spooling.

Text Books:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier.
2. Carl Hamachar, Zvonco Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill.
3. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia Student Edition.

Reference Books:

1. John P. Hayes, Computer Architecture and Organization, McGraw-Hill.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 606C.1	2	1	-	1	1	-	-	-	-	-	-	1
CS(EE) 606C.2	3	1	1	-	-	-	-	-	-	-	-	-
CS(EE) 606C.3	3	3	3	3	1	-	-	-	-	-	-	3
CS(EE) 606C.4	2	3	2	3	-	-	-	-	-	-	-	2

Paper Name: Software Engineering
Code: CS(EE) 606D
Contact: 3L:0T:0P
Credit: 3

Prerequisites: An understanding of basic computer software Object Oriented programming skills.

Course Objective:

1. To understand the working environment in industry and aware of cultural diversity, who conduct themselves ethically and professionally.
2. Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes:

CS(EE) 606D.1. To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

CS(EE) 606D.2. To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CS(EE) 606D.3. To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.

CS(EE) 606D.4. To acquire the ability to function effectively in teams.

CS(EE) 606D.5. To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.

CS(EE) 606D.6. To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Course Content

Module – 1: **(6L)**

Software Engineering - Characteristics, Components, Application, Definitions, Software Process models - Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral. Agile Method.

Software Project Planning - Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO (Basic, intermediate, Complete) model.

Module – 2: **(3L)**

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modelling, Software Requirements Specification

Module – 3: **(3L)**

Software Design Aspects: Objectives, Principles, Concepts, Top-Down and Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional vs. Object- Oriented approach.

Module – 4: **(4L)**
Unified Modelling Language: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity, diagram, implementation diagram, Use Case diagram.

Module – 5: **(14L)**
Coding & Documentation – Structured Programming, Modular Programming, Module Relationship - Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. [4L]
Testing – Levels of Testing, Integration Testing, System Testing. [4L]
Test Cases- White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture. [6L]

Module – 6: **(6L)**
Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Reference Books:

1. Software Engineering: A practitioner's approach– Pressman(TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 606D.1	1	1	2	2	1	-	-	-	-	-	-	-
CS(EE) 606D.2	2	2	1	-	-	-	-	-	-	-	-	-
CS(EE) 606D.3	-	-	-	-	-	2	-	1	-	1	-	-
CS(EE) 606D.4	-	-	-	-	-	-	-	-	-	2	-	-
CS(EE) 606D.5	-	-	-	-	-	-	-	-	3	-	1	2
CS(EE) 606D.6	-	-	-	-	-	-	-	-	2	1	2	2

Paper Name: Control System II Laboratory
Code: EE 691
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Knowledge of MATLAB.

Course Objective: Provide knowledge of position control system and non-linear control systems with their response analysis.

Course Outcome:

- **EE 691.1.** Student will be able to perform experiments on nonlinearity.
- **EE 691.2.** Student will be able to take initiative to identify, formulate and analyse problems regarding lead-lag compensation, state variable analysis using simulation tools.
- **EE 691.3.** Student will be able to write report on the performed experiment.
- **EE 691.4.** Student will be able to perform the experiment effectively as an individual using MATLAB and hardware equipment.
- **EE 691.5.** Student will be able to provide meaningful solutions by applying knowledge acquired in non-linear control system.
- **EE 691.6.** Student will be able to function as a member or leader in team regularly.

Course Content

List of Experiments:

1. ***Study of a Practical Position Control System:***
   Obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components in SIMULINK. Determination of un-damped natural frequency and damping ratio from the experimental data.
2. ***Tuning of P, PI, and PID Controller for First Order Plant with Dead Time using Z-N Method:***
   Process parameters (time constant and delay/lag) will be provided, the students would compute controller gains by using Z-N method. Steady state and transient performance of the closed loop plant with and without steady disturbances will have to be noted. Theoretical phase and gain margins will have to be manually computed for each gain settings.
3. ***Design of Lead and Lag Compensation using Cascade Tools:***
   Plant transfer function will be provided. Step response is to be obtained (PSPICE, MATLAB, SciLab may be used).
4. ***State Variable Analysis using Cascade Command Tool:***
   Familiarization and use of *CASCADE* command for state variable analysis. Obtaining transfer function from SV model and vice versa. Obtaining step response for a SISO system given in SV form (PSPICE, MATLAB, SciLab may be used).
5. ***State Variable Analysis using Cacsad Block Diagram Tool:***
   Familiarization and use of *CASCADE BLOCK DIAGRAM TOOL* for state variable analysis. Obtaining step response and initial condition response for a single input, two output system given in SV form (PSPICE, MATLAB, SciLab may be used).
6. ***Performance Analysis of a Discrete Time System using Cascade Tool:***

Familiarization and use of CACSAD block diagram tool for Digital Control System. Study of closed response of a continuous system with a digital controller with sample and hold (PSPICE, MATLAB, SciLab may be used).

7. ***Studying The Effects of Nonlinearity in a Feedback Controlled System using Time Response:***
   Determination of step response with a limiter nonlinearity introduced into the forward path of 2nd order unity feedback control systems. The open loop plant will have one pole at the origin and the other pole will be in LHP or RHP. To verify that (i) with open loop stable pole, the response is slowed down for larger amplitude input and (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude (PSPICE, MATLAB, SciLab may be used).
8. ***Studying The Effects of Nonlinearity in a Feedback Controlled System using Phase Plane Plots:***
   Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities. *CASCADE* block diagram tool will be used (PSPICE, MATLAB, SciLab may be used).

Reference Books:

1. Herniter, Programming in MATLAB, Vikas
2. Ogata K: Modern Control Engg. 4e, Pearson/PHI

Note: From the list of experiments a minimum of 7 (seven) experiments shall have to be performed by one student.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 691.1	3	2	1	1	1	1	-	-	2	-	-	-
EE 691.2	-	-	-	-	-	-	-	-	3	-	-	-
EE 691.3	-	-	-	-	-	2	3	-	-	-	-	1
EE 691.4	-	-	-	-	2	1	-	-	-	-	-	-
EE 691.5	2	-	2	-	1	-	-	-	-	-	-	1
EE 691.6	-	-	-	-	-	3	-	3	3	-	2	2

Paper Name: Power System II Laboratory
Paper Code: EE 692
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Power Systems - I, Electrical Machines - I, Circuit Theory

Course Objective:

1. To design and conduct experiments on various power system components-analyze and interpret data.
2. To give hands on experience in using modern software tools for simulation of various power system controls.
3. Acquiring these knowledge Students are ready to perform to industrial and research power system laboratory.

Course Outcome: On completion of the course students will be able to

EE 692.1. Analyze the testing, operation and response of protection of electrical instruments.
EE 692.2. Conduct experimental investigation and gain knowledge of various parts of relays and its operation.
EE 692.3. Able to incorporate the measuring error with actual value and calibrate the instruments transformer.
EE 692.4. Enhance the capability of software analysis by load flow solution in ETAP, MATLAB etc.

Course Content

List of Experiments:

1. Study on (i) on load Time Delay Relay (ii) off load Time Delay Relay
2. Polarity, Ratio and Magnetization Characteristics Test of CT & PT
3. Testing on (i) Under Voltage Relay and (ii) Earth Fault Relay
4. Study on D C Load Flow
5. Study of A C Load Flow Using Gauss – Seidel Method
6. Study of A C Load Flow Using Newton -Raphson Method
7. Study of IEEE 30, 66 bus Load Flow by Software Simulation (ETAP, MATLAB or others)
8. Study on Economic Load Dispatch by software
9. Study of Transformer Protection by Simulation
10. Study of Generator Protection by Simulation
11. Study of Motor Protection by Micom Relay
12. Study of Different Characteristics of Over Current Relay

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 692.1	-	3	-	-	-	1	-	-	-	-	-	-
EE 692.2	-	3	3	-	-	1	-	-	-	-	-	-
EE 692.3	-	-	-	2	-	-	-	-	-	-	-	-
EE 692.4	3	-	3	2	-	-	-	-	-	-	-	-

Paper Name: Power Electronics Laboratory
Paper Code: EE 693
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concept of Basic Electronics

Course Objective: The objectives of this course are

1. To prepare students to perform the analysis of any power electronics circuit.
2. To study of the characteristics of different power electronics devices and how it's work.
3. Familiar with PSIM Software to study of the operation of different power electronics converter.
4. Using PSIM Software plot different circuit wave response and also find out the average value, peak value and RMS value of different voltages & currents.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 693.1. The skill to analyze the response of any power electronics devices.
EE 693.2. The ability to troubleshoot the operation of a power electronics circuit.
EE 693.3. The ability to select suitable power electronic devices for a given application.
EE 693.4. The ability to know how to control and convert output signal as per requirements.
EE 693.5. The ability to construct any power electronics circuits as needed in operation.

Course Content

List of Experiments:

1. Study of the characteristics of an SCR.
2. Study of the characteristics of a TRIAC
3. Study of different triggering circuits of an SCR.
4. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
5. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
6. Study of performance of step down chopper with R and R-L load.
7. Study of performance of single phase controlled converter with and without source inductance (simulation)
8. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
9. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter. (Simulation)
10. Study of performance of three phase controlled converter with R & R-L load (simulation)
11. Introduction to PLC and different industrial applications.

Text Books:

1. P.C. Sen, Power Electronics.
2. M.H. Rashid, Power Electronics, PHI/ Pearson Education.
3. P.S. Bhimra, Power Electronics, Khanna Publications.
4. K. Hari Babu: Power Electronics

Reference Books:

1. C.W. Lander, Power Electronics, McGraw Hill.
2. B.K.Bose, Modern Power Electronics, JAICO.
3. Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 693.1	3	-	-	1	-	-	-	-	-	-	-	-
EE 693.2	-	1	-	2	-	-	-	-	-	-	-	-
EE 693.3	2	1	-	2	-	-	-	-	1	-	-	-
EE 693.4	2	-	-	2	-	-	-	-	1	-	-	-
EE 693.5	2	1	-	2	-	-	-	-	-	-	-	-

Paper Name: Introduction to Programming in JAVA Laboratory
Paper Code: CS(EE) 696A
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Knowledge of C programming language

Course Objective:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be aware of the important topics and principles of software development.
4. Have the ability to write a computer program to solve specified problems.
5. Be able to use the Java SDK environment to create, debug and run simple Java programs.

Course Outcome:

CS(EE) 696A.1. Implement the process of object orientation in java with the help of Class-object-Constructor relationship in Object Oriented Programming

CS(EE) 696A.2. Implement basic knowledge of code reusability with the help of Java in Object Oriented Programming.

CS(EE) 696A.3. Analyze the significance of various keywords w.r.t Encapsulation and polymorphism technique in OOPs. Implements exception handling in Java.

CS(EE) 696A.4. Discuss basic Data abstraction concept w.r.t. Inheritance, Package and Interface

CS(EE) 696A.5. Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java

Course Content

List of Experiments:

1. Assignments on Basic Object oriented programming in java using class-object & method, constructor (Default constructor, parameterized constructor, Copy constructor), method/constructor overloading.
2. Assignments on Inheritance (Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance) method overriding.
3. Assignments on Dynamic method Dispatch, encapsulation, this keyword, super keyword &super () method, static keyword, final keyword.
4. Assignments on developing Data abstraction- Abstract class & abstract methods, interfaces- multiple inheritance, extending interfaces.
5. Assignments on creating and accessing packages, exception handling (Different case studies of try-catch- finally block, chained exception, used defined exception with throw and throws keyword.)
6. Assignments on multithreaded programming-Thread creation, different method implementation of Thread life cycle (yield(), suspend(),resume(),sleep(n),join(),isAlive(), wait(), notify()), Thread priority, Thread Synchronization.
7. Assignments on applet programming.

Text Books:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 696A.1	3	-	2	-	-	-	-	-	-	-	-	-
CS(EE) 696A.2	3	2	2	-	-	-	-	-	-	-	-	-
CS(EE) 696A.3	-	3	3	3	-	-	2	-	-	-	-	-
CS(EE) 696A.4	3	3	2	-	-	-	-	-	-	-	-	-
CS(EE) 696A.5	-	-	3	-	2	-	-	-	2	2	-	-

Paper Name: Object Oriented Programming using C++ Laboratory
Paper Code: CS(EE) 696B
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Computer Fundamentals and Principle of Computer Programming Laboratory.

Course Objective: The objective of course is to develop programming skills of students, using object oriented programming concepts, learn the concept of class and object using C++ and develop classes for simple applications.

Course Outcomes: On successful completion of the course, the student will able to

CS(EE) 696B.1. identify importance of object oriented programming and difference between structured oriented and object oriented programming features.

CS(EE) 696B.2. demonstrate use of objects and classes for developing programs.

CS(EE) 696B.3. apply various object oriented concepts to solve different problems.

Course Content

1. To find the sum of two numbers using function.
2. To find Simple Interest and Compound Interest.
3. To demonstrate the working of following Loops: While, Do While, For, If-Else, switch
4. To find greatest of three numbers.
5. To check whether a number is even or odd.
6. To check whether a year is leap year or not.
7. To add and subtract two matrices.
8. To display elements of an array.
9. To calculate Sum and Average of an array.
10. To sort elements of an array using Bubble sort.
11. To calculate Factorial of a number.
12. To check whether a given number is Prime or not.
13. To generate Fibonacci series.
14. To show function Overloading.
15. To create a class and access member function of a class
16. To `show Constructor and Destructor in a class
17. To convert the temperature in Fahrenheit to Celsius and vice-a-verse
18. To show the concept of Single inheritance in classes

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 696B.1	3	1	-	-	-	-	-	-	-	-	-	-
CS(EE) 696B.2	3	2	3	2	-	-	-	-	-	-	-	2
CS(EE) 696B.3	2	3	3	3	2	-	-	-	-	-	1	2

Paper Name: Computer Architecture and Operating Systems Laboratory
Paper Code: CS(EE) 696C
Contact: 0L:0T:2P
Credit: 1

Prerequisites:
1. Digital Systems
2. Introduction to Computers
3. Systems Programming

Course Objective:
1. To learn Unix commands and shell programming
2. To implement various CPU Scheduling Algorithms
3. To implement Process Creation and Inter Process Communication.
4. To implement Deadlock Avoidance and Deadlock Detection Algorithms
5. To implement Page Replacement Algorithms
6. To implement File Organization and File Allocation Strategies

Course Outcome: At the end of the course, the student should be able to

CS(EE) 696C.1. Compare the performance of various CPU Scheduling Algorithms.
CS(EE) 696C.2. Implement Deadlock avoidance and Detection Algorithms.
CS(EE) 696C.3. Implement Semaphores.
CS(EE) 696C.4. Create processes and implement IPC.
CS(EE) 696C.5. Analyze the performance of the various Page Replacement Algorithms.
CS(EE) 696C.6. Implement File Organization and File Allocation Strategies.

Course Content

List of Experiments:
1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
    a) First Fit
    b) Worst Fit
    c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms
    a) FIFO
    b) LRU
    c) LFU

14. Implementation of the various File Organization Techniques
15. Implementation of the following File Allocation Strategies
    a) Sequential
    b) Indexed
    c) Linked

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 696C.1	3	2	3	2	2	-	-	-	-	-	-	3
CS(EE) 696C.2	3	2	2	-	-	-	-	-	-	-	-	2
CS(EE) 696C.3	3	2	3	2	3	-	-	-	-	-	-	-
CS(EE) 696C.4	3	3	-	-	-	-	-	-	-	-	-	-
CS(EE) 696C.5	3	2	-	-	-	-	-	-	-	-	-	2
CS(EE) 696C.6	3	2	2	1	-	-	-	-	-	-	-	2

Paper Name: Software Engineering Laboratory
Paper Code: CS(EE) 696D
Contact: 0L:0T:2P
Credit: 1

Prerequisites: For Software Engineering Laboratory, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Objective:

1. To learn software development skill through various stages of software life cycle.
2. To ensure the quality of software through software development with various protocol based environment.

Course Outcome:

CS(EE) 696D.1. To handle software development models through rational method.
CS(EE) 696D.2. To prepare SRS document, design document, test cases and software configuration management and risk management related document.
CS(EE) 696D.3. To Develop function oriented and object oriented software design using tools like rational rose.
CS(EE) 696D.4. To perform unit testing and integration testing.
CS(EE) 696D.5. To apply various white box and black box testing techniques.

Course Content

Assignments to be given from the following:

1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system). DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose. (For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan (both Black box and White Box approach)
6. Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

Recommended Book:

1. Software Engineering: A practitioner's approach– Pressman (TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 696D.1	3	3	3	2	2	-	-	-	-	-	-	3
CS(EE) 696D.2	3	2	3	-	-	-	-	-	-	-	-	2
CS(EE) 696D.3	3	2	3	2	3	-	-	-	-	-	-	-
CS(EE) 696D.4	3	3	-	-	-	-	-	-	-	-	-	-
CS(EE) 696D.5	3	2	-	-	-	-	-	-	-	-	-	2

Paper Name: Electrical System Design II
Paper Code: EE 681
Contact: 0L:1T:3P
Credit: 2

Prerequisites: Concept of Stationary and Rotating machines, Magnetic Circuit and coupling, basic knowledge of computer aided drawing.

Course Objective:
1. Ability to understand the various parts and performance of Machines.
2. Ability to design and estimate for a particular machine.
3. Ability to design magnetic circuit of machines and performance and characteristics study.

Course Outcome: On completion of the course students will be able to
EE 681.1. Gain knowledge of designing a system.
EE 681.2. Synchronize different machines in a system.
EE 681.3. Use of theoretical designing concept to implement a practical model.
EE 681.4. Estimate and planning system.

Course Content

List of Experiments:
1. Designing the power distribution system for a small township.
2. Designing a double circuit transmission line for a given voltage level and power (MVA) transfer.
3. Designing a three phase squirrel cage induction motor.
4. Designing a permanent magnet fractional hp servo motor
5. Project module using computer aided machine design.

Text Books:
1. Electrical Systems Design, M. K. Giridharan, I. K. International Publishing House Pvt. Ltd.
2. Electrical Systems Designing Made Simple, Rajiv Shankar, Viva Books Private Limited.
3. Electrical Power System Design, M.V. Deshpande, Mcgraw Higher Ed Reference Book:
4. Electrical Design Estimating and Costing, K. B. Raina, New Age International Ltd.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 681.1	3	-	3	-	1	-	-	-	-	-	1	-
EE 681.2	-	2	-	-	1	-	-	-	-	-	-	2
EE 681.3	-	3	1	-	-	-	-	-	-	-	1	-
EE 681.4	2	-	2	-	-	-	-	-	-	-	-	1

SYLLABUS

OF

B.TECH SEVENTH SEMESTER

COURSES

Paper Name: Value and Ethics in Profession
Paper Code: HU 702
Contact: 2L:0T:0P
Credit: 2

Prerequisites: Basic knowledge of management, basics of communication, Knowledge about environment science.

Course Objective: To create awareness on professional ethics and Human Values.

Course Outcome: On Completion of this course student will be able to

- **HU 702.1.** Understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values.
- **HU 702.2.** understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories
- **HU 702.3.** understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field
- **HU 702.4.** Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.
- **HU 702.5.** acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

Course Contents

Module – 1: Introduction
Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module – 2: Psycho-social Theories of Moral Development
View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module – 3: Ethical Concerns
Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society, Nature of values: Value Spectrum of a good life.

Module – 4: Ethics of Profession
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module – 5: Self Development
Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module – 6: Effects of Technological Growth
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental

Ethics. Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 702.1	-	-	-	-	-	1	1	1	1	2	-	-
HU 702.2	-	-	-	-	-	1	1	3	1	2	-	-
HU 702.3	-	-	-	-	-	3	2	3	-	1	-	-
HU 702.4	-	-	-	-	-	3	2	1	-	-	-	-
HU 702.5	-	-	-	-	-	3	2	2	-	1	3	-

Paper Name: Electric Drives
Paper Code: EE 701
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concept of Electrical Machines and Power Electronics.

Course Objective:

1. Provide knowledge to select electrical machines for particular drive requirement.
2. Study the characteristics and the operation of electrical machines for specific requirement.

Course Outcome:

EE 701.1. Student will be able to select electric motors for a particular drive based on their characteristics.

EE 701.2. Student will be able to accrue the knowledge of speed-control of DC motors and Induction motors.

EE 701.3. Student will be able to accrue the knowledge of power electronic converters used for DC motor and Induction motor speed control.

Course Contents

Module – 1: Electric Drive (4L)

Concept, classification, parts and advantages of electrical dives, Types of Loads, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. 2L

Determination of moment of inertia, Steady state stability, Transient stability. Multiquadrant operation of drives. 2L

Module – 2: Motor Power Rating (3L)

Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. 3L

Module – 3: Starting of Electric Drives (2L)

Effect of starting on Power supply, motor and load. Methods of starting of electric motors. Acceleration time, Energy relation during stating, methods to reduce the Energy loss during starting. 2L

Module – 4: DC Motor Drives (11L)

Review of fundamental equations of DC machines, torque-speed characteristics of separately excited DC motor, conventional method of speed control – armature voltage control and field flux control. 1L

Single phase and three phases fully controlled and half controlled DC drives, Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current. 3L

Chopper fed DC motor for speed control, armature current waveform and ripple, calculation of losses in DC motor and chopper, efficiency of DC drive. 2L

Motoring and generating modes operation of a separately excited dc machine, four quadrant operation of DC machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi- quadrant chopper fed DC drive, regenerative braking. 2L

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of DC motor – dynamic equations and transfer functions, plant transfer function, current controller specification and design, speed controller specification and design. 3L

Module – 5: Induction Motor Drives (8L)

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, constant flux operation, flux weakening operation. 2L

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit. 3L

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery. 3L

Module – 6: Industrial Applications (2L)

Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes and hoist drives. 2L

Text Books:

1. G.K. Dubey, “Fundamental of Electrical Drives”, New Age International Publication.
2. Vedam Subrahmanyam, “Electric Drives”, TMH
3. S.K. Pillai, “A first course on Electrical Drives”, New Age International Publication.

Reference Books:

1. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.
2. B.K. Bose, “Modern Power Electronics & AC Drives”, Pearson Education.
3. Austin Hughes, “Electric Motor & Drives”, Newnes.
4. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.
5. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 701.1	1	-	-	-	-	-	-	-	-	-	-	-
EE 701.2	1	3	2	-	1	-	-	-	1	-	-	1
EE 701.3	1	3	2	-	1	-	-	-	1	-	-	1

Paper Name: Utilization of Electric Power
Paper Code: EE 702A
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Basic Electrical Engineering and Electrical Machines.

Course Objective:

1. To understand basic areas of utilization of electrical energy e.g. illumination, electrolysis etc.
2. To study various methods of electric heating.
3. To understand electric traction.

Course Outcome:

EE 702A.1. Ability to formulate and then analyze the working of traction motor & their control using mathematical model under loaded and unloaded conditions.
EE 702A.2. Ability to understand and explain the principle of operation and performance of traction motor.
EE 702A.3. Skill to analyze the response of d.c. motor, induction motor and transformer.
EE 702A.4. Ability to troubleshoot the operation of d.c. motor, induction motor and transformer.
EE 702A.5. Ability to analyze the working of Electric Heating, welding processes.
EE 702A.6. Ability to calculate illumination level for a given application and then select the suitable specification for installation.

Course Content

Module – 1: Electric Traction **16L**

Requirement of an ideal traction system, Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion).

Electric traction motor & their control:

Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction.

Traction motor control:

DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.

Module – 2: Illumination **8L**

The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement).

Types of Lamps:

Conventional and energy efficient, Basic principle of light control, Different lighting scheme & their design methods, Flood and Street lighting.

Module – 3: Electric Heating and Welding **6L**

Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwave heating.

Module – 4: Electrolytic Processes **6L**

Basic principles, Faraday's law of Electrolysis, Electro deposition, Extraction and refining of Metals, Power supply of Electrolytic processes.

Reference Books:

1. Generation Distribution and Utilization of Electrical Energy, C.L. Wadhawa, New Age International Publishers.
2. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & Sons.
3. Utilisation of Electric Energy, E.Openahaw Taylor, Orient Longman.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 702A.1	3	-	-	-	-	-	-	-	-	-	-	-
EE 702A.2	3	2	1	-	-	-	-	-	-	-	-	-
EE 702A.3	-	-	2	3	-	-	-	-	-	-	-	-
EE 702A.4	-	-	2	-	-	-	-	-	-	-	-	-
EE 702A.5	-	-	3	3	-	-	-	-	-	-	-	-
EE 702A.6	-	-	2	3	-	-	-	-	-	-	-	-

Paper Name: Advanced Power Electronics
Paper Code: EE 702B
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Knowledge in Power Electronics.

Course Objective: After successful completion of this course, the students will be able to understand the concept of different converters, multilevel inverters and compensators.

Course Outcome:

EE 702B.1. Describe the basic concepts of resonant converters, matrix converter and multilevel inverter.

EE 702B.2. Describe the basic concepts of matrix converter and multilevel inverter.

EE 702B.3. Apply the knowledge of contemporary technical issues in Power electronics field and Compensators currently used in modern industries.

Course Content

Module – 1: Advanced Switch Mode Power Converters 11L

Cuk dc-dc converter, Full bridge dc-dc converter, Half-bridge converter, Forward converter, Flyback converter, Push-pull converter, voltage & current mode control of DC-DC converter, SEPIC converter, different protection schemes.

Module – 2: Resonant Converters 9L

Introduction, classification of resonant converters, series and parallel resonant inverters, load resonant converters, resonant switch converters, zero voltage and zero current switching resonant converters.

Module – 3: Multilevel Inverters 7L

Concept, types of multilevel inverters, diode-clamped, flying-capacitor, and cascaded multilevel inverters, SPWM techniques of multilevel inverter, applications, comparison.

Module – 4: FACTS 3L

Principles of shunt and series compensation.

Module – 5: Compensators 6L

TCR, TCS, SVC, TSSC, TCSC, UFC, comparison, Matrix converters: Basic principles and analysis, applications.

Text / Reference Books:

1. M. H. Rashid, “Power Electronics: Circuits, Device and Applications”, 2nd Ed. 1993, Prentice-Hall, Inc.
2. N. Mohan, T. M. Undeland, and W. P. Robbins, “Power Electronics: Converters, Application and Design”, 3rd. Ed., John Wiley, 2003
3. M. Trzynadlowski, “Introduction to Modern Power Electronics” John Wiley, 1998.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 702B.1	3	2	-	-	-	-	-	-	-	-	-	-
EE 702B.2	-	-	1	2	-	-	-	-	-	-	-	-
EE 702B.3	-	-	-	3	-	2	1	-	-	-	-	-

Paper Name: Illumination Engineering
Paper Code: EE 702C
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concept of Physics, Basic Electrical Engineering.

Course Objective:

1. To provide an introduction to the fundamentals of illumination engineering and architectural lighting design.
2. To impart lighting fundamentals, measurement, and technology and their application in the analysis and design of architectural lighting systems.

Course Outcome:

EE 702C.1. Understand the need for good illumination and learning the physics behind various luminous sources, other terms & units.

EE 702C.2. Apply the Laws of Illumination; understand the measurement of light by using photometry.

EE 702C.3. Analyze the working principles of various Electric light sources and their operating characteristics.

EE 702C.4. Able to design and Lighting Calculations, Design of Energy efficient lighting systems for energy conservation & maintenance of lighting system.

Course Content

Module – 1: Fundamentals of light, sight and colour [6L]

Sources of light: Day light, artificial light sources, energy radiation, visible spectrum of Radiation, optical system of human eye, eye as visual processor. Reflection, refraction and other behaviour of light. Black body radiation and full radiator, Incandescence, dependence of light o/p on temperature, Perception of light and colour, Colorimetry – Visual basis, Source colour, Object colour, Colorimetric instrument – Colorimetry of light source and materials, Colour rendering index.

Module – 2: Measurement of light [6L]

Photometry – Basic concept, Fundamentals of detector, radiometric and photometric quantities, units of measurement, Measurement of light distribution, direct and diffused reflection, refraction, diffusion, polarization and optical design, photometric measurements, application data and its use.

Module – 3: Lamp, accessories & luminaries [12L]

Lamp materials – glass, filament, phosphor coating, ceramics, electrodes, gases, capping cement etc. Theory & basic properties of GLS filament, tungsten halogen lamps, fluorescent lamps, compact fluorescent lamp (CFL), low and high pressure sodium lamps, high pressure mercury lamp, metal halide lamp, Optical fibre – its construction as light guide, characteristics.
Functions of luminaries, classification, design consideration.

Module – 4: Interior lighting and Outdoor lighting [10L]

Interior lighting:

Lighting calculations of interior lighting, Design considerations for interior lighting of – houses, offices, conference rooms, hospitals, teaching places etc., design calculations. Concept of isolux in lighting design, Application of daylight in interior lighting.

Outdoor lighting:

(a) Calculation of lighting & design considerations for exterior lighting of - Road lighting.
(b) Flood lighting – Industrial complex, Commercial complex, Sports complex.

Software design on road lighting and flood lighting.

Module – 5: Lighting control [6L]

Purpose of lighting control – Energy conservation Electromagnetic & Electronic ballast – Operation & Ignitor – its function in lamps, photocell & occupancy sensor in lighting control. Fundamentals of lighting survey and audit. Techniques of achieving energy efficient lighting design, role of computers in lighting design, advantages and limitations of computer aided lighting design.

Text Books:

1. Generation, Distribution and Utilization of Electrical Energy, C.L. Wadha, New Age International Ltd.
2. Applied Illumination Engineering, Jack L. Lindsey, The Fairmont Press Inc.
3. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & Sons.
4. Standard Hand Book for Electrical Engineers, Fink & Beaty, McGraw Hill International.

Reference Books:

1. Utilization of Electric Power, C.L. Wadha, New Age International Ltd.
2. Handbook of Applied Photometry, Casimer M Decusatis, Springer.
3. Light Engineering: Applied calculations, R.H. Simons, Robert Bean, Architectural Press.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 702C.1	-	-	-	-	-	-	-	-	-	-	-	-
EE 702C.2	3	-	-	-	-	-	-	-	-	-	-	-
EE 702C.3	-	3	3	-	3	-	-	-	-	-	-	-
EE 702C.4	-	-	-	-	-	-	-	-	-	-	-	-

Paper Name: Advanced Power Systems
Paper Code: EE 703A
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Electrical Machines – II (EE 501), Power Systems – I (EE 502), Power Systems – II (EE 602), Control Systems – I (EE 503), Control Systems – II (EE 603).

Course Objective: The purpose of this course is to provide advance industry oriented knowledge of Power System.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 703A.1. Acquire in-depth advance knowledge in the domain of modern and industrial oriental power systems.

EE 703A.2. Ability to critically analyze various power systems components, models and their operation, optimization of cost criteria.

EE 703A.3. Ability to apply fundamentals and concepts to analyze, formulate and solve complex problems of electrical power systems and its components and control of frequency and voltages.

EE 703A.4. Ability to use advanced techniques, skills and modern scientific and engineering tools for professional practice for power system to enhanced power quality, Stability, reliability, security and load ability.

Course Content

Module – 1: Objectives of Power System Operation [6L]
Power Systems in Restructured Environment; Distributed and Dispersed Generation; Environment Aspects of Electric Power Generation.

Module – 2: Economic Operation of Energy Generation Systems
Generation Cost Curves; Economic Operation of Thermal System; Plant Scheduling; Transmission Loss and Penalty Factor; Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment.

Module – 3: Automatic Generation Control [8L]
Concept of AVR and ALFC Loops, Significance of Double Loop in ALFC; Exciter and VAR Control; Single Area Load Frequency Control; Two Area Load Frequency Control; Frequency Response.

Module – 4: Compensation in Power System [8L]
Reactive Power Sensitivity and Voltage Control; Load Compensation with Capacitor Banks; Line Compensation withReactors; Shunt and Series Compensation; Fixed Series Capacitors; Thyristor Controlled Series Capacitors(TCSC); Introduction to SVC and STATCOM, UPFC.

Module – 5: Power System Transients [8L]
Types of System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Protection against Lightning and Surges.

Text Books:

1. Power System Engineering, Kothari & Nagrath, Mc Graw Hill
2. Power System Analysis, Granger and Stevension, Mc Graw Hill
3. Electric Power Genration operation and control, Wood and Woolenberg, Willey.

Reference Books:

1. Power system stability and Control, P. Kundur, Mc Graw Hill
2. Modern power system analysis, Kothari & Nagrath, Mc.Graw Hill
3. Power system Analysis, Nagsarkar & Sukhija, Pearson
4. Power system analysis, operation and control, Chakrabarti and Halder, PHI
5. Power system analysis -Book of Elgard.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 703A.1	3	1	-	-	-	-	2	-	2	-	2	1
EE 703A.2	3	3	2	-	2	-	-	1	1	-	1	1
EE 703A.3	3	2	3	2	-	-	-	-	2	-	-	1
EE 703A.4	3	2	3	3	-	-	-	-	2	-	1	1

Paper Name: Power Generation and Economics
Paper Code: EE 703B
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concepts of Basic Electrical Engineering, Circuit Theory and Electrical Machine.

Course Objective:

1. To introduce students to different aspects of power generation.
2. To understand the electrical power plant operation and control with respect to its economic aspect.
3. To familiarize the students to the working of power plants based on different fuels.
4. To expose the students to the principles of safety and environmental issues.
5. To inculcate research attitude and lifelong learning among graduates.

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

EE 703B.1. Describe and analyze different types of sources and mathematical expressions related to with power generation and economics.

EE 703B.2. Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.

EE 703B.3. Discuss the working principle and basic components of the steam power plants, hydroelectric plants, nuclear power plant and the economic principles and safety precautions involved with it.

EE 703B.4. Discuss and analyze the mathematical and working principles of different electrical equipments involved in the generation of power.

EE 703B.5. Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed & analyze various power systems components, models and their operation, optimization of cost criteria

EE 703B.6. Use advanced techniques, skills and modern scientific and engineering tools for professional practice for power system to enhanced power quality, reliability, security and load ability.

Course Content

Module – 1: Economics of Generation [7L]

Introduction: Energy sources and their availability, Principle types of power plants, their special features and applications, Present status and future trends.

Cost of power generation- Thermal, Hydro and Nuclear. Types of Consumers in a distribution system - Domestic, Commercial, Industrial etc. Concept of load factor, plant capacity factor, plant use factor, diversity factor, demand factor. Choice of size and number of generation units.

Module – 2: Tariff [8L]

Block rate, flat rate, two part, maximum demand, Power factor and three part tariffs. Subsidization and Cross subsidization. Availability tariff of generation companies. Pool tariff of transmission companies. Availability based tariff (ABT).

Module – 3: Unit Commitment [7L]

Constraints in Unit Commitment, Spinning reserve, Thermal unit constraints, Hydro constraints, Must run, Fuel constraints. Unit commitment solution methods.

Module – 4: Economic Dispatch [10L]
Transmission loss formulae and its application in economic load scheduling. Computational methods in economic load scheduling. Active and reactive power optimization.

Module – 5: State Estimation and Load Forecasting in Power System [8L]
Introduction, state estimation methods, concept of load forecasting, load forecasting technique and application in power system.

Text Books:

1. Economic operation of Power System, L.K. Kirchmayar John Wiely, Newyork.
2. Power system Analysis, operation & control, Chakrabarty & Haldar, 2nd edition, PHI.
3. Modern power system analysis, D.P. Kothari & I.J. Nagtrath, Tata McGraw Hill.

Reference Books:

1. Power generation operation & control, A.J. Wood & B.F. Wollenberg, Wiley India.
2. Operation and control in power system, P.S.R. Murthy, BSP Publication.
3. A Course in Power Systems J.B. Gupta Katson

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 703B.1	2	2	2	3	3	1	1	-	-	2	-	1
EE 703B.2	3	3	3	3	2	-	-	-	-	1	2	2
EE 703B.3	3	2	1	2	-	1	-	1	1	2	1	1
EE 703B.4	3	1	3	1	2	-	1	-	-	1	1	1
EE 703B.5	3	1	3	2	-	-	2	2	1	1	1	2
EE 703B.6	3	3	2	2	-	-	2	1	-	1	1	1

Paper Name: High Voltage Engineering
Paper Code: EE 703C
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Concept of Basic Physics, Measurement and Instrumentation, Fundamentals of Power System, Switchgear, Travelling waves.

Course Objective: To introduce the concepts of breakdown in gases, solids, generation and measurement of high voltage and their tests.

Course Outcomes: On completion of the course students will be able to

- **EE 703C.1.** Understand the basic physics associated with various breakdown processes in different insulating materials.
- **EE 703C.2.** Knowledge of generation and measurement of A. C., D.C.,Impulse voltages and currents
- **EE 703C.3.** Knowledge of tests on H.V. equipment and on insulating materials, as per the standards.
- **EE 703C.4.** Knowledge of the causes of Overvoltages in power system and Insulation Coordination in a substation

Course Content

MODULE – I: Breakdown Occurrences 13L

i) Breakdown of Gases:

Ionization processes and de-ionization processes, Types of Discharge, Charge multiplication, Secondary emission, Townsend's Theory, Streamer Mechanism, Paschen's Law, Gases as insulating materials, Determination of Minimum breakdown voltage, Breakdown in uniform and non-uniform gaps, Corona discharge.

ii) Breakdown of Liquid:

Breakdown in pure and commercial liquids, Cavitation Theory, Suspended Particle Theory.

iii) Break Down of Solids:

Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Streamer Breakdown.

iv) Partial Discharge:

Definition and development in solid dielectrics and composite dielectrics.

v) Breakdown in Vacuum:

Non-metallic electron emission mechanism, Clump mechanism, Effect of pressure on breakdown voltage.

MODULE – II: Generation of High Voltages and Currents 7L

i) Generation of High Alternating Voltages and Currents:

Testing transformer, Cascaded transformer, Series resonant circuit, single stage and multi stage. Advantages of Series Resonant Circuit in testing of cables.

ii) Generation of High D.C. Voltages and Currents.:

Cockcroft Walton doubler and multistage circuit, Electrostatic generator.

Definition of Impulse Voltage and current as per Indian Standard Specification, Wave front and wave tail time, Generation of Impulse Voltage, Multistage Impulse generator, tripping and control of impulse generators.

MODULE – III: Measurement of High Voltages and Currents 5L

Peak voltage, impulse voltage and high direct current measurement method as per Indian Standard Specifications, cathode ray oscillographs for impulse voltage and current measurement, Sphere gap voltmeter, Resistance and Capacitance Potential dividers, Peak voltmeters for measurement of high A.C. voltage in conjunction with capacitance dividers. Capacitance Voltage Transformer, Rotating Voltmeter for the measurement of D.C. high voltage, partial discharge measurements, Electrostatic Voltmeter.

MODULE – IV: Lightning and Switching Over-voltages 9L

Lightning Phenomena, Charge formation in the Clouds, Development of Lightning Stroke, lightning induced over voltage, direct stroke, indirect stroke. Protection of Electrical Apparatus against over voltage, Lightning Arrestors, Valve Type, Metal Oxide arresters, Expulsion type. Effect of location of lightning arresters on protection of transformer. Protection of substation, Ground wires, Surge diverters, Surge absorbers, Insulation Coordination, Basic Insulation level. Basic Impulse level, Switching Impulse level. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment.

MODULE – V: High Voltage Testing of Electrical Apparatus and High Voltage Laboratories 5L

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, induced over voltage and impulse test on transformers, Power frequency dry and wet withstand test of insulators, Impulse test on insulators, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H.V. Laboratories.

Text Books:

1. High Voltage Engineering, C.L. Wadhwa, New Age International Publishers.
2. High Voltage Engineering, M.S. Naidu & V. Kamaraju, Tata McGraw Hill publication.
3. Extra High Voltage AC Transmission Engineering, R.D. Bgamudre, New Age Internal Publishers.
4. D. V. Razevig (Translated by Dr. M. P. Chourasia), "High Voltage Engineering Fundamentals", Khanna Publishers.

Reference Books:

1. High Voltage Engineering, M.A. Salem, H. Anis, A. E. Morahedy, R. Radwan, Marcel Dekker, Inc.
2. E. Kuffel, W. S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication.
3. R. Arora and W. Mosch "High Voltage and Electrical Insulation Engineering", John Wiley & Sons.
4. Various IS standards for HV Laboratory Techniques and Testing.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 703C.1	3	3	1	-	-	-	-	-	-	-	2	3
EE 703C.2	3	3	1	-	-	-	-	-	-	-	2	3
EE 703C.3	3	2	2	-	-	-	-	-	-	-	2	3
EE 703C.4	3	3	2	-	-	-	-	-	-	-	2	3

Paper Name: Advanced Electrical Measurement and Instrumentation
Paper Code: EE 703D
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Electrical and Electronics Measurement.

Course Objective:
1. To provide the knowledge of advanced measurement and calibration instruments.
2. To become acquainted with microprocessor based measuring instruments.

Course Outcome:
EE 703D.1. Demonstrate the Advanced Electrical measuring system.
EE 703D.2. Apply different intelligent measuring instruments.

Course Content

Module 1: Measurement Standards **4L**
Voltage, current, resistance, capacitance, inductance, time and frequency.

Module 2: Advanced measurement and Calibration equipments **15L**
inductive voltage dividers, AC and DC comparators, programmable synthetic signal sources and power supplies, Quad bridge, automatic AC bridges, phase sensitive detectors, lock-in-amplifiers, digital phase and frequency measurements. Digital Phase Locked Loop and its application.

Module 3: Intelligent Measuring Instruments and Systems **12L**
Microprocessor based instruments, PC based instruments and instrumentation systems and instrument networking.

Module 4: Automated Test and Calibration Systems **9L**
GPIB based systems, machine computation of errors and uncertainties in measurement. Virtual Instrumentation system.

Text Books:
1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

Reference Books:
1. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
2. Instrument transducers, H.K.P. Neubert, Oxford University press.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 703D.1	3	2	2	-	-	-	-	-	-	-	1	2
EE 703D.2	3	2	1	-	-	-	-	-	-	-	-	3

Paper Name: Artificial Intelligence and Soft Computing
Paper Code: CS(EE) 705A
Contact: 3L:0T:0P
Credit: 3

Prerequisites:
1. Basics of Design and Analysis of Algorithm
2. A solid background in mathematics, including probability.

Course Objective: Apply knowledge of computing and mathematics appropriate to the discipline. Analyze a problem, and identify and define the computing requirements appropriate to its solution. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs Understand current techniques, skills, and tools necessary for computing practice.

Course Outcomes: After completion of this course student will be able to

CS(EE) 705A.1. Understand various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction).

CS(EE) 705A.2. Apply facts, rules, and concepts of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving.

CS(EE) 705A.3. Analyze working knowledge of reasoning in the presence of incomplete and/or uncertain information.

CS(EE) 705A.4. Evaluate and create knowledge representation, reasoning, and machine learning techniques for the solution of real-world problems.

Course Content

Module – 1: Introduction to Artificial Intelligence and Agent [3L]
Foundations and History of Artificial Intelligence, Turing Test, Intelligent Agents – Agents and environment. Concept of Rationality, Nature of environments and Structure of agents.

Module – 2: Searching and Problem Solving [12L]
Problem solving agents - Problem formulation with suitable examples, searching for solutions, 8 puzzle problem, tower of Hanoi problem, water jugs problem, 8-queen problem, Data driven and goal driven search, Uninformed search strategies – Breadth-first search, Uniform-cost search, depth-first search, Depth-limited search, Uninformed search strategies Iterative deepening depth-first search, Bidirectional search, avoiding repeated states, Informed search strategies – Greedy best first search, A* search, Informed search strategies Memory-bounded heuristic search, Heuristic Functions, Constraint satisfaction problems.

Module – 3: Game Playing [3L]
Adversarial search, Mini-max, alpha-beta pruning.

Module – 4: Knowledge Representation and Reasoning [10L]
Building a Knowledge Base, Propositional logic, first order, script and frame, Logic, situation calculus. Theorem Proving in First Order Logic. Planning, partial order planning, Hierarchical Task network planning, Planning and acting in nondeterministic domains. Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks, Inference using full joint distribution, Independence,

Bayes' rule and its use, Semantics of Bayesian Networks, Exact Inference in Bayesian networks, Dempster-Shafer-theory.

Module – 5: Learning **[5L]**

Learning from observation – Forms of learning, Inductive learning, Learning Decision trees, Knowledge in learning - Explanation based learning, Learning Decision Trees, Neural Networks Clustering concept, Reinforcement Learning – Introduction, Passive reinforcement Learning, Active Reinforcement Learning.

Module – 6: Introduction to Soft Computing **[4L]**

Introduction to Fuzzy Set, Fuzzy Logic and Fuzzy Controller. Introduction to Artificial Neural Network, Perceptron and types of ANN. Application of Fuzzy logic and ANN.

Text Books:

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

Reference Book:

1. Prolog Programming for Artificial Intelligence Paperback by Ivan Bratko
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 705A.1	-	2	3	3	-	-	-	-	-	-	-	-
CS(EE) 705A.2	2	-	3	3	-	-	-	-	-	-	-	-
CS(EE) 705A.3	2	3	1	3	-	-	-	-	-	-	-	-
CS(EE) 705A.4	2	3	1	3	-	1	1	2	-	-	-	-

Paper Name: Digital Image Processing
Paper Code: CS(EE) 705B
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Digital Signal Processing. Familiarity with linear algebra and probability theory is desirable.

Course Objective:

1. To become familiar with digital image fundamentals
2. To learn Transform of Digital Images and its applications.
3. To get familiar with simple image enhancement techniques in both spatial and frequency domain.
4. To become familiar with image compression and recognition methods
5. To learn concepts of image restoration techniques and image segmentation and representation techniques.
6. To study the Edge detection in Digital Image Processing.
7. To become familiar with basics of Security in Digital Image Processing

Course Outcome:

CS(EE) 705B.1. Have a clear idea on Digital Imaging fundamentals and Importance of Digital Image Transform.

CS(EE) 705B.2. Understanding the importance of Digital Image enhancement in spatial and frequency domain and filtering techniques.

CS(EE) 705B.3. Explaining the requirements and types of Image Compression and its standards.

CS(EE) 705B.4. Demonstrate the basic concepts of Digital Image Restoration and Segmentation of Digital Images.

CS(EE) 705B.5. Familiarize with Edge detection techniques and concepts on security in Digital Image Processing.

Course Content

Module 1: Digital Imaging Fundamentals

Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing.

Transform of Digital Images: Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area.

Module 2: Digital Image Enhancement

Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bit plane slicing, Histogram, Histogram Equalization , Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF.

Module 3: Digital Image Compression

Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression

Module 4: Digital Image Restoration

Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering.

Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm.

Module 5: Edge detection in Digital Image Processing

Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator.

Security in Digital Image Processing: Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography.

Text Book:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
2. S. Annadurai, R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education, 2006.

Reference Book:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 705B.1	3	-	2	1	-	-	-	-	-	-	-	3
CS(EE) 705B.2	3	-	2	-	-	-	-	-	-	-	-	2
CS(EE) 705B.3	3	3	3	-	1	-	-	-	-	-	-	2
CS(EE) 705B.4	3	3	1	-	2	-	-	-	-	-	-	2
CS(EE) 705B.5	3	3	1	-	1	-	-	-	-	-	-	3

Paper Name: Computer Networking
Paper Code: CS(EE) 705C
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Familiarity and knowledge of Operating Systems and Computer Architecture Also require little bit programming languages concepts like C, Java.

Course Objective:

1. To educate basic knowledge of networking technologies and network management concepts
2. To interpret the layering concepts in computer networks.
3. To analyze the functions of each layer and gain knowledge in different applications that use computer networks.
4. To emphasize the hand-on experience of network topology in a laboratory environment
5. To be familiar with contemporary issues in networking technologies.

Course Outcome:

CS(EE) 705C.1. Understand OSI and TCP/IP models.
CS(EE) 705C.2. Analyze MAC layer protocols and LAN technologies.
CS(EE) 705C.3. Design applications using internet protocols.
CS(EE) 705C.4. Implement routing and congestion control algorithms.
CS(EE) 705C.5. Develop application layer protocols and understand socket programming

Course Content

Module – I: Introduction [6L]

Introduction:

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network. 3L

Physical Layer:

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network. 3L

Module – II: Data Link Layer [10L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. 5L

Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching. 5L

Module – III: Network Layer [10L]

IP Addressing, IPv4 and IPv6. Difference IPv4 and IPv6, Conversion of IPv4 and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network. 5L

Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, RIP, OSPF, BGP; Routing for Mobile Hosts. 5L

Module – IV: Transport Layer [6L]
Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. 5L
Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. 1L

Module – V: Application Layer [4L]
Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Module – VI: Socket Programming [2L]
Introduction to Socket Programming, UDP socket and TCP Socket

Text Books:
1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.)" – TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

Recommended Books:
1. Kurose and Rose – "Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH Walrand – "Communication Networks" – TMH.
3. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 705C.1	-	2	-	2	-	-	-	-	2	-	-	-
CS(EE) 705C.2	-	2	-	-	-	-	-	-	2	-	-	-
CS(EE) 705C.3	2	2	-	-	2	-	-	-	2	-	-	-
CS(EE) 705C.4	2	2	-	-	2	2	-	-	2	-	-	-
CS(EE) 705C.5	3	3	-	-	3	-	-	-	2	-	-	-

Paper Name: Data Base Management System
Paper Code: CS(EE) 705D
Contact: 3L:0T:0P
Credit: 3

Prerequisites:
1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objective:
1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcome: On completion of the course students will be able to

CS(EE) 705D.1. Apply the knowledge of Entity Relationship (E-R) diagram for an application.
CS(EE) 705D.2. Create a normalized relational database model
CS(EE) 705D.3. Analyze real world queries to generate reports from it.
CS(EE) 705D.4. Determine whether the transaction satisfies the ACID properties.
CS(EE) 705D.5. Create and maintain the database of an organization.

Course Content

Module – 1: Introduction [3L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module – 2: Entity-Relationship and Relational Database Model [11L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module – 3: SQL and Integrity Constraints [6L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module – 4: Relational Database Design [8L]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module – 5: Internals of RDBMS [9L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module – 6: File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System, McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing: Concepts and Techniques", Moragan Kauffman Publishers.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference Books:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 705D.1	2	2	2	2	3	2	1	1	2	2	3	3
CS(EE) 705D.2	2	3	3	3	3	1	1	1	2	2	3	3
CS(EE) 705D.3	3	3	2	3	3	2	2	2	3	3	3	3
CS(EE) 705D.4	3	3	2	2	2	1	1	1	1	1	2	3
CS(EE) 705D.5	3	3	3	3	3	2	2	2	3	3	3	3

Paper Name: Electric Drives Laboratory
Paper Code: EE 791
Contact: 0L:0T:3P
Credit: 2

Prerequisites: Concept of Electrical Machines and Power Electronics.

Course Objective:

1. Provide knowledge to operate electrical machines for a specific drive.
2. Study the speed control techniques of electrical machines for particular drive requirement.

Course Outcome:

EE 791.1. Student will be able to apply power electronic converters for motor speed control.
EE 791.2. Student will be able to analyze the characteristics of electric motors for different type of loads.

Course Content

List of Experiments:

1. Study of thysistor controlled DC Drive.
2. Study of Chopper fed DC Drive.
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using MATLAB / PSPICE / PSIM Software.
5. VSI fed Induction motor Drive analysis using MATLAB / PSPICE / PSIM Software.
6. CSI fed Induction motor Drive analysis using MATLAB / PSPICE / PSIM Software.
7. Study of V/f control operation of 3 phase induction motor drive.
8. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
9. Regenerative / Dynamic braking operation for DC Motor – Study using software.
10. Regenerative / Dynamic braking operation of AC motor – study using software.
11. PC/PLC based AC/DC motor control operation.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 791.1	-	1	-	3	3	2	-	-	-	-	-	1
EE 791.2	-	1	-	3	3	2	-	-	-	-	-	1

Paper Name: Artificial Intelligence and Soft Computing Laboratory
Paper Code: CS(EE) 795A
Contact: 0L:0T:2P
Credit: 1

Prerequisites:
1. Basics of Design and Analysis of Algorithm
2. A solid background in mathematics, including probability.

Course Objective: Apply knowledge of computing and mathematics appropriate to the discipline. Analyze a problem, and identify and define the computing requirements appropriate to its solution. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs Understand current techniques, skills, and tools necessary for computing practice.

Course Outcome: After completion of this course student will be able to

CS(EE) 795A.1. Understand and recognize various AI search algorithms and AI tools.

CS(EE) 795A.2. Apply the fundamentals of knowledge representation, inference and theorem proving using AI tools.

CS(EE) 795A.3. Analyze working knowledge of reasoning in the presence of incomplete and/or uncertain information.

CS(EE) 795A.4. Evaluate and create knowledge representation, reasoning, and machine learning techniques for the solutions of real-world problems.

Course Content

List of Programs:

A. Write the following programs using PROLOG
   1. Study of PROLOG facts and rules.
   2. Write a program to compute factorial of a number.
   3. Write a program to compute GCD of two numbers.
   4. Write a program to represent facts and rules.
   5. Write a program to represent a family tree.
   6. Write a program to diagnosis intelligently.
   7. Write a program to check whether a given line segment is vertical or horizontal?
   8. Write a program for list processing.

B. Write the following programs using PROLOG
   1. Write a program to solve 8 queens problem
   2. Solve any problem using depth first search.
   3. Solve any problem using best first search.
   4. Solve 8-puzzle problem using best first search
   5. Solve Robot (traversal) problem using means End Analysis
   6. Solve traveling salesman problem.

C. Write some programs on recent trend in AI (It may be recent real world problems)
   Jupyter Notebook (iPython): Medical diagnosis. Design an Expert System. Basic Fuzzy logic and ANN program using Matlab

Projects assigned by instructor to model and solve real world problems.

Text Book:

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

Reference Book:

1. Prolog Programming for Artificial Intelligence Paperback by Ivan Bratko
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 795A.1	2	-	-	-	-	-	-	-	-	-	-	1
CS(EE) 795A.2	-	3	-	-	-	-	-	-	-	-	-	1
CS(EE) 795A.3	1	-	3	-	-	-	-	-	-	-	-	1
CS(EE) 795A.4	-	3	-	2	-	-	-	-	-	-	-	1

Paper Name: Digital Image Processing Laboratory
Paper Code: CS(EE) 795B
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Students are expected to have knowledge in linear signals and systems, 1-D Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable and working knowledge of Matlab.

Course Objective:

1. To prepare the students to have a basic knowledge with digital image fundamentals and Transformation of Digital Images.
2. To build knowledge on simple image enhancement techniques in both spatial and frequency domain.
3. To become familiar with image compression and recognition methods
4. To understand characteristics of image restoration and image segmentation techniques.
5. To build ideas on Edge detection in Digital Image Processing.
6. To provide Security in Digital Image using cryptography or watermarking technique

Course Outcome:

CS(EE) 795B.1. Build knowledge on Digital Imaging fundamentals and Digital Image Transform.
CS(EE) 795B.2. Understanding Digital Image enhancement techniques in spatial and frequency domain.
CS(EE) 795B.3. Explaining the requirements and types of Image Compression and its standards.
CS(EE) 795B.4. Demonstrate the Digital Image Restoration and Segmentation of Digital Images.
CS(EE) 795B.5. Build ideas on Edge detection techniques and concepts on Digital Image security.

Course Content

List of Experiments:

1. Convert RGB Digital Images into Grayscale Images and show result.
2. Transform a grayscale image into frequency domain and show its magnitude and phase angle.
3. Display histogram of a digital image and equalized the image.
4. Apply LPF and HPF in a Grayscale Digital Image and display result.
5. Apply Mean and Median filtering in a Grayscale Digital Image and display result.
6. Compress and reconstruct a Grayscale Digital Images in spatial domain.
7. Compress and reconstruct a Grayscale Digital Image in frequency domain.
8. Apply segmentation technique (any one) in a Digital Image and display result.
9. Apply Edge detection technique in a Digital Image and display result.
10. Apply any cryptography or watermarking technique for image encryption and display result.
11. Innovative experiment.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 795C.1	2	3	2	2	1	-	-	-	-	-	2	3
CS(EE) 795C.2	2	3	2	-	2	-	-	-	-	-	2	3
CS(EE) 795C.3	3	2	1	2	-	-	-	-	-	-	1	3
CS(EE) 795C.4	3	3	-	-	2	-	-	-	-	-	1	3
CS(EE) 795C.5	3	2	2	2	-	-	-	-	-	-	1	3

Paper Name: Computer Networking Laboratory
Paper Code: CS(EE) 795C
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Familiarity and knowledge of Computer Network and Computer Architecture. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Objective:

1. To provide students with an overview of the concepts and fundamentals of data communication and computer networks
2. To familiarize with the basic taxonomy and terminology of computer networking area.
3. To experience the designing and managing of communication protocols while getting a good exposure to the TCP/IP protocol suite

Course Outcome:

CS(EE) 795C.1. Demonstrate the socket program using TCP & UDP.
CS(EE) 795C.2. Develop simple applications using TCP & UDP.
CS(EE) 795C.3. Develop the code for Data link layer protocol simulation.
CS(EE) 795C.4. Examine the performances of Routing protocol.
CS(EE) 795C.5. Experiment with congestion control algorithm using network simulator

Course Content

1. Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. [6L]
2. Implementation of flow control mechanisms [3L]
3. Socket Programming using TCP and UDP [15L]
4. Implementing routing protocols such as RIP, OSPF. [2L]
5. Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS [4L]
6. Server Configuration: only web server (If time permit. instructor can do more than that) [6L]

Text Book:

1. TCP sockets in C programs - Practical guide for Programmers By Micheal J Donahoo and Kenneth L calvert.
2. Socket Programming by rajkumar Buyaa.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 795C.1	3	3	3	2	3	2	1	-	3	2	2	3
CS(EE) 795C.2	3	3	3	2	3	3	2	3	3	2	2	3
CS(EE) 795C.3	3	3	3	2	2	1	2	1	3	2	2	3
CS(EE) 795C.4	3	3	3	1	2	2	1	3	3	2	2	3
CS(EE) 795C.5	3	3	3	2	2	2	1	2	3	2	2	3

Paper Name: Data Base Management System Laboratory
Paper Code: CS(EE) 795D
Contact: 0L:0T:2P
Credit: 1

Prerequisites:
1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objective:
1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcome: On completion of the course students will be able to

CS(EE) 795D.1. Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CS(EE) 795D.2. Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CS(EE) 795D.3. Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CS(EE) 795D.4. Analyze database system concepts and apply normalization to the database.

CS(EE) 795D.5. Apply and create different transaction processing and concurrency control applications.

Course Content

- Structured Query Language
  1. Creating Database
     a) Creating a Database
     b) Creating a Table Specifying Relational Data Types
     c) Specifying Constraints Creating Indexes
  2. Table and Record Handling
     a) INSERT statement
     b) Using SELECT and INSERT together
     c) DELETE, UPDATE, TRUNCATE statements
     d) DROP, ALTER statements
  3. Retrieving Data from a Database
     a) The SELECT statement
     b) Using the WHERE clause
     c) Using Logical Operators in the WHERE clause

d) Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
e) Using Aggregate Functions
f) Combining Tables Using JOINS
g) Sub-queries

4. Database Management
   a) Creating Views
   b) Creating Column Aliases
   c) Creating Database Users
   d) Using GRANT and REVOKE

- PL/SQL
- Database design using E-R model and Normalization
- Design and implementation of some on line system [Library Management System]

Text Book:

1. SQL, PL/SQL by Ivan Bayross, BPB Publications
2. Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE) 795D.1	2	2	2	2	3	2	1	1	2	2	3	3
CS(EE) 795D.2	2	3	3	3	3	1	1	1	2	2	3	3
CS(EE) 795D.3	3	3	2	3	3	2	2	2	3	3	3	3
CS(EE) 795D.4	3	3	2	2	2	1	1	1	1	1	2	3
CS(EE) 795D.5	3	3	3	3	3	2	2	2	3	3	3	3

SYLLABUS

OF

B.TECH EIGHTH SEMESTER COURSES

Paper Name: Industrial and Financial Management
Paper Code: HU 805
Contact: 2L:0T:0P
Credit: 2

Prerequisites: Mathematics, English

Course Objective:

1. Introduce students to financial management and its importance and its applications in business, their relationship with the business environment and the role and functions of chief financial officer.
2. Introduce students to financial planning, and objectives, and its benefits, and the types of areas and stages of financial planning, and the factors that help the success of financial planning.
3. Introduce students to the methods used in financial planning to assess the short-term financial needs.
4. Introduce students to time value of money and its relationship to the objectives of financial management, rationale for using the time value of money, and simple and compound interest and how to calculate it, and also to understand the present value of the future payments.
5. Introduce students to major financial statements of businesses as well as the definition of the purposes and tools of financial analysis and its importance in the financial control process.
6. Introduce students to the basics of investing in securities through exposure to the following points: knowledge of financial markets, and their components, and functions of the financial market, and the parties worked in the financial markets, the stock traded in the money markets and capital markets, then find out the efficiency standards of the financial market, as well as valuations of Shares and bonds.
7. Giving students how to apply full financial cycle and makes the necessary adjustments on service and commercial installations.
8. Giving student's of Application processors to finance small projects.

Course Outcome: After completion of this course students will be able to

HU 805.1. Explain and describe various technology-based business models and the dynamics of value creation, value proposition, and value capture in industrial enterprises.
HU 805.2. Select, interpret and use different costing techniques as a basis for decisions in various business situations.
HU 805.3. Understand the basic principles of financial accounting and reporting.
HU 805.4. Produce and interpret an industrial company's Annual Statement, at a basic level.
HU 805.5. Describe the operations of an industrial enterprise from various perspectives, and analyze its basic strengths and weaknesses based on concepts from the field of Industrial Management.
HU 805.6. Explain how the industrial company markets and price it's products considering GST.

Course Content

Module – 1: Introduction to Accounting **[12L]**

Important Definitions, Basic concepts and conventions, Types of Accounts with Golden Rule of Accounting, Journal, Ledger and Trial Balance, Preparation of Trading Account, Profit & Loss A/C and Balance Sheet for business organizations.

Module – 2: Financial Management [13L]

Introduction to Financial Management:

Introduction, Definition and concept, scope, objective, functions of Finance Manager.

Ratio Analysis:

Definition, Objectives, Advantages & Disadvantages, Classification of Ratios: Liquidity ratios, Capital Structure ratios, Activity ratios & Profitability Ratios.

Capital Budgeting:

Nature of Investment Decision, Importance of Capital Budgeting, capital budgeting process, Investment criteria, payback period, Rate of return, cash flow, discounting cash flow NPV method and IRR method, Benefit cost ratio, ARR.

Module – 3: Cost Accounting and Budget [8L]

Cost Accounting:

Introduction to cost accounting-Cost Centre, Cost unit, Elements of costs, Statement of cost or cost sheet, Marginal cost & C-V-P analysis with BEC.

Budget and Budgetary Control:

Concepts of Budget, Budgeting and budgetary control, advantages, disadvantages, uses, Master Budget, Zero Based Budget ,Cash budget, Flexible budget.

Module – 4: Working capital management [6L]

Introduction-working capital concept-financing working capital-importance of working capital-management of working capital-working capital cycle- management of different components of working capital-working capital forecast.

Text Books:

1. Financial Management, Khan & Jain, S. Chand
2. Management Accounting, Khan & Jain, S. Chand
3. Modern Accountancy, Haniff& Mukherjee, TMH

Reference Books:

1. An Introduction to Accountancy, S.N.Maheswari, Vikas publication
2. Cost Accounting: Theory and Practices, B. Banerjee, PHI
3. Financial Management, IM Pandey, Vikas

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 805.1	-	1	1	2	-	2	-	-	-	-	-	-
HU 805.2	-	-	-	-	3	1	2	-	-	-	1	-
HU 805.3	3	-	-	-	-	2	-	-	-	-	3	-
HU 805.4	-	2	-	-	1	-	1	-	-	-	-	-
HU 805.5	-	3	-	2	-	-	-	-	-	-	-	-
HU 805.6	-	2	2	3	-	-	-	-	-	-	2	-

Paper Name: HVDC Transmission
Paper Code: EE 801A
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concept of Power System & Power Electronics.

Course Objective:

1. Ability to understand the concept of HVDC Transmission system.
2. Ability to familiarize the students with the HVDC converters and their control system.
3. Ability to expose the students to the harmonics and faults occur in the system and their prevention.
4. Ability to understand Multiterminal HVDC and FACTS Devices.

Course Outcome: On successful completion of the learning sessions of the course, the learner will be able to

EE 801A.1. Acquire knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.

EE 801A.2. Formulate and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links.

EE 801A.3. Analyze the different harmonics generated by the converters and their variation with the change in firing angles.

EE 801A.4. Study and understand the nature of faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same.

EE 801A.5. Understand the existing HVDC systems along with MTDC systems and modern transmission system.

Course Content

MODULE – I: Introduction [4L]
Introduction of DC power transmission technology, comparison of AC and DC transmission, limitation of HVDC transmission, reliability of HVDC systems, application of DC transmission, description of DC transmission system, planning for HVDC transmission, modern trends in DC transmission.

MODULE – II: Analysis of HDVC Converters [6L]
Choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, Characteristics of a twelve pulse converter, detailed analysis of converters.

MODULE – III: Control of HVDC Converter and Systems [8L]
Necessity of control of a DC link, rectifier control, compounding of rectifiers, power reversal of DC link, voltage dependent current order limit(VDCOL) characteristics of the converter, inverter extinction angle control, pulse phase control, starting and stopping of DC link, constant power control, control scheme of HVDC converters.

MODULE – IV: Harmonics and Filters [10L]

Generation of harmonics by converters, characteristics of harmonics on DC side, characteristics of current harmonics, characteristic variation of harmonic currents with variation of firing angle and overlap angle, effect of control mode on harmonics, non-characteristic harmonic. Harmonic model and equivalent circuit, use of filter, filter configuration, design of band-pass and high pass filter, protection of filters, DC filters, power line communication and RI noise, filters with voltage source converter HDVC schemes.

MODULE – V: Fault and Protection Schemes in HVDC Systems [4L]
Nature and types of faults, faults on AC side of the converter stations, converter faults, fault on DC side of the systems, protection against over currents and over voltages, protection of filter units.

MODULE – VI: Multiterminal HVDC Systems [8L]
Types of multiterminal (MTDC) systems, parallel operation aspect of MTDC Series and shunt devices and principle of operation and control, UPFC and IPFC, modeling of FACTS devices for power system studies.

Text Books:

1. HVDC Transmission, S. Kamakshaiah & V. Kamaraju, Tata McGraw hill education
2. HVDC Power transmission system, K.R.Padiyar, Wiley Eastern Limited
3. High Voltage Direct Current Transmission, J. Arrillaga, Peter Pregrinu Reference Books:
4. Power System Stability and Control by PrabhaKundur, McGraw hill
5. Power System Analysis: Operation and Control, AbhijitChakrabarti and SunitaHalder, PHI Learning Pvt. Ltd.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 801A.1	-	-	-	-	-	-	-	-	-	-	-	-
EE 801A.2	2	2	-	-	-	-	-	-	-	-	-	-
EE 801A.3	2	3	1	-	-	-	-	-	-	-	-	-
EE 801A.4	-	-	2	-	1	-	-	-	-	-	-	-
EE 801A.5	-	-	1	2	-	-	-	-	-	-	-	-

Paper Name: Energy Management and Audit
Paper Code: EE 801B
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Power Systems – I, Power Systems – II, Control Systems – I, Control Systems – II.

Course Objective:

1. Ability to Identify the energy management skills and strategies in the energy management system.
2. Ability to understand various energy conservation methods useful in a particular industry.
3. Ability to Select appropriate energy conservation method for the critical area identified.
4. Ability to prepare an energy audit report.

Course Outcome: On completion of the course students will be able to

EE 801B.1. Identify the demand supply gap of energy in Indian scenario
EE 801B.2. Carry out energy audit of an industry/Organization.
EE 801B.3. Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.
EE 801B.4. Select appropriate energy conservation method to reduce the wastage of energy.
EE 801B.5. Evaluate the techno economic feasibility of the energy conservation technique adopted.

Course Content

Module – 1: Energy Management & Audit (5L)
Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments and intervals of EA regulation. General Principles of Energy Management. Energy Management Skills, Energy Management Strategy. Economics of implementation of energy optimization projects, it's constraints, barriers and limitations, Financial Analysis: Simple Payback, IRR, NPV, Discounted Cashflow. Case studies of implemented energy cost optimization projects in electrical utilities as well as thermal utilities.

Module – 2: Energy Scenario (5L)
Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Concept of smart grid, Tariff.

Module – 3: Energy Conservation Act-2001 and Related Policies (5L)
Energy Conservation Act-2001 and its features, Notification Under the act, Designated agencies, Schemes of Bureau of Energy Efficiency (BEE) - ECBC, S & L, DSM, BLY, SME's, Designated Consumers, Electricity Act 2003, Integrated Energy Policy.

Module – 4: Energy Efficiency and Climate Changes (6L)

Energy and environment, Air pollution, Climate change, United Nations Framework Convention on climate change (UNFCCC), Kyoto Protocol, Clean Development Mechanism (CDM), CDM methodology and Procedures, Sustainable development.

Module – 5: Non-Conventional Energy Sources (5L)
Concept of renewable Energy and importance, Different types of renewable Energy, Solar energy, Wind energy, Biomass energy, Hydro-energy, Fuel cells, Energy from wastes, Wave, Tidal and geothermal. Concept of energy storing device.

Module – 6: Energy Efficient Technologies in Electrical Systems (6L)
Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology.

Module – 7: Electrical Distribution and Utilization (8L)
Electrical Systems, Transformers loss reductions, parallel operations, T & D losses, P.F. improvements, Demand Side management (DSM), Load Management, Harmonics & its improvements, Energy efficient motors and Soft starters, Automatic power factor Controllers, Variable speed drivers, Electronic Lighting ballasts for Lighting, LED Lighting, Trends and Approaches. Study of 4 to 6 cases of Electrical Energy audit and management (Power factor improvement, Electric motors, Fans and blowers, Cooling Towers, Industrial/Commercial Lighting system, etc.)

Text Books:

1. Leon K. Kirchmayer, “Economic Operation of power system”, Wiley India Pvt Ltd, July 2010.
2. Jean-Claude SabonnadiAre, “Low emission power generation technologies and energy management”, John Wiley & Sons, August 2010.
3. Ursula Eicker, “Low energy cooling for sustainable buildings”, John Wiley & Sons, August 2010
4. Timothy J. E. Miller, “Reactive power control in electric systems”, Wiley edition, August 2010
5. Paul C. Crause, Oleg Wasynczuk, Scott D.sudhoff, “Analysis of electric machinery and drive system”, Wiley 2nd Edition, August 2010.
6. Albert Thumann, P.W. “Plant Engineers and Managers Guide to Energy Conservation” TWI Press Inc, Terre Haute, 9th edition, 2008
7. Francois, Leveque, “Transport pricing of electricity networks”, Springer 2003.
8. Parasiliti F., P. Bertoldi, “Energy Efficiency in motor driven systems”, Springer, 2003.

Reference Books:

1. Turner, Wayne C., “Energy Management Handbook”, Lilburn, The Fairmont Press, 2001
2. Donald R. W., “Energy Efficiency Manual”, Energy Institute Press,2000
3. Giovanni Petrecca, “.Industrial Energy Management: Principles and Applications”, The Kluwer international series -207, 1999 Springer 2000.
4. Anthony J. Pansini, Kenneth D. Smalling, “Guide to Electric Load Management”, Pennwell Pub,1998
5. Albert Thumann , “Handbook of Energy Audits”, Fairmont Pr; 5th edition,1998
6. Howard E. Jordan, “Energy-Efficient Electric Motors and Their Applications”, Plenum Pub Corp; 2nd edition 1994
7. Petrecca, Giovanni, “Industrial Energy Management”, Springer 1993

8. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.,1985
9. NESCAP-Guide Book on Promotion of Sustainable Energy Consumption.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 801B.1	3	2	1	-	-	-	-	-	-	-	-	-
EE 801B.2	2	3	1	-	-	-	-	-	-	-	-	-
EE 801B.3	-	-	2	-	1	-	-	-	-	-	-	-
EE 801B.4	-	-	2	2	-	-	-	-	-	-	-	-
EE 801B.5	2	1	2	-	1	-	-	-	-	-	-	-

Paper Name: Power Plant Engineering
Paper Code: EE 801C
Contact: 3L:0T:0P
Credit: 3

Prerequisites: Concept of Energy Conversion.

Course Objective:

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
5. Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Discussing environmental and safety aspects of power plant operation.

Course Outcome:

EE 801C.1. Understand the principles of operation for different power plants.
EE 801C.2. Understand the economics of operation for different power plants.
EE 801C.3. Analyse the interconnection between different power plants.

Course Content

Module 1: Introduction **8L**

Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant.

Power Plant Economics and Selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

Module 2: Steam Power Plant **8L**

General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power.

Module 3: Diesel Power Plant **4L**

General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel

plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.

Module 4: Gas Turbine Power Plant 4L

Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant.

Module 5: Other Power Plants 9L

Nuclear Power Plant: Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants.

Hydro Electric Station: Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

Non-Conventional Power Plants: Introduction to non-conventional power plants (Solar, wind, geothermal, tidal) etc.

Module 6: Electrical System 7L

Generators and their cooling, transformers and their cooling. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation.

Numerical problems to be solved in the class.

Text Books:

1. Power Plant Engineering, P.K. Nag, Tata McGraw Hill.
2. Power Plant Engineering, F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras
3. Power Plant Technology El-Vakil, McGraw Hill.

Reference Books:

1. Steam and Gas Turbines & Power Plant Engineering by R. Yadav, Central Pub. House.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 801C.1	3	3	-	-	-	-	-	-	-	-	-	3
EE 801C.2	3	-	3	-	-	-	-	-	-	-	2	-
EE 801C.3	2	-	3	-	-	-	2	-	-	-	2	-

Paper Name: Sensors and Transducers
Paper Code: EE 802A
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Basic Electrical Engineering, Basic Electronics Engineering, Electrical and Electronics Measurement.

Course Objective:

1. To deal with various types of Sensors & Transducers and their working principle.
2. To deal with Resistive, Capacitive and Inductive transducers.
3. To deal with some temperature transducers.
4. To know the overview of miscellaneous sensors.

Course Outcome:

EE 802A.1. Students should be able to illustrate the fundamental principles of various types of sensors.
EE 802A.2. Students should be able to compare the different types of transducers available.
EE 802A.3. Students should be familiar with criteria to recommend appropriate sensors to perform engineering tasks and scientific researches.
EE 802A.4. Students will be able to understand the design of different Sensors.

Course Content

Module – I: Introduction to Sensors and Transducers 12L

Introduction to sensors and transducers, Measurement system, Principles of sensing & transduction, Classification of sensors.

Resistive Sensing Element:

Potentiometer: Loading effect, Strain gauge: theory, types, temperature compensation, and applications: force, velocity and torque measurements.

Inductive Sensing Element:

Self-inductive transducer, Mutual inductive transducers, Variable Reluctance type, Linear Variable Differential Transformer (LVDT): construction, Characteristic Curve, application: LVDT Accelerometer, LVDT displacement sensors

Module – II: Capacitive Sensing Element 12L

Capacitive transducer:

Variable Area Type, Variable distance type, Variable Permittivity type, calculation of sensitivities, applications.

Piezoelectric & Piezoresistive Sensing Element:

Piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, piezoelectric accelerometer, piezoresistive sensor.

Temperature Sensing Element:

Material expansion type - solid, liquid, gas and vapour Resistance change type: RTD, materials, construction, tip sensitive and stem sensitive type, Thermister materials, shapes, ranges, accuracy specifications. Thermocouple: types, thermoelectric powers, general consideration, Thermopile.

Module – III: Magnetic Sensors 8L

Sensors based on Villari effect for assessment of force, torque, rpm meters, Hall effect and Hall drive, performance characteristics

Miscellaneous Sensors:

Optical sensors: Light Dependent Resistor, Optocoupler, solar cell, Geiger counters, Scintillation detectors, Tachometers: Stroboscopes, Encoders, seismic accelerometer, Measurement of vibration, Proximity switches, Load cell, Introduction to Smart sensors and Sensor network.

Text Books:

1. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999.
2. John Brignell,"Intelligent Sensor Systems", CRC Press; 2nd Revised edition edition,1996

Reference Books:

1. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
2. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
3. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
4. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, 2007.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 802A.1	2	3	1	2	-	-	-	-	-	-	-	-
EE 802A.2	1	1	-	3	2	2	1	-	-	-	-	-
EE 802A.3	1	2	3	1	2	2	-	-	-	-	-	-
EE 802A.4	2	2	2	1	3	-	-	-	-	-	-	2

Paper Name: Process Control and Instrumentation
Paper Code: EE 802B
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Knowledge of Control Theory.

Course Objective:

1. To have a knowledge on basic process control loop & characteristics
2. To understand the different controllers mode
3. To know about methods of tuning of controllers
4. To have a knowledge of final control element & different actuators
5. To apply the knowledge of Cascade, Ratio, Feed forward control to control a complicated process.
6. To provide knowledge levels needed for PLC programming and operating.

Course Outcome: Upon successful completion of the course students will be able to

EE 802B.1. Design controller by applying the knowledge of different control action
EE 802B.2. Calculate controller parameters by applying different tuning methods
EE 802B.3. Describe different advanced control strategy
EE 802B.4. State the operation and use of final control element
EE 802B.5. Develop ladder diagram

Course Content

Module – I: **[10L]**
General Review of Process, Process Control and Automation. Servo and Regulatory Control, Basic process Control loop block diagram. Characteristic parameters of a process – Process Quantity, Process Potential, Process Resistance, Process Capacitance, Process Lag, Self-Regulation, Characteristics and functions of different modes of control actions : Schemes and analysis of On-Off, Multistep, Floating, Time Proportional, Proportional, Integral, Derivative, PI,PD & PID control, Electronic PID controller design Pneumatic Controllers - brief analysis

Module – II: **[5L]**
Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain bandwidth product, State Controllability, Tuning of Controllers: both Closed and Open loop methods (Ziegler – Nichols, Cohen – Coon, PRC method and 3-C method of parameter adjustment)

Module – III: **[10L]**
Different control strategies - schemes, brief analysis and uses (i) Ratio control (ii) Cascade control (iii) Feedforward control (iv) Multivariable control, Final Control Element: Actuators (Pneumatic Actuators, Electrical Actuators) and Control Valves (Globe, Ball, Butterfly, Gate, Pinch), Different Parts, Fail Position, Valve characteristics, Cv, Single & Double Seated Valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise Control Valve Accessories – Air Filter Regulator, I/P Converter, Brief study of Safety Valves and Solenoid valves

Module – IV: **[8L]**
Introduction to Programmable Logic Controllers – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; PLC

Programming and Applications, Introduction to DCS

Text Books:

1. D. Patranabis, Principles of Process Control, TMH , New Delhi, 2nd Ed.
2. D. P. Eckman, Automatic Process control, John Wiley, New York
3. Surekha Bhanot, Process Control Principal & Application , Oxford
4. B. W. Bequette, Process Control – Modeling, Design and Simulation, PHI
5. D. R. Coughanowr, Process Systems Analysis and Control, McGraw Hill
6. G. Stephanopoulos, Chemical process Control, PHI
7. C. D. Johnson, Process Control Instrumentation Technology, PHI
8. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia

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EE 802B.1	3	2	2	1	2	-	1	-	1	-	2	2
EE 802B.2	3	2	1	-	1	-	-	-	-	-	1	2
EE 802B.3	2	1	1	-	1	-	1	1	-	-	2	-
EE 802B.4	1	1	-	-	-	-	-	-	-	-	1	-
EE 802B.5	3	-	3	2	1	-	-	-	-	-	2	2

Paper Name: Electronic Instrumentation and Control
Paper Code: EE 802C
Contact: 3L:1T:0P
Credit: 4

Prerequisites: Knowledge of Measurement and Instrumentation, Control Systems.

Course Objective:
1. To provide knowledge on different instrumentations applicable to power plants.
2. To provide a foundation on the control of different power plant equipment.

Course Outcome: After successful completion of the course, student will be able to
EE 802C.1. Demonstrate thermal power plant and its instrumentations.
EE 802C.2. Apply the knowledge of control for different components of a power plant.

Course Content

Module 1: **8L**
Concepts of Power plants of different types: Setups, energy conversions and measurement requirements, examples of Thermal, Hydal, and Nuclear plants. Thermal power plant and system instrumentation.

Module 2: **12L**
Instrumentation for Turbines, Condensers, Generators, Coal handling, Water treatment, Feed water, combustion air and flue gases.

Module 3: **12L**
Control: Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feed water control, Data logger and computer control, supervisory control and monitoring system.
Instrumentation for safety interlocks: Protective gears, emergency measures, Alarm systems and Analysis etc. Pollution measurement, monitoring and control.

Module 4: **8L**
Data handling: Processing, logging, acquisition, accounting, display and storage.
Instrumentation for Generator and Busbar coupling.
Introduction to power plant modeling/simulation.

Text Books:
1. Principles of Industrial Instrumentation, D. Patranabis, TMH New Delhi

Reference Books:
1. Electric Power Engineering Handbook – Edited by L. L. Grigsby.
2. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 802C.1	3	3	1	-	2	-	-	-	-	-	1	2
EE 802C.2	3	3	1	2	2	-	-	-	-	-	1	2