

Department: Electrical Engineering

Curriculum Structure & Syllabus

(Effective from 2018-19 admission batch)

Under Autonomy (GR A: ECE, EE, EIE, BME; GR B: CSE, IT, ME, CE, FT)

1st Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	M 101	Mathematics - I	3	1	0	4	4
2	BS	CH 101 / PH 101	Chemistry (Gr. A) / Physics - I (Gr. B)	3	0	0	3	3
3	ES	EE 101 / EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							12	12
B. PRACTICAL								
5	BS	CH 191 / PH 191	Chemistry Laboratory (Gr. A) / Physics - I Laboratory (Gr. B)	0	0	3	3	1.5
6	ES	EE 191 / EC 191	Basic Electrical Engineering Laboratory (Gr. A) / Basic Electronics Engineering Laboratory (Gr. B)	0	0	3	3	1.5
7	ES	ME 191 / ME 192	Engineering Graphics & Design (Gr. A) / Workshop/Manufacturing Practices (Gr. B)	0	0	3	3	1.5
8	PROJ	PR 191	Project – IA	0	0	1	1	0.5
9	PROJ	PR 192	Project – IB	0	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 181	Induction Program	0	0	0	0	0
Total of Theory, Practical & Mandatory Activities / Courses							23	17.5

* Project – I on any one practical paper (0.5 credit)

Course Name: Mathematics-I

Course Code: M 101

Contact: 3:1:0

Total contact Hours: 48

Credit: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus.

Course Outcome:

- CO1.** Recall the distinctive characteristics of matrix algebra and calculus.
- CO2.** Understand the theoretical working of matrix algebra and calculus.
- CO3.** Apply the principles of matrix algebra and calculus to address problems in their disciplines.
- CO4.** Examine the nature of system using the concept of matrix algebra and calculus.

Course Content

Module I: Matrix Algebra (11)

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series (10)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) - I (9)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian.

Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl.

Module V: Integral Calculus (11)

Evolute and involute; Evaluation of definite integrals and its applications to evaluate surface areas and volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	-	-	-	-	-	-	-	-	1

Course Name: Chemistry
Course Code: CH 101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: A basic knowledge in 10+2 science with chemistry.

Course Outcome:

- CO1.** Able to describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table.
- CO2.** Able to apply fundamental concepts of thermodynamics in different engineering applications.
- CO3.** Able to apply the knowledge of water quality parameters, corrosion control & polymers to different industries.
- CO4.** Able to determine the structure of organic molecules using different spectroscopic techniques.
- CO5.** Capable to evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

Course Content

Module-I: Inorganic Chemistry 9

Atomic structure (5 Lectures)

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

Periodic properties (4 Lectures)

Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module-II: Physical Chemistry 8

Use of free energy in chemical equilibria (6 Lectures)

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

Real Gases (2 Lectures)

Reason for deviation of real gases from ideal behaviour, Equations of state of real gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

Module III: Organic Chemistry 8

Stereochemistry (4 Lectures)

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

Organic reactions**(4 Lectures)**

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction)

Module IV: Industrial Chemistry**8****Water****(2 Lectures)**

Hardness, alkalinity, numerical

Corrosion**(2 Lectures)**

Types of corrosion: wet & dry, preventive measures

Polymers**(3 Lectures)**

Classification of polymers, conducting polymers, biodegradable polymers

Synthesis of a commonly used drug molecule**(1 Lecture)**

Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry**3**

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ¹H Nuclear magnetic resonance spectroscopy, chemical shift.

Text Books

1. A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

Reference Books

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins
4. Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition
5. <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	2	2	-	-	-	-	1	2	2
CO2	3	3	3	2	1	-	2	1	-	1	-	3
CO3	3	3	3	3	3	1	1	1	-	1	-	2
CO4	2	3	3	3	3	-	-	-	-	1	1	2
CO5	3	3	3	3	1	1	1	-	1	-	2	3

Course Name: Basic Electrical Engineering

Course Code: EE 101

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Pre-requisite: Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcome: After completion of the course students able to

- CO1.** Understand Basic Electrical circuits, Power distribution and Safety measures.
- CO2.** Analyze and apply DC network theorems.
- CO3.** Analyze and apply concept of AC circuits of single-phase and three-phase.
- CO4.** Analyze and apply concepts of AC fundamentals in solving AC network problems.
- CO5.** Understand basic principles of Transformers and Rotating Machines.

Course Content

Module I: DC Circuits (9L)

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 II: AC Fundamentals (9L)

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 series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

Module III: Single-Phase Transformer (5L)

Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

Module IV: Electrical Rotating Machines (8L)

a) DC Machines (4L)

Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

b) Three-Phase Induction Motor (4L)

Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem.

Module V: General Structure of Electrical Power System (1L)

Power generation to distribution through overhead lines and underground cables with single line diagram.

Module VI: Electrical Installations (4L)

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

Text books:

1. D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti, Nath & Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.

Reference books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Printice Hall India, 1989.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	2	-	-	-	2	2	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	2	3	1	-	-	-	-	-	-	-	1	1
CO4	1	2	3	1	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: English
Course Code: HU 101
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisite: The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

Course Outcome:

- CO1.** Able to comprehend the basic knowledge of communication skills in English through exposure to communication theory and practice.
- CO2.** Apply the basic grammatical skills of the English language through intensive practice.
- CO3.** Able to develop listening and writing skills.
- CO4.** Able to write Official Letters , Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.
- CO5.** 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

Module 1:	Communication in a Globalized World	4L
1.1	Definition, Process, Types of Communication	
1.2	Verbal and Non-Verbal Communication	
1.3	Barriers to Communication	
1.4	Workplace Communication	
Module 2:	Functional Grammar	4L
2.1.	Articles, Prepositions and Verbs	
2.2.	Verb-Subject Agreement	
2.3.	Voice, Modality and Modifiers	
2.4.	Direct and Indirect Speech	
2.5.	Common Errors in English	
Module 3:	Vocabulary and Reading	6L
3.1.	Word Roots, Prefixes and Suffixes	
3.2.	Antonyms, Synonyms and one word Substitution	
3.3.	Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)	
3.4.	Reading Comprehension (Fictional and Non-fictional prose)	
Module 4:	Professional Writing	10L
4.1.	Writing Functions: Describing, Defining, Classifying	
4.2.	Structuring—coherence and clarity	
4.3.	Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).	
4.4.	E-mails—types, conventions, jargons and modalities.	
4.5.	Reports and Proposals	
4.6.	Précis writing	
4.7.	Essay writing	
4.8.	Punctuation and its importance in writing	
4.9.	Writing for an Audience	

Text Books:

1. Ruskin Bond: The Night Train at Deoli
2. Khushwant Singh: The Portrait of a Lady
3. Roald Dahl: Lamb to the Slaughter
4. Somerset Maugham: The Man with the Scar
5. Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and 13th February 1944)
6. Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

Reference Books:

1. Raymond Murphy. *English Grammar in Use*. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. *A Practical English Grammar* Oxford: OUP, 1980.
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. Ben Heasley and Liz Hamp-Lyons. *Study Writing*. Cambridge: CUP, 2006.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	-	1	3	3	3	3
CO2	-	-	-	-	-	2	-	-	2	3	3	3
CO3	-	3	2	2	-	3	2	2	3	3	3	3
CO4	-	-	-	2	-	2	-	-	3	3	2	3
CO5	-	2	1	-	-	2	2	1	3	3	2	3

Course Name: Chemistry Lab

Course Code: CH 191

Contact: 0:0:3

Total Contact Hours: 24

Credits: 1.5

Prerequisite: 10+2 science with chemistry

Course Outcome:

- CO1.** Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
- CO2.** Able to work as an individual also as a team member.
- CO3.** Able to analyse different parameters of water considering environmental issues.
- CO4.** Able to synthesize nano and polymer materials.
- CO5.** Capable to design innovative experiments applying the fundamentals of chemistry.

List of Experiments:

9

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).
10. Innovative experiment: Preparation of silver nano-particles.

Text Books:

1. A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

Reference Books:

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins
4. Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition
5. <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	2	2	-	-	-	-	1	2	2
CO2	3	3	3	2	1	-	2	1	-	1	-	3
CO3	3	3	3	3	3	1	1	1	-	1	-	2
CO4	2	3	3	3	3	-	-	-	-	1	1	2
CO5	3	3	3	3	1	1	1	-	1	-	2	3

Course Name: Basic Electrical Engineering Lab

Course Code: EE 191

Contact: 0:0:3

Credits: 1.5

Prerequisite: Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit.

Course Outcome:

- CO1.** Identify and use common electrical components.
- CO2.** To develop electrical networks by physical connection of various components and analyze the circuit behaviour.
- CO3.** Apply and analyze the basic characteristics of transformers and electrical machines.

List of Experiments:

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter method.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	2	-	-	-	-	-	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: Engineering Graphics & Design

Course Code: ME 191

Contact: 0:0:3

Credits: 1.5

Prerequisite: Basic knowledge of geometry

Course Outcome:

- CO1.** Get introduced with Engineering Graphics and visual aspects of design.
- CO2.** Know and use common drafting tools with the knowledge of drafting standards.
- CO3.** Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
- CO4.** Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

List of Drawing:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and

annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

Module 6: Demonstration of a simple team design project

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	1	1	-	1	2	1	-	-
CO2	2	1	2	-	1	1	-	2	1	2	1	1
CO3	2	1	3	2	3	-	-	2	2	2	1	1

2nd Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	M 201	Mathematics - II	3	1	0	4	4
2	BS	CH 201 / PH 201	Chemistry (Gr. B) / Physics - I (Gr. A)	3	0	0	3	3
3	ES	EE 201 / EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							16	16
B. PRACTICAL								
6	ES	CS 291	Programming for Problem Solving Laboratory	0	0	3	3	1.5
7	BS	CH 291 / PH 291	Chemistry Laboratory (Gr. B) / Physics - I Laboratory (Gr. A)	0	0	3	3	1.5
8	ES	EE 291 / EC 291	Basic Electrical Engineering Laboratory (Gr. B) / Basic Electronics Engineering Laboratory (Gr. A)	0	0	3	3	1.5
9	ES	ME 291 / ME 292	Engineering Graphics & Design (Gr. B) / Workshop/Manufacturing Practices (Gr. A)	0	0	3	3	1.5
10	HS	HU 291	Language Laboratory	0	0	2	2	1
11	PROJ	PR 291	Project – II	0	0	1	1	0.5
12	PROJ*	PR 292	Innovative Activities – I	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	0	3	0
Total of Theory, Practical & Mandatory Activities / Courses							34	24

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation / innovation / entrepreneurship cell of the institute; participation in conferences / workshops / competitions etc.; Learning at Departmental Lab / Tinkering Lab / Institutional workshop; Working in all the activities of Institute's Innovation Council for e.g., IPR workshop / Leadership Talks / Idea / Design / Innovation / Business Completion / Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head / Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics - II

Course Code: M 201

Contact: 3:1:0

Total Contact Hours: 48

Credits: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) standard calculus.

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

- CO1.** Use mathematical tools to evaluate multiple integrals and vector integrals.
- CO2.** Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
- CO3.** Recall the properties of Laplace Transform to evaluate multiple integrals and their usage.
- CO4.** Understand the concept of Laplace transform to solve ordinary differential equations.

Course Content

Module I: Multivariable Calculus (Integration): **(12 Lectures)**

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module II: First Order Ordinary Differential Equations (ODE): **(10 Lectures)**

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p , solvable for y solvable for x and Clairaut's equation.

Module III: Second Order Ordinary Differential Equations (ODE): **(12 Lectures)**

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module IV: Laplace Transform (LT): **(14 Lectures)**

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 $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of $\int f(t)dt$, 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.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Course Name: Physics –I
Course Code: PH 201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre requisite: Knowledge of Physics up to 12th standard.

Course Outcome: At the end of the course students should be able to

- CO1.** Describe various types mechanical resonance and its electrical equivalence.
- CO2.** Explain basic principles of Laser, Optical fibers and various types of semiconductors.
- CO3.** Apply superposition to explain interference and diffraction as well as apply wave mechanics to attainment of Heisenberg's uncertainty principle.
- CO4.** Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors.
- CO5.** Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

Course Content

Module 1: Waves & Oscillations (6L)

Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems. 6L

Module 2: Classical Optics (8L)

Interference of light: Huygens's principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Diffraction of light: Fresnel and Fraunhofer class, Fraunhofer diffraction of a single slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems. 5L

Module 3: Quantum Mechanics-I (8L)

Quantum Theory: Inadequacy of classical physics and its modifications by Planck's quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment. 4L

Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems. 4L

Module 4: Solid State Physics-I**(7L)**

Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 4L

Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 3L

Module 5: Modern Optics-I**(7L)**

Laser: Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser. 5L

Fibre optics: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems. 2L

Text Books:**Waves & Oscillations:**

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramaniam, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)

2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

Reference Books:

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. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	1
CO4	2	3	-	-	-	-	-	-	-	-	-	1
CO5	1	3	-	-	-	-	-	-	-	-	-	1

Course Name: Basic Electronics Engineering

Course Code: EC 201

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite: 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, Kirchhoff's Law i.e. KVL, KCL, Ampere's Law etc.

Course Outcome:

- CO1.** Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
- CO2.** Learn how operational amplifiers are modelled and analysed, and to design Op-Amp circuits to perform operations such as integration differentiation on electronic signals.
- CO3.** Study the concepts of both positive and negative feedback in electronic circuits.
- CO4.** Develop the capability to analyse and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.

Course Content

Module-I: Basics of semiconductor

5

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

7

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 (I_{DC} , I_{rms} , V_{DC} , V_{rms} , 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

8

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 Transistors

6

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

8

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)

2

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

Text Books:

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

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	1	-	-	-	-	-	-	3
CO4	3	3	2	3	2	-	-	-	-	-	-	3

Course Name: Programming for Problem Solving

Course Code: CS 201

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite: Number system, Boolean Algebra

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

- CO1.** Understand and differentiate among different programming languages for problem solving.
- CO2.** Describe the way of execution and debug programs in C language.
- CO3.** Define, select, and compare data types, loops, functions to solve mathematical and scientific problem.
- CO4.** Understand the dynamic behavior of memory by the use of pointers.
- CO5.** Design and develop modular programs using control structure, selection structure and file.

Course Content

Module I: Fundamentals of Computer: (8L)

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. 3L

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

Overview of Procedural vs Structural language, compiler and assembler (basic concepts). 1L

Problem solving-Algorithm & flow chart. 2L

Module II: C Fundamentals: (28L)

Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. 2L

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. 3L

Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields. 1L

Branching and Loop Statements: Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue. 4L

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. 5L

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. 7L

Structures and Unions: Basic of structures, arrays of structures, structures and pointers, structures and functions. 3L

Files handling with C: Formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. 3L

Text books:

1. Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition
2. Kanetkar Y. - Let us C, BPB Publication, 15th Edition

Reference Books:

1. E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition
3. Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS, 2nd Edition

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	1	-	3	3	1	1
CO2	2	2	3	3	2	2	-	-	3	3	3	3
CO3	2	2	2	2	2	1	-	-	3	3	1	3
CO4	3	2	2	2	2	3	-	-	3	3	2	3
CO5	3	3	3	3	2	3	-	-	3	3	3	3

Course Name: Engineering Mechanics

Course Code: ME 201

Contacts: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite: Basic Concept of Physics

Course Outcome:

- CO1.** To understand representation of force, moments for drawing free-body diagrams and analyze friction based systems in static condition.
- CO2.** To locate the centroid of an area and calculate the moment of inertia of a section.
- CO3.** Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics.
- CO4.** Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration.

Course Content

Module 1: Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

Module 2: Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

Module 3: Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

Module 4: Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

Module 5: Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. 5L

Module 6: Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). 5L

Module 7: Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Module8: Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

Text books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shames and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	1	-	-	-
CO2	3	3	2	2	-	-	-	-	1	-	-	1
CO3	3	2	3	2	1	-	-	-	1	-	-	1
CO4	3	3	3	3	-	-	-	-	1	-	1	-

Course Name: Programming for Problem Solving Lab

Course Code: CS 291

Contact: 0:0:3

Credits: 1.5

Prerequisites: Number system, Boolean Algebra

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

- CO1.** Learn the concept of DOS system commands and editor.
- CO2.** To formulate the algorithms for simple problems and to translate given algorithms to a working and correct program.
- CO3.** To be able to identify and correct syntax errors / logical errors as reported during compilation time and run time.
- CO4.** To be able to write iterative as well as recursive programs.
- CO5.** Learn the concept of programs with Arrays, Pointers, Structures, Union and Files.

List of Experiments:

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.
12. Innovative Experiment

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	2	-	1	-	1	2	3
CO2	3	3	3	-	-	-	-	-	-	-	-	2
CO3	2	2	2	2	2	-	-	-	-	-	-	3
CO4	1	2	2	2	2	-	-	-	-	-	-	2
CO5	2	3	3	3	2	2	3	1	3	3	3	3

Course Name: Physics-I Lab

Course Code: PH 291

Contact: 0:0:3

Credits: 1.5

Prerequisite: Basic knowledge of 10+2

Course Outcome: Student will able to:

- CO1.** Demonstrate experiments allied to their theoretical concepts.
- CO2.** Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer.
- CO3.** Participate as an individual, and as a member or leader in groups in laboratory sessions actively.
- CO4.** Analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiments.

List of Experiment:

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 moduli 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.**

Innovative experiments:

- 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 Poiseuille's capillary 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
CO1	1	-	-	-	2	2	-	1	-	1	2	3
CO2	3	3	3	-	-	-	-	-	-	-	-	2
CO3	2	2	2	2	2	-	-	-	-	-	-	3
CO4	1	2	2	2	2	-	-	-	-	-	-	2

Course Name: Basic Electronics Engineering Lab

Course Code: EC 291

Contact: 0:0:3

Credits: 1.5

Prerequisite: 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 Outcome:

- CO1.** Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
- CO2.** Analyse the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
- CO3.** Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
- CO4.** Able to know the application of Diode, BJT & OPAMP.

List of Experiment:

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 Experiments

Text Books:

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

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	1	-	-	-	-	-	-	3
CO4	3	3	2	3	2	-	-	-	-	-	-	3

Course Name: Workshop/Manufacturing Practices

Course Code: ME 292

Contact: 0:0:3

Credits: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry

Course Outcome: Upon completion of this laboratory course, students will be able to

CO1. Fabricate components with their own hands.

CO2. Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO3. Produce small devices of their interest for project or research purpose.

Course Content:

(i) Theoretical discussion & videos:

(6P)

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

(ii) Workshop Practice:

Module 1 - Machine shop

(6P)

Typical jobs that may be made in this practice module:

- i. To make a pin from a mild steel rod in a lathe.
- ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop (6P)

Typical jobs that may be made in this practice module:

- i. To make a Gauge from MS plate.

Module 3 - Carpentry (6P)

Typical jobs that may be made in this practice module:

- i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) (6P)

Typical jobs that may be made in this practice module:

- i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arcwelding.
- ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics (3P)

House wiring, soft Soldering

Module 6 - Smithy (3P)

Typical jobs that may be made in this practice module:

- i. A simple job of making a square rod from a round bar or like.

Innovative Experiments:**Module 7 - Casting**

Typical jobs that may be made in this practice module:

- i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting

Typical jobs that may be made in this practice module:

- i. For plastic moulding, making at least one simple plastic component should be made.
- ii. At least one sample shape on glass should be made using laser cutting machine.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	-	-	-	2	1	-	2
CO2	3	3	2	2	1	-	-	-	2	1	-	2
CO3	3	2	2	2	1	1	-	1	2	2	3	2

Course Name: Language Lab

Course Code: HU 291

Contact: 0:0:2

Credit: 1

Pre requisite: Basic knowledge of LSRW skills

Course Outcome:

- CO1.** Able to understand advanced skills of Technical Communication in English through Language Laboratory.
- CO2.** Able to apply listening, speaking, reading and writing skills in societal and professional life.
- CO3.** Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
- CO4.** Able to analyze communication behaviours.
- CO5.** 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. Academic Listening vs Business Listening
- d. Listening in Business Telephony
- e. Study of Contextualized Examples based on Lab Recordings

Module 3: Speaking

- a. Speaking—Accuracy and Fluency Parameters
- b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
- c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
- d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
- e. Group Discussion: Principles and Practice

Module 4: Lab Project Work

- a. Making a brief Animation film with voice over (5 minutes) OR
- b. Making a brief Documentary film (10 minutes)

References:

1. IIT 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
CO1	2	-	-	3	-	3	2	2	3	3	-	3
CO2	2	3	3	3	-	3	3	3	2	3	-	3
CO3	1	3	3	3	-	2	2	2	2	3	-	2
CO4	1	2	3	3	-	2	1	1	2	3	-	2
CO5	3	3	2	3	-	2	3	2	2	3	-	2

3rd Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	ES	EE 301	Electrical Circuit Analysis	3	1	0	4	4
2	PC	EE 302	Measurement and Instrumentation	3	0	0	3	3
3	PC	EE 303	Analog Electronics	3	0	0	3	3
4	BS	M(EE) 301	Mathematics – III	3	1	0	4	4
Total of Theory							14	14
B. PRACTICAL								
5	ES	EE 391	Electrical Circuit Analysis Laboratory	0	0	3	3	1.5
6	PC	EE 392	Measurement and Instrumentation Laboratory	0	0	3	3	1.5
7	PC	EE 393	Analog Electronics Laboratory	0	0	2	2	1
8	PROJ	PR 391	Project – III	0	0	2	2	1
9	PROJ*	PR 392	Innovative Activities – II	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 301	Environmental Science	3	0	0	3	0
Total of Theory, Practical & Mandatory Activities / Courses							27	19.5

* Students may choose either to work on participation in all the activities of Institute's Innovation Council for e.g., IPR workshop/ Leadership Talks / Idea / Design / Innovation / Business Completion / Technical Expos etc.

Innovative activities to be evaluated by the Programme Head / Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Electrical Circuit Analysis

Course Code: EE 301

Contact: 3L:1T:0P

Total Contact Hrs: 40

Credit:4

Prerequisites: The students to whom this course will be offered must have the concept of Basic electrical engineering, Laplace transform, First order ordinary differential equation and Second order ordinary differential equation.

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

- CO1.** Understand the basic concepts of electric, magnetic and filter circuits.
- CO2.** Synthesize different electrical circuits with network theorems.
- CO3.** Analyze the transient condition of electrical circuits.
- CO4.** Analyze two port circuit behaviors.

Course Content

MODULE I: Introduction (3)

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: Coupled Circuits (5)

Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Ideal Transformer, Solution of problems.

MODULE III: Laplace Transform in Circuit Analysis (8)

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances.

MODULE IV: Network Theorems (8)

Loop variable analysis, Node variable analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem Solution of Problems with DC & AC sources.

MODULE V: Graph Theory (4)

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: Two Port Network (8)

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: Filter (6)

Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and

second order only) using operational amplifier.

MODULE VIII: Fourier Series Analysis (6)

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 , Dirichlet's conditions, Sum of Fourier series. 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).

Text Books:

1. Sudhakar: Circuits & Networks: Analysis & Synthesis 2/e TMH
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. D. Chattopadhyay and P. C. Rakshit: Electrical Circuits

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
3. Sivanandam: Electric Circuits Analysis
4. V. K. Chandna, A Text Book of Network Theory & Circuit Analysis, Cyber Tech References.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	1	3
CO2	3	3	3	2	2	-	-	-	-	-	1	3
CO3	3	3	3	2	2	-	-	-	-	-	2	3
CO4	3	3	3	2	2	-	-	-	-	-	2	3

Course Name Measurement and Instrumentation

Course Code: EE 302

Contact: 3L:0T:0P

Total Contact Hrs: 36

Credit: 3

Prerequisites: Concepts of Basic Electrical Engineering.

Course Outcome:

- CO1.** Understand the operating principles of electrical and electronic measuring instruments.
- CO2.** Identify and measure various physical parameters using appropriate measuring instruments.
- CO3.** Measure various electrical parameters.
- CO4.** Understand statistical data analysis and computerized data acquisition.

Course Content

Module –I:

Measurements: (4)
 Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Errors in measurement. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp, Cpk.

Analog meters: (6)
 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. Disadvantage of shunt and multipliers

Galvanometer: (2)
 Basic concept: Principle of operation, Advantage, Disadvantage, Error and Application.

Module – II:

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

Module – III:

Measurement of resistance: (3)
 Measurement of medium, low and high resistances, Megger. Basic concept of Crompton's DC potentiometer Polar and Co-ordinate type AC potentiometer. Application.

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

Module – IV:

Cathode ray oscilloscope (CRO): (3)
Basic concept of Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Digital Storage Oscilloscope

Electronic Instruments: (3)
Basic concept of Digital voltmeter (Electronic), Resolution and sensitivity of digital meters, Digital Multi meter Digital frequency meter, True RMS meters, Clamp-on meters

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.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
4. 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
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	1	-	-	-	-	-	-	-
CO4	-	3	2	-	2	-	-	-	-	-	-	-

Course Name : Analog Electronics

Course Code: EE 303

Contact: 3L:0T:0P

Total Contact Hrs: 34

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 Outcome:

- CO1.** Students will be able to design D.C power supplies.
- CO2.** Students will be able to analyze transistor amplifier circuit.
- CO3.** Students will be able to understand effects of different feedback mechanism in amplifier circuit.
- CO4.** Students will be able to analyze signal generator Circuit.
- CO5.** Student will be able to design power amplifier circuit.
- CO6.** 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, 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 Amplifiers & Oscillators

[5L]

Feedback concept, negative & positive feedback, Voltage/Current & Series/Shunt Feedback Barkhausen criterion, RC Oscillators-Phase shift and Wein bridge oscillators, LC Oscillator-Colpitts, Hartley's and crystal oscillators.

Module – 5: Operational Amplifier

[4L]

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 amplifiers

[3L]

Class A, B, AB, C, Conversion efficiency, Tuned amplifier.

Module – 8: Multivibrators

[2L]

Astable, Monostable, Bistable multivibrators; Astable and Monostable operation using 555 timer.

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 Driscoll-Operational Amplifier and Linear Integrated Circuits – Pearson Education

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	2	-	3	-	-	3
CO2	3	3	3	3	2	-	2	-	3	-	-	3
CO3	3	3	3	3	2	-	2	-	3	-	-	3
CO4	3	3	3	3	2	-	2	-	3	-	-	3
CO5	3	3	3	3	2	-	2	-	3	-	-	3
CO6	3	3	3	3	2	-	2	-	3	-		3

Course Name: Mathematics – III
Course Code: M(EE) 301
Contact: 3L:1T:0P
Total Contact Hours: 48
Credit:4

Prerequisites: The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

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

- CO1.** Recall the underlying principle and properties numerical analysis, Statistics, partial differential equation and ordinary differential equation.
- CO2.** Exemplify the variables, functions and differential equations and find their distinctive measures using the underlying concept partial differential equation and ordinary differential equation, numerical methods and statistics.
- CO3.** Apply numerical methods used to obtain approximate solutions to intractable mathematical problems.
- CO4.** Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's).
- CO5.** Interpret complex statistical findings using the understanding of inferential statistics.

Course Content

MODULE I: Interpolation (8 Lectures)

Difference Operators (Only Definition): Forward and Backward, Shift Operator, Newton forward interpolation, Newton backward interpolation, Lagrange's Interpolation.

MODULE II: Numerical Solution of Linear and Non-linear Equations (6 Lectures)

Numerical Solution of a System of Linear Equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.

Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Newton-Raphson method.

MODULE III: Numerical Integration and Numerical Solution of Differential Equation (10 Lectures)

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

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.

Numerical solution of partial differential equation: Finite Difference method, Crank-Nicolson method.

MODULE IV: Statistics (12 Lectures)

Basic Statistics: Basic statistics, measure of central tendency, mean, median, mode, dispersion, correlation coefficient and regression.

Sampling theory: Random sampling. Statistic and its Sampling distribution. Sampling distribution

of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson). Confidence intervals and related problems

MODULE V: Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE) (12 Lectures)

Solution of PDE: Method of Separation of Variables.

Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.

Series solution of ODE: General method to solve $P_0 y'' + P_1 y' + P_2 y = 0$ and related problems to Power series method, Bessel's Function, Legendre Polynomial.

Text Books:

1. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
2. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
3. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
4. Raisinghania, M .D. *Advanced Ordinary & Partial Differential. Equation*; S. Chand Publication.
5. Ross, S. L. *Differential Equations*, John Willey & Sons.
6. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
7. Kreyszig, E. *Advanced Engineering Mathematics*, John Wiley & Sons, 2006.

Reference Books:

1. Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
2. Shastri, S. S. *Numerical Analysis*, PHI.
3. Mollah, S. A. *Numerical Analysis*, New Central Book Agency Spiegel,
4. 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. Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
7. Delampady, M. *Probability & Statistics*, Universities Press.
8. Sneddon, I. N. *Elements of Partial Differential Equations*, McGraw Hill Book Co.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1
CO5	3	3	2	3	-	-	-	-	-	-	-	1

Course Name: Electrical Circuit Analysis Laboratory
Course Code: EE 391
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Concepts of Basic Electrical Engineering

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

- CO1.** Demonstrate transient analysis of electric circuits frequency response characteristics of Filter circuits.
- CO2.** Analyze electric circuits, signals and algorithms using mathematical tools

List of Experiment:

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

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	3	-	-	-	1	1	-	-
CO2	2	-	2	1	3	--	-	-	1	1	-	-

Course Name: Measurement and Instrumentation Laboratory

Course Code: EE 392

Contact: 0L:0T:3P

Credit: 1.5

Prerequisites: Concepts of different measuring system.

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

- CO1.** Conduct experiment to measure of Resistance, Inductance, Capacitance, Power and Energy.

List of Experiment:

1. Measurement of power in polyphase circuit.
2. Measurement of power using instrument transformer.
3. Measurement of capacitance using Schering Bridge technique as well as LCR meter.
4. Calibration of Digital Energy Meter.
5. Testing of energy Meter
6. Measurement of capacitance using Anderson Bridge technique as well as LCR meter.
7. Measurement of low resistance using Kelvin Double bridge.
8. Measurement of high resistance and insulation resistance using Megger.
9. Usage of DSO to capture transient like step change in R-L-C circuit.
10. Current measurement using shunt, CT and Hall Sensor
11. Measurement of capacitance by De sauty bridge
12. Measurement of frequency by Wien Bridge.
13. Innovative Experiments.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	3	-	-	-	-	3	2	-	1

Course Name: Analog Electronics Laboratory
Course Code: EE 393
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Knowledge in electrical circuits and electronic devices.

Course Outcome:

- CO1.** Able to understand, analyse the analog circuits pertaining to applications like amplifier, oscillators and timer.
- CO2.** Able to know how to interface digital circuits with ADC & DAC.
- CO3.** Able to understand the fundamental concepts and techniques used in digital electronics.
- CO4.** Able to understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.
- CO5.** Able to understand, analyse the analog circuits pertaining to applications like amplifier, oscillators and timer.
- CO6.** Able to know how to interface digital circuits with ADC & DAC.

List of Experiment:

Any 8 Experiments has to be done

1. Design of voltage regulator circuit using zener diode.
2. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
3. Design of RC coupled amplifier & study of its gain & Bandwidth using BJT.
4. Design of RC Phase shift oscillator using BJT.
5. Design of wien bridge oscillator using BJT.
6. Study of class A & class B power amplifiers.
7. Design of Integrator using OPAMP IC 741
8. Design of Differentiator using OPAMP IC 741
9. Study of V to I and I-V converter using OPAMP IC 741
10. Design of Instrumentation Amplifier using OPAMP IC 741
11. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
12. Study of voltage controlled oscillator.
13. Innovative Experiments.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	2	-	3	-	-	3
CO2	3	3	3	3	2	-	2	-	3	-	-	3
CO3	3	3	3	3	2	-	2	-	3	-	-	3
CO4	3	3	3	3	2	-	2	-	3	-	-	3
CO5	3	3	3	3	2	-	2	-	3	-	-	3
CO6	3	3	3	3	2	-	2	-	3	-	-	3

Course Name: Environmental Science

Course Code: MC 301

Contact: 3:0:0

Pre requisites: Basic knowledge of Chemistry

Course Outcome:

CO1. 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 Contents

- 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.
- 2. Air pollution and control 6L**
 - 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))**
- 3. Water Pollution 6L**
 - 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

Lake: Eutrophication [Definition, source and effect].

- 3.4. **Ground water:** Aquifers, hydraulic gradient, ground water flow (Definition only), ground water pollution (Arsenic & Fluoride; sources, effects, control)
- 3.5. **Quality of Boiler fed water:** DO, hardness, alkalinity, TDS and Chloride
- 3.6. **Layout of waste water treatment plant** (scheme only).

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

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, L_{10} (18 hr Index) .
- 5.4. Noise pollution control.

References Books:

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited
2. Environmental Studies, Dr. J P Sharma, University Science Press
3. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	-	2	3	3	-	-	1	2

4th Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	PH 401	Physics – II	3	0	0	3	3
2	PC	EE 401	Electrical Machines – I	3	0	0	3	3
3	PC	EE 402	Power Electronics	3	0	0	3	3
4	PC	EE 403	Digital Electronics	3	0	0	3	3
5	PC	EE 404	Electromagnetic Fields	2	0	0	2	2
6	HS	HU 401	Values and Ethics in Profession	2	0	0	2	2
Total of Theory							16	16
B. PRACTICAL								
7	BS	PH 491	Physics – II Laboratory	0	0	3	3	1.5
8	PC	EE 491	Electrical Machines – I Laboratory	0	0	3	3	1.5
9	PC	EE 492	Power Electronics Laboratory	0	0	3	3	1.5
10	PC	EE 493	Digital Electronics Laboratory	0	0	2	2	1
11	PROJ	PR 491	Project – IV	0	0	2	2	1
12	PROJ*	PR 492	Innovative Activities – III	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 481	Behavioural & Interpersonal Skills	0	0	3	3	0
Total of Theory, Practical & Mandatory Activities / Courses							32	23

* Students may choose either to work on participation in all the activities of Institute's Innovation Council for e.g., IPR workshop / Leadership Talks / Idea / Design / Innovation / Business Completion / Technical Expos etc.

Innovative activities to be evaluated by the Programme Head / Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Physics – II
Course Code: PH 401
Contact: 3L:0T:0P
Total Contact Hours: 40
Credit: 3

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

Course Outcome: After completion of this course student will be able to

- CO1.** Explain electron transport in metal-insulators and semiconductors using energy Band theory.
- CO2.** Apply Schrödinger equation in variety of atomic scale problems including nanomaterials.
- CO3.** Analyze the physics of various kinds of electric and magnetic materials
- CO4.** Justify the importance of Fermi energy level in turning electronic properties of various.

Course Content

Module 1: Electric and Magnetic properties of materials (10L)

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), Dielectric losses, Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability – Clausius-Mossotti equation (with derivation); ferroelectric and piezoelectrics (Qualitative study). 5L

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 θ_p , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) 5L

Module 2: Quantum Mechanics – II (8L)

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 $E < V_0$). 4L

Module 3: Statistical Mechanics (4L)

Concept of energy levels and energy states, phasespace, 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 4: Elements of solid state physics (6L)**Module 4.01: Free electron theory (qualitative) – Electronic conduction in solids**

Drude's theory, B 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. 3L

Module 5: Physics of Nanomaterials (4L)

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). 4L

Module 6: Nuclear energy as future energy (4L)

Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energy output, Nuclear Reactor. 4L

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
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	2	3	-	-	-	-	-	-	-	-	-	1
CO4	1	2	2	3	-	-	-	-	-	-	-	1

Course Name: Electrical Machines - I

Course Code: EE 401

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

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

Course Outcome:

- CO1.** Understand the operation of Transformers, D.C. Machines, Three-Phase Induction Motor.
- CO2.** Analyze the equivalent circuit of Transformers, D.C. Machines, Three-Phase Induction Motor.
- CO3.** Conduct different tests on Transformers, D.C. Machines, Three-Phase Induction Motor.

Course Content

MODULE – I: General Introduction to Electrical Machines (3L)

Faraday's laws of electromagnetic induction, Fleming's rule and Lenz's Law. 1L
 Concept of Electrical and Mechanical degree. 2L

MODULE – II: D.C. Machine (9L)

EMF generation in armature, Characteristics of D.C. Machines. 1L
 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. 2L
 Commutation method, Concept of reactance voltage. 1L
 Power flow diagram, Losses and efficiency, Solution of problems. 1L
 Testing of D.C. machines – Hopkinson's, Swinburne's test, Brake test (Tests specified as per standards). 1L
 Starting and Speed Control of D.C. Motors. 2L

MODULE – III: Single-Phase Transformers (5L)

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, Solution of problems. 2L
 Single-phase Auto transformer – Comparison of weight, copper loss with 2-winding transformer. 1L
 Sumpner Test, Applications of 2-winding transformer and Auto transformer. 1L

MODULE – IV: Three-Phase Transformers (9L)

Types of three-phase transformer. Construction and Different types of windings. 1L
 Polarity of transformer, Vector groups for various connections. 1L
 Parallel operation and load sharing, Solution of problems. 2L
 Effect of unbalanced loading and neutral shifting, Tertiary windings. 1L
 Scott-connected transformer and open-delta connection – working principle, connection diagram, practical application. 1L
 Tap-changing methods, Tap changers – Off load and On-load type. 1L
 Special Transformer: Pulse transformer, Grounding transformer. 1L
 Testing of Three-phase Transformers. 1L

MODULE – V: Three-Phase Induction Motor (10L)

Induction motor as a transformer, Concept of rotating magnetic field, Power stages in 3-phase induction motor and their relation, power-slip characteristics. 3L

Determination of equivalent circuit parameters, Separation of losses, Efficiency, Solution of problems. 2L

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. 2L

Testing and Industrial applications of 3-phase induction motor. 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
CO1	3	3	-	-	-	-	2	-	-	2	3	3
CO2	3	3	3	3	3		-	-	2	-	3	3
CO3	3	1	2	-	-	3	-	1	2	-	3	3

Course Name: Power Electronics

Course Code: EE 402

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Basic Electronics, Electrical Circuit Analysis, Analog Electronics.

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

- CO1.** Demonstrate the characteristics of different power electronic switches along with their turn-on, turn-off, triggering and protection circuits.
- CO2.** Analyse various power converter circuits.
- CO3.** Understand the use of power converters in commercial and industrial applications.

Course Content

MODULE I: Power Electronic Switching Devices 8L

Advances in Power Electronics Power Semiconductor Switches: 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 II: Uncontrolled and Controlled Rectifiers 6L

Single-Phase and Three-Phase Uncontrolled rectifiers.

Phase controlled Rectifiers: Principle of operation of single phase and three phase semi-controlled, full controlled converters with R, R-L and RLE loads. Effects of source inductance on the performance of converters. Performance parameters of converters, Dual converters, Solution of problems.

MODULE III: 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 IV: Inverters 10L

Inverters: Principle of operation of single phase inverter, 120° 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 V: Cycloconverters and AC Voltage Regulators 5L

AC Voltage Controllers, Single phase and three phase Cycloconverters, Concept of Matrix Converter.

MODULE VI: Applications 2L

UPS (Online and Offline), SMPS, Battery Chargers.

Text Books:

1. L. Umanand, Power Electronics: Essentials and Applications.
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
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	2	1	-	-	-	-	-	-	-

Course Name: Digital Electronics

Course Code: EE 403

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Knowledge of Basic Electronics and Mathematics.

Course Outcome: The students will be able to:

- CO1.** 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.
- CO2.** Design of combinational circuits
- CO3.** Design of various synchronous and asynchronous sequential circuits using State Diagrams & Tables.
- CO4.** Understand DAC & ADC technique and corresponding circuits
- CO5.** Analyze logic family interfaces, switching circuits & memory storage devices to Plan and execute projects.

Course Content

Module 1:

11L

Binary, Octal and Hexadecimal number system representation and their conversions; BCD, Gray codes and their conversions. 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.

Module 2:

10L

Combinational circuits- Half Adder, Full Adder, Serial & Parallel 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:

10L

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, Ring & Johnson Counter.

Module 4:

5L

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.

Textbooks:

1. A. Anand Kumar, Fundamentals of Digital Circuits-PHI
2. Morris 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
CO1	3	3	3	1	3	1	1	1	1	1	1	3
CO2	3	3	3	1	3	1	1	1	1	1	1	3
CO3	3	3	3	3	3	2	2	1	1	1	2	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3
CO5	3	3	3	3	3	1	2	1	2	2	2	3

Course Name: Electromagnetic Fields
Course Code: EE 404
Contact: 2L:0T:0P
Total Contact Hours: 24
Credit: 2

Prerequisites: Concept of mathematics, physics and basic electrical engineering.

Course Outcome:

- CO1.** Know the orthogonal co-ordinates and their transformation to solve & analyze problems on vector calculus.
- CO2.** Know the basic laws of electrostatics and electromagnetism and define associated terms.
- CO3.** Understand Maxwell's equation in different forms.
- CO4.** Understand the propagation of EM waves associated with different Electrical Networks.

Course Content

Module 1: Co-ordinate systems **3L**
 Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates and their transformation. Differential length, area and volume in different coordinate systems. Solution of problems.

Module 2: Introduction to Vector calculus **3L**
 DEL operator, Gradient of a scalar, Divergence of a vector and Divergence theorem, Curl of a Vector and Strokes theorem, 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, Concept of Electric dipole, flux lines and Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor–dielectric, Conductor-free space. Poisson's and Laplace's equation, Solution of problems.

Module 4: Magneto static fields **5L**
 Biot-savart's 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, Concept of Magnetic energy, Magnetostriction, Solution of problems.

Module 5: Electromagnetic fields **3L**
 Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Solution of problems.

Module 6: Electromagnetic wave propagation **5L**
 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 and Poynting vector. Solution of problems.

Text Books:

1. Quantum Field Theory, Lewis H. Ryder, 2nd Edition, Cambridge University Press.

2. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University press.
3. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
4. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
5. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
6. 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
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-

Course Name: Values and Ethics in Profession

Course Code: HU 401

Contact: 2L:0T:0P

Total Contact Hours: 24

Credit: 2

Prerequisites: Basic knowledge of engineering and management.

Course Outcome: On Completion of this course student will be able to

- CO1.** Understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values.
- CO2.** Understand the basic perception of profession, professional ethics, various moral issues
- CO3.** Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field
- CO4.** Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.
- CO5.** 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 Content

Module 1: Introduction 4L

Definition, Relevance, Types of values, changing concepts of values, Concept of Morals and Ethics, Work ethic – Service learning – Civic virtue, Stress Management -Concept of stress, causes and consequences, managing stress.

Module 2: Theories of Self Development 4L

Emotional Intelligence (EI): Concept, Importance and Measurement, Concept of Motivation, Maslow's theory, Kohlberg's theory.

Module 3: Moral and Ethical Concerns 4L

Variety of Moral Issues, Moral Dilemmas, Nature of values, Value Crisis in contemporary society, Value Spectrum of a good life, Steven Covey's Pursuit of Excellence

Module 4: Engineering Ethics 4L

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals, Social and ethical responsibilities of Technologists, Codes of professional ethics, Ethical and Unethical practices – case studies, Whistle blowing and beyond, Case studies.

Module 5: Technology and Sustainable Development 8L

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, Environmental Regulations, Environmental Ethics and appropriate Technology, Movement of Schumacher, Problems of Technology transfer, Technology assessment impact analysis, Human Operator in Engineering projects and industries, Problems of man, machine, interaction, Impact of assembly line and automation.

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.
4. S. K. Chakraborty: Values and Ethics in Organization, OUP
5. Caroline Whitbeck: Ethics in Engineering Practice and Research, Cambridge University Press.
6. Jaysree Suresh and B.S Raghavan: Human values and Professional Ethics, S. Chand Publication

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-		-	-	-	1	1	1	1	2	-	-
CO2	-	-	-	-	-	1	1	3	1	2	-	-
CO3	-	-	-	-	-	3	2	3	-	1	-	-
CO4	-	-	-	-	-	3	2	1	-	-	-	-
CO5	-	-	-	-	-	3	2	2	-	1	3	-

Course Name: Physics – II Laboratory
Course Code: PH 491
Contact: 0L:0T:3P
Credit: 1.5

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

Course Outcome: At the end of the course students' will be able to

- CO1.** Demonstrate experiments allied to their theoretical concepts
- CO2.** Conduct experiments using semiconductors , dielectric and ferroelectrics
- CO3.** Classify various types of magnetic materials.
- CO4.** Participate as an individual, and as a member or leader in groups in laboratory sessions actively.
- CO5.** Analyze experimental data from graphical representations, and to communicate effectively them in laboratory reports including innovative experiments.

List of Experiment:

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

1. Study of dipolar magnetic field behavior using deflection magnetometer.
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.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent) / Measurement of losses in a dielectric using LCR circuits.

Experiments on Module 2: Quantum Mechanics-II (6L)

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

Experiments on Module 4: Solid state physics (9L)

9. Determination of band gap of a semiconductor using four probe method.
10. Determination of Hall co-efficient of a semiconductor and measurement of magnetoresistance of a given semiconductor
11. Study of I-V characteristics of a LED.
12. Study of Intensity-Resistance characteristics of a LDR.

****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.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Innovative Experiments.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	1
CO2	2	1	-	3	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-

Course Name: Electrical Machines – I Laboratory
Course Code: EE 491
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Concept of Basic Electrical Engineering Laboratory, Electrical Measurement Laboratory.

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

- CO1.** Conduct different tests on Transformers, D.C. Machines, Three-Phase Induction Motor.
- CO2.** Analyze the characteristics of Transformers, D.C. Machines, Three-Phase Induction Motor.

List of Experiment (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.
13. Innovative Experiments.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	3	-	-	-	-	3	2	-	1
CO2	2	-	-	3	-	-	-	-	3	2	-	1

Course Name: Power Electronics Laboratory

Course Code: EE 492

Contact: 0L:0T:3P

Credit: 1.5

Prerequisites: Concept of Basic Electronics, Electrical Circuit Analysis, Analog Electronics.

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

- CO1.** The skill to analyze the response of any power electronics devices.
- CO2.** The ability to troubleshoot the operation of a power electronics circuit.
- CO3.** The ability to select suitable power electronic devices for a given application.
- CO4.** The ability to know how to control and convert output signal as per requirements.
- CO5.** The ability to construct any power electronics circuits as needed in operation.

List of Experiment (At least *ten* experiments to be performed):

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 the performance of step down chopper.
7. Study the performance of step up chopper.
8. Study the performance of single-phase inverter with 180° conduction mode of operation.
9. Study the performance of SPWM controlled single-phase inverter.
10. Study of performance of single phase controlled converter with and without source inductance (Simulation).
11. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
12. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter (Simulation).
13. Study of performance of three phase controlled converter with R & R-L load (simulation).
14. Innovative Experiments.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	-	-	-	-	-	-
CO2	-	1	-	2	-	-	-	-	-	-	-	-
CO3	2	1	-	2	-	-	-	-	1	-	-	-
CO4	2	-	-	2	-	-	-	-	1	-	-	-
CO5	2	1	-	2	-	-	-	-	-	-	-	-

Course Name: Digital Electronics Laboratory

Course Code: EE 493

Contact: 0L:0T:2P

Credit: 1

Prerequisites: Knowledge of Basic Electronics and Mathematics.

Course Outcomes:

- CO1.** Able to understand the fundamental concepts and techniques used in digital electronics.
- CO2.** Able to understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.
- CO3.** Able to understand, analyse the timing properties (input setup and hold times, minimum clock period, output propagation delays) and design various combinational and sequential circuits using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
- CO4.** Able to understand different digital circuits using Programmable Logic Devices.
- CO5.** Able to know how to interface digital circuits with ADC & DAC.

List of Experiment:

1. Realization of basic gates using Universal logic gates.
2. Realization of logic gates using TTL.
3. Design the circuit of Grey to Binary and vice versa.
4. Design a circuit for BCD to 7-segment display.
5. Four-bit parity generator and comparator circuits.
6. Construction of simple Encoder & Decoder circuits using logic gates.
7. Construction of simple Multiplexer & De Multiplexer circuits using logic gates.
8. Design of Half Adder & Full Adder Circuit using Logic Gates.
9. Design Half Subtractor & Full Subtractor Circuit using Logic Gates.
10. Realization of RS, D, JK and T flip-flops using logic gates.
11. Realization of Register using flip-flops and logic gates.
12. Realization of Up/Down counters.
13. One Innovative design of Digital Circuits.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3	1	1	1	-	-	1	3
CO2	3	3	3	1	3	1	1	-	1	1	1	3
CO3	3	3	3	3	3	2	2	1	-	1	2	3
CO4	3	3	3	3	3	2	2	1	-	2	1	3
CO5	3	3	3	3	3	1	2	1	2	2	2	3

Course Name: Behavioral & Interpersonal Skills

Course Code: MC 481

Contact: 0:0:3

Course Outcome:

- CO1.** It will equip the student to handle workplace interpersonal communication in an effective manner.
- CO2.** To enable students with strong oral and written interpersonal communication skills.
- CO3.** To prepare students to critically analyze workplace situations and take appropriate decisions.
- CO4.** To make students campus ready through proper behavioral and interpersonal grooming.
- CO5.** Integration of enhanced skill set to design and frame team based Project Report and Presentation.

MODULE I – INTERPERSONAL COMMUNICATON

- 1. The skills of Interpersonal Communication.
- 2. Gender/Culture Neutrality.
- 3. Rate of Speech, Pausing, Pitch Variation and Tone.
- 4. Corporate Communication.
- 5. Branding and Identity.

MODULE II- INTERPERSONAL COMMUNICATION BASED ON WORKPLACE COMMUNICATION

- 6. Workplace Communication.
- 7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
- 8. Communication with Clients, Customers, Suppliers etc.
- 9. Organizing/Participating in Business Meeting.
- 10. Note Taking.
- 11. Agenda.
- 12. Minutes.

MODULE III – BUSINESS ETIQUETTE AND CORPORATE LIFE

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

MODULE IV – MOVIE MAKING: CORPORATE BUSINESS MEETING

- 18. Team based Brainstorming.
- 19. Process Planning and Developing Plot.
- 20. People management.
- 21. Documentation and Scripting.
- 22. Shooting the Movie: Location and Camera.
- 23. Post Production and Editing.
- 24. Movie Review: Feedback and Analysis

List of Reference:

- 1. Interpersonal Communication, Peter Hartley, Routledge, 1993.

2. Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.
3. Transnational Business Cultures Life and Work in a Multinational Corporation, Fiona Moore, Ashgate, 2005.
4. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger Publishers, 2006.
5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.
6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.
7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.
8. Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

5th Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	EE 501	Electrical Machines – II	3	0	0	3	3
2	PC	EE 502	Power System – I	3	0	0	3	3
3	PC	EE 503	Control System – I	3	0	0	3	3
4	OE	EE 504	A. Data Structure	3	0	0	3	3
			B. Computer Network					
			C. Internet of Things					
5	PE	EE 505	A. Electrical Energy Conservation and Auditing	3	0	0	3	3
			B. Electromagnetic Waves					
			C. Illumination Engineering					
			D. Power Plant Engineering					
Total of Theory							15	15
B. PRACTICAL								
6	PC	EE 591	Electrical Machines – II Laboratory	0	0	3	3	1.5
7	PC	EE 592	Power System – I Laboratory	0	0	3	3	1.5
8	PC	EE 593	Control System – I Laboratory	0	0	3	3	1.5
9	OE	EE 594	A. Data Structure Laboratory	0	0	3	3	1.5
			B. Computer Network Laboratory					
			C. Internet of Things Laboratory					
10	PROJ	PR 591	Project – V	0	0	2	2	1
11	PROJ*	PR 592	Innovative Activities – IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Constitution of India	3	0	0	3	0
Total of Theory, Practical & Mandatory Activities / Courses							32	22.5

* Students may choose either to work on participation in Hackathons etc. Development of new product / Business Plan / registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry / NGO's / Government organizations / Micro / Small / Medium enterprises to make themselves ready for the industry / Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Electrical Machines - II

Course Code: EE 501

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

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

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

- CO1.** Demonstrate the applications of synchronous machine and fractional kW motors based on different types of requirement.
- CO2.** Understand the principle of operation and know performance of synchronous machine and fractional kW motors.
- CO3.** Illustrate different tests on electrical machine and determine the performance machines.

Course Content

MODULE – I: Synchronous Machines (21L)

Construction of 3-phase Synchronous Machines, Description of salient & non-salient rotor, Advantages of Stationary armature and Rotating field system, Name plate rating. 1L

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, Solution of problems. 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, Solution of problems. 1L

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. Solution of problems. 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 Vcurves. 1L

Hunting and its prevention. 1L

Applications of synchronous motor, Synchronous condenser. 1L

MODULE – II: Single-Phase Induction Motor (11L)

Construction, Concept of Pulsating Torque, Double-revolving field theory. 2L

Development of equivalent circuit, Determination of equivalent circuit parameters, Solution of problems. 2L

Methods of starting using auxiliary winding, Selection of capacitor value during starting and running, Solution of problems. 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

(4L)

Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper Motor.

2L

Construction and Operational characteristics of Induction generator and Linear Induction motor.

2L

Text Books:

1. Electrical Machines, Nagrath & Kothary, TMH
2. The performance and design of Alternating Current machines, M. G. Say, C.B.S Publishers & Distributors
3. Electrical Machinery, P.S. Bhimra, Khanna Publishers.
4. Electrical Machines, Ashfaq Husain, Dhanpat Rai & Co.
5. Electrical Machines, S.K.Bhattacharya, T.M.H Publishing Co. Ltd.

Reference Books:

1. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI
2. Electrical Technology, H.Cotton, C.B.S. Publisher New Delhi
3. Electric Machinery & Transforms, Irving L. Kosow, PHI
4. Electric Machinery, A.E.Fitzgerald, Charles Kingsley, Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
5. 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
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	-	-	2	-	-	-	-	-	-	-	-

Course Name: Power System - I
Course Code: EE 502
Contact: 3L:0T:0P
Total Contact Hours: 36
Credit: 3

Prerequisites: Concepts of basic electrical engineering, circuit theory and electrical machine.

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

- CO1.** Understand the concept of power system, know various power system components and define associated terms.
- CO2.** Know different type of power generation.
- CO3.** Understand basic performances of power system.

Course Content

Module 1: Basic Concept of Electrical Supply System **1L**

Structure of Power system, basic idea of transmission, distribution, tie lines, Grid networks etc.

Module 2: Generation of Electric Power **3L**

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 and 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 and 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 **3L**

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 **5L**

Types of cables, cable components, capacitance of single core and 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.

Module 7: Performance of Lines **8L**

Short, medium (nominal π , T) and long lines and their representation. ABCD 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 and 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
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-

Course Name: Control System - I
Course Code: EE 503
Contact: 3L:0T:0P
Total Contact Hours: 36
Credit: 3

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

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

- CO1.** Get knowledge of basic structure of control systems, define basic terminologies, components.
- CO2.** Modelling physical systems using transfer function to analyse system dynamic and steady state behaviour.
- CO3.** Understand the concept of feedback system and controllers, design compensators in frequency domain.

Course Content

Module 1: Introduction to Control System **2L**
 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 Modelling of Dynamic Systems **6L**
 Writing differential equations and determining transfer function of model of various physical systems including - Translational & Rotational mechanical systems, Basic Electrical systems and 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 **2L**
 Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tachogenerators, Actuators.

Module 4: Time Domain Analysis **8L**
 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 **4L**
 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 **8L**
 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 7: Control System Performance **4L**
 Improvement of system performance through compensation, Lead, Lag and Lead-Lag compensation.

Module 8: Case-studies**4L**

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:

1. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2. Control systems, K.R. Varmah, Mc Graw Hill
3. Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
4. Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, Pearson Education.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1

Course Name: Data Structure

Course Code: EE 504A

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites:

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

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

- CO1.** Differentiate how the choices of data structure and algorithm methods impact the performance of program.
- CO2.** Solve problems based upon different data structure and also write programs.
- CO3.** Identify appropriate data structure and algorithmic methods in solving problem.
- CO4.** Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.
- CO5.** 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	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

Text Books:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications.
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press.

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1st Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited.
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson.
4. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	2	2	3	3	3	2	3
CO2	3	2	2	2	2	2	3	2	2	3	3	2
CO3	3	3	3	2	3	3	3	2	2	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Course Name: Computer Network
Course Code: EE 504B
Contact: 3L:0T:0P
Total Contact Hours: 36
Credit: 3

Prerequisites:

1. Familiarity and knowledge of Operating Systems and Computer Architecture
2. Also require little bit programming languages concepts like C, Java

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

- CO1.** Understand OSI and TCP/IP models.
- CO2.** Analyze MAC layer protocols and LAN technologies.
- CO3.** Design applications using internet protocols.
- CO4.** Implement routing and congestion control algorithms.
- CO5.** Develop application layer protocols and understand socket programming.

Course Content

Module I: Introduction 6L

Introduction: Computer Network, data communication, topology, OSI and TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

3L

Physical Layer: Overview of data (analog and digital), signal (analog and digital), transmission (analog and digital) and transmission media (guided and unguided); Circuit switching: time division and 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**3L**

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Module VI: Socket Programming**1L**

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
3. Walrand – “Communication Networks” – TMH.
4. 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
CO1	-	2	-	2	-	-	-	-	2	-	-	-
CO2	-	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	2	-	-	-	2	-	-	-
CO4	2	2	-	-	2	2	-	-	2	-	-	-
CO5	3	3	-	-	3	-	-	-	2	-	-	-

Course Name: Internet of Things

Course Code: EE 504C

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Fundamental knowledge in computer networking and wireless sensor network.

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

- CO1.** To understand the concepts of Internet of Things.
- CO2.** To analyze basic protocols in wireless sensor network.
- CO3.** To design IoT applications in different domain and be able to analyze their performance.
- CO4.** To implement basic IoT applications on embedded platform.

Course Content

Module I: Fundamental of IoT

7L

The Internet of Things , Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

Module II: IoT and M2M

7L

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

Module III: Wireless Sensor Network

6L

Network and Communication aspects, Wireless medium access issues, MAC protocol , routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination.

Module IV: IoT Architecture

7L

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

Module V: IoT Applications for Value Creations

5L

Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and internet technologies, Maximize safety, security and reliability through high precision automation and control, Advanced Metering Infrastructure (AMI), Smart Inverters, Remote control operation of energy consuming devices.

Module VI: Internet of Things Privacy, Security and Governance**4L**

Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in smart cities, Security.

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

Reference Books:

1. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1-4493-9357-1
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice".

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	-	-	-	-	2
CO2	3	3	2	2	2	1	1	-	-	-	-	2
CO3	3	2	3	2	3	3	3	-	1	2	2	2
CO4	3	2	3	1	3	3	3	-	1	2	2	2

Course Name: Electrical Energy Conservation and Auditing

Course Code: EE 505A

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Electrical Machines and Power Systems.

Course Outcome:

- CO1.** Identify the demand supply gap of energy in Indian scenario.
- CO2.** Carry out energy audit of an industry/Organization.
- CO3.** Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.
- CO4.** Select appropriate energy conservation method to reduce the wastage of energy.
- CO5.** Evaluate the techno economic feasibility of the energy conservation technique adopted.

Course Content

Module 1: 5L

Energy Conservation and Environment: Electricity Act 2003, Integrated Energy Policy. Energy and environment, Air pollution, Climate change, United Nations Framework Convention on climate change (UNFCCC), Montreal Protocol, Kyoto Protocol, Clean Development Mechanism (CDM), CDM methodology and Procedures, Sustainable development.

Module 2: 9L

Electrical Systems: Supply and Demand Side, Economic operation, Input-Output curves, Load profiling, Electricity tariff types;

Energy auditing: Necessity of Energy audit, Types of energy audit, Energy audit instruments and intervals of EA regulation. Energy Conservation Act-2001 and its features, Notification Under the act, Designated agencies, Schemes of Bureau of Energy Efficiency (BEE);

Energy Economics: Economic assessment and Economic methods for specific energy analysis.

Module 3: 6L

Electric motors: Energy efficient controls and starting efficiency-Motor Efficiency and Load Analysis- Energy efficient /high efficient Motors-Case study; Load Matching and selection of motors.

Variable speed drives; Pumps and Fans-Efficient Control strategies- Optimal selection and sizing – Optimal operation and Storage; Case study

Module 4: 7L

Electrical Demand Side: Transformer Loading/Efficiency analysis, Feeder/cable loss evaluation, case study. Reactive Power management-Capacitor Sizing-Degree of Compensation, Peak Demand controls-Methodologies-Types of Industrial loads-Optimal Load scheduling-case study; Lighting-Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study;

Module 5: 9L

Cogeneration: Types and Schemes;

Electric loads and Energy conservation measures: Air conditioning and Refrigeration, Cold storage-Types-Optimal operation-case study; Electric water heating-Geysers-Solar Water Heaters-

Power Consumption in Compressors, Energy conservation measures; Electrolytic Process;

Computer Controls: Hardware, Software-EMS.

Text Books:

1. Leon K. Kirchmayer, “Economic Operation of power system”, Wiley India Pvt Ltd, July 2010.
2. Jean-Claude Sabonnadiere, “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
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	-	-	2	-	1	-	-	-	-	-	-	-
CO4	-	-	2	2	-	-	-	-	-	-	-	-
CO5	2	1	2	-	1	-	-	-	-	-	-	-

Course Name: Electromagnetic Waves

Course Code: EE 505B

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Physics, Mathematics and Basic Electrical Engineering.

Course Outcome:

- CO1.** Understand the propagation of EM waves associated with different Electrical Networks.
- CO2.** Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.
- CO3.** Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.
- CO4.** Apply concepts of Antenna Engineering and its applications.

Course Content

Module 1: Electromagnetic Waves

6L

Maxwell's equations, Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power and Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems.

Module 2: Transmission Lines

4L

Concept of lumped and distributed parameters, Line parameters, Transmission line equation and solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems

Module 3: Waveguides

3L

Parallel planes waveguides, Rectangular waveguides, Circular waveguides, Power transmission in waveguides, Dielectric slab waveguides, Application of waveguides.

Module 4: Antenna Parameters and Characteristics

5L

Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Yagi-Uda array, Array Antennas.

Module 5: Radio Wave Propagation

3L

Different modes of propagation, Tilt, Sky wave propagation, MUF maximum Usable frequency, Skip distance, Critical frequency, Virtual height.

Module 6: Space Wave Propagation

3L

Space wave propagation, Modified refractive index, Diffraction, Anomalous propagation, Duct propagation, Tropospheric propagation.

Text Books:

1. Quantum Field Theory, Lewis H. Ryder, 2nd Edition, Cambridge University Press.
2. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University press.
3. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
4. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH

5. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
6. 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.
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-

Course Name: Illumination Engineering

Course Code: EE 505C

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Physics, Basic Electrical Engineering.

Course Outcome:

- CO1.** Analyse the fundamentals of illumination and its measurements with different apparatus.
- CO2.** Explain the characteristics of various types of lamp with their accessories and their control circuits.
- CO3.** Demonstrate the interior and exterior lighting.

Course Content

Module 1: Fundamentals of Light

5L

Types of illumination, Theory of gas discharge and production of light, Perception of light and colour, Radiation of energy, Electromagnetic radiation and Electromagnetic spectrum, Human eye as an optical system, Spectral sensitivity of human eye, Visual characteristics and Visual performance.

Module 2: Measurement of Light

7L

Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Photometry – Fundamentals of detector, Application of Polar Photometer and Goniophotometer, Calculation of luminance and illumination, Luxmeter, CIE standard source of illuminant, Colorimetry – Source colour and Object colour. Colorimetric instrument, Colour rendering index.

Module 3: Lamp, Accessories and Luminaries

9L

Lamp materials – glass, filament, phosphor coating, ceramics, electrodes, gases, capping cement etc., Theory and basic properties of low and high pressure gas discharge. Theory of operation, Life, Characteristics and Application of - High and Low pressure sodium vapour, High and Low pressure mercury vapour, Metal halide, Fluorescent lamp, LED, LASER, Luminaire – Types of luminaire, Design consideration, Indian standard recommendation.

Module 4: Illumination Control and Control circuits

6L

Purpose of lighting control in view of energy conservation, Operation of Electromagnetic and Electronic ballast and their comparison in light control, Function of Ignitor in lamps, Control circuits and operation of Fluorescent lamp circuit, Low pressure sodium vapour lamp circuit, High pressure sodium vapour lamp circuit.

Module 5: Interior Lighting

6L

National standards of interior lighting calculation, Design considerations for interior lighting of Residential complex, Commercial complex, Industrial premises, Day lighting – Sky luminance pattern, Daylight factor, estimation of average daylight factor, window design considerations for maximum day lighting, Application of daylight in interior lighting, Use of photocell, occupancy sensor in lighting controls, Concept of Isolux contour in lighting design.

Module 6: Exterior Lighting**3L**

Lighting calculations of exterior lighting, Calculation of lighting and design considerations for exterior lighting of Road lighting, Flood lighting, Industrial complex, Commercial complex, Sports complex, National and CIE standards of exterior lighting calculation.

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
CO1	3	2	2	-	2	3	2	-	-	-	3	3
CO2	3	2	1	3	3	3	-	-	-	-	3	3
CO3	3	1	2	-	3	3	-	-	-	-	3	3

Course Name: Power Plant Engineering

Course Code: EE 505D

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Energy Conversion.

Course Outcome:

- CO1.** Understand the principles of operation for different power plants.
- CO2.** Understand the economics of operation for different power plants.
- CO3.** Analyse the interconnection between different power plants.

Course Content

Module 1: Basics of Power Generation 2L

Importance of electrical power in daily life, Different forms of energy, Comparison of different energy sources, Power crisis in India and Future Trend, Overview of method of electrical power generation.

Module 2: Coal Based Thermal Power Plants 8L

List of thermal power stations in the state with their capacities, basic Rankine cycle and its modifications, Selection of site for thermal power stations, Layout of modern coal power plant, Quality of fuel and its effect on quality of power generation, Operation of different components – Super critical boilers, FBC boilers, Economizer, Air pre heater, Super-heaters and re-heaters, Steam turbines, Condensers, Spray ponds and cooling towers, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems, Merits and demerits of Thermal Power Plants.

Module 3: Nuclear Power Stations 6L

Basics of nuclear energy conversion, Selection of site for Nuclear Power plants, Block diagram and working of Nuclear Power station, Fuels used in Nuclear Power Station, subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants, Merits and demerits of Nuclear Power Plants, List of Nuclear power stations in state and county with their capacities.

Module 4: Hydro Power Stations 5L

Selection of site and classification of Hydroelectric Power Plants, Layout and working of Hydro Power Station, Types of Turbines and generators used, Pumped storage Power Plant, Merits and demerits of Hydro Power Station, List of Hydro Power stations with their capacities and number of units in the state.

Module 5: Gas Turbine Power Plants 3L

Selection of site for Gas Turbine Power Station, Fuels for gas turbine, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems, Merits, demerits and application Gas turbine power plants.

Module 6: Diesel Electric Power Stations 3L

Selection of site for Diesel Electric Power Station, Elements of diesel Electric power plants and

their working, Operation, maintenance & trouble shooting, chart of diesel Electric plant, Merits, demerits and applications of diesel electric power stations, Performance and thermal efficiency of Diesel Electric Power Plant.

Module 7: Non-Conventional Energy Sources

3L

Principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

Module 8: Economics of Power Generation

3L

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, firm power, cold reserve, hot reserve, spinning reserve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Module 9: Interconnected Power Systems

3L

Advantages of Interconnection, Base load and peak loads, load allocation among various types of power stations, Load sharing and transfer of load between power stations, Inter connection of power stations at state and national level.

Text Books:

1. P.K. Nag – Power plant Engineering, Tata McGraw – Hill.
2. T. C. Elliot, K. Chen and R. C. Swanekamp, Power Plant Engineering, 2nd ed., McGraw Hill, 1998.
3. M. M. El Wakil, Power Plant Technology, Tata McGraw Hill, 2010.
4. Arora and Domkundwar – A course in Power plant Engineering, Dhanpat Rai & Sons.

Reference Books:

1. Godfrey Boyle, Renewable Energy, Oxford University Press.
2. Soni, Gupta and Bhatnagar, A course in Electrical Power, Dhanpatrai & Sons.
3. Dr. S. L. Uppal, Electrical Power, Khanna Publishers.
4. Umesh Rathore, Energy Management, S.K.Katharia & Sons
5. K.K. Ramalingam, Power Plant Engineering, Scitech Publication (India) Pvt. Ltd.
6. S P Sukhatme, Solar Energy, Tata McGrawhill Publishing co. Ltd.
7. A.K.Raja, M. Dwibedi and A.P.Srivastava, Introduction to Non-conventional Energy sources, Scitech Publication (India) Pvt. Ltd.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3	-	-	-	-	-	-	-	2	-
CO3	2	-	3	-	-	-	2	-	-	-	2	-

Course Name: Electrical Machines – II Laboratory
Course Code: EE 591
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Concepts of Electrical Machine.

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

- CO1.** Perform different tests on Three-Phase A.C. Generators, Synchronous Motors and Single-Phase Induction Motor.
- CO2.** Interpret the observed result using theoretical knowledge and hence calculate unknown parameters.

List of Experiment (At least *ten* experiments to be performed):

1. To observe the effect of excitation and speed on induced e.m.f of a three-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 [X_d] and quadrature reactance [X_q] of a 3-phase synchronous machine by slip test.
4. Parallel operation of three-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 Three-Phase 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.
10. Innovative Experiments.

N.B.: Experiment No. 2(a) and 2(b) may be considered as separate experiment.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	-	-	-	3	2	-	-
CO2	2	-	-	3	-	-	-	-	3	2	-	-

Course Name: Power System – I Laboratory
Course Code: EE 592
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Concepts of Power System.

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

- CO1.** Able to estimate performance of Transmission Line and Distribution line.
- CO2.** Able to select line support for a particular Transmission Line.
- CO3.** Able to explain methods of active and reactive power control.
- CO4.** Able to test the reliability of different components of Transmission Line and Distribution Line.

List of Experiment:

1. Draw the Schematic diagram of structure of power system and power transmission line and Symbol of Electrical Equipment.
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 System – I.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	-	-	-	3	2	-	-
CO2	2	-	-	3	-	-	-	-	3	2	-	-
CO3	2	-	-	3	-	-	-	-	3	2	-	-
CO4	2	-	-	3	-	-	-	-	3	2	-	-

Course Name: Control System – I Laboratory
Course Code: EE 593
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Concept of Simulation Software and Control System.

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

- CO1.** Simulate, analyze system behaviour using software simulator/hardware.
- CO2.** Design compensators, controllers to meet desired performance of system.

List of Experiment:

1. Familiarization with MATLAB control system tool box, MATLAB simulink tool box and PSPICE.
2. Determination of Step response for first order and Second order system with unity feedback on CRO and calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response and Impulse response for Type-0, Type-1 and Type-2 system with unity feedback using MATLAB and PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system and 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 and Simulink for Engineers, Agam Kumar Tyagt, Oxford.
2. Modeling and Simulation Using MATLAB - Similink, Dr. S. Jain, Wiley India.
3. MATLAB and Its Application in Engineering, Raj K Bansal, A.K. Goel and 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
CO1	2	-	-	3	-	-	-	-	3	2	-	-
CO2	2	-	-	3	-	-	-	-	3	2	-	-

Course Name: Data Structure Laboratory
Course Code: EE 594A
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Computer Fundamentals and Principal of Computer Programming Laboratory.

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

- CO1.** Choose appropriate data structure as applied to specified problem definition.
- CO2.** Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.
- CO3.** Have practical knowledge on the applications of data structures.
- CO4.** Able to store, manipulate and arrange data in an efficient manner.
- CO5.** Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

List of Experiment:

1. Write a C program to implement Single Link List.
2. Write a C program to implement Double Link List.
3. Write a C program to implement Single Circular Link List.
4. Write a C program to implement Double Circular Link List.
5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
6. Write a C program to convert a given infix expression into its postfix Equivalent.
7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
8. Write a C program to implement Binary Search Tree (BST).
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
 - a) Insertion sort
 - b) Merge sort
10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
 - a) Quick sort
 - b) Selection sort
11. Write C programs for implementing the following searching methods:
 - a) Linear Search
 - b) Binary Search
 Write a C program to implement all the functions of a dictionary (ADT) using hashing.
12. Write C programs for implementing the following graph traversal algorithms:
 - a) Depth first search
 - b) Breadth first search

Text Books:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill

Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications

3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	1	-	1	-	-
CO2	3	2	2	-	2	2	1	-	-	1	-	2
CO3	2	1	1	-	-	-	-	1	-	-	-	-
CO4	3	2	-	2	-	1	1	-	1	-	1	-
CO5	1	-	2	1	2	-	-	1	1	-	1	2

Course Name: Computer Network Laboratory

Course Code: EE 594B

Contact: 0L:0T:3P

Credit: 1.5

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

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

- CO1.** Demonstrate the socket program using TCP and UDP.
- CO2.** Develop simple applications using TCP and UDP.
- CO3.** Develop the code for Data link layer protocol simulation.
- CO4.** Examine the performances of Routing protocol.
- CO5.** Experiment with congestion control algorithm using network simulator.

List of Experiment:

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. Socket Programming using TCP and UDP. 18L
3. Implementing routing protocols such as RIP, OSPF. 2L
4. Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS. 4L
5. Server Configuration: only web server (If time permit..instructor can do more than that). 6L

Text Books:

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
CO1	3	3	3	2	3	2	1	-	3	2	2	3
CO2	3	3	3	2	3	3	2	3	3	2	2	3
CO3	3	3	3	2	2	1	2	1	3	2	2	3
CO4	3	3	3	1	2	2	1	3	3	2	2	3
CO5	3	3	3	2	2	2	1	2	3	2	2	3

Course Name: Internet of Things Laboratory
Course Code: EE 594C
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites:

1. Fundamental knowledge in computer networking and wireless sensor network.
2. Basic Programming Knowledge.

Course Outcomes: After successful completion of this course, student will be able

- CO1.** To understand the concepts of Internet of Things.
- CO2.** To explain the IoT tools like Arduino Uno, Raspberry Pi.
- CO3.** To design IoT applications in different domain and be able to analyze their performance.
- CO4.** To implement basic IoT applications on embedded platform.

Major Equipment:

1. Raspberry pi.
2. Arduino.

List of Experiment:

1. Introduction to various sensors and various actuators and its Application. Perform experiment using Arduino Uno using following Ultrasonic Sensor: [9L]
 - a) PIR Motion Sensor.
 - b) Rain Drop Sensor.
 - c) Moisture Sensor.
 - d) Temperature Sensor.
 - e) Touch Sensor.
 - f) Infrared Sensor.
 - g) Servo Moto.
 - h) RFID Sensor.
 - i) Bluetooth Module.
 - j) Wi-Fi Module.
2. Getting Started with ESP8266 Wi-Fi SoC and hands on. [6L]
3. Demonstrate NodeMCU and its working principal. [3L]
4. Create a circuit using Arduino and sensors. Perform experiment using Arduino Uno to Learn Working of Servo Motor. [6L]
5. Define and Explain Eclipse IoT Project, List and summarize few Eclipse IoT Projects. [3L]
6. Creating a webpage and display the values available through Arduino. [3L]
7. Demonstration of Setup & Working principal of Raspberry Pi. [6L]
8. Connect Raspberry Pi with your existing system components. [3L]

Text books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Reference books:

1. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

2. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks: Theory and Practice”.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	--	--	--	--	2
CO2	3	3	2	2	2	1	1	--	--	--	--	2
CO3	3	2	3	2	3	3	3	--	1	2	2	2
CO4	3	2	3	1	3	3	3	--	1	2	2	2

Course Name: Constitution of India

Course Code: MC 501

Contact: 3L:0T:0P

Prerequisites: NA.

Course Outcome:

- CO1.** Develop human values, create awareness about law ratification and significance of Constitution.
- CO2.** Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.
- CO3.** Create understanding of their Surroundings, Society, Social problems and their suitable solutions.
- CO4.** Familiarize with distribution of powers and functions of Local Self Government.
- CO5.** Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course Content

- | | | |
|-----|--|----|
| 1. | Meaning of the constitution law and constitutionalism | 2L |
| 2. | Historical perspective of the Constitution of India | 2L |
| 3. | Salient features and characteristics of the Constitution of India | 1L |
| 4. | Scheme of the fundamental rights | 2L |
| 5. | The scheme of the Fundamental Duties and its legal status | 2L |
| 6. | The Directive Principles of State Policy – Its importance and implementation | 2L |
| 7. | Federal structure and distribution of legislative and financial powers between the Union and the States | 3L |
| 8. | Parliamentary Form of Government in India – The constitution powers and status of the President of India | 2L |
| 9. | Amendment of the Constitutional Powers and Procedure | 2L |
| 10. | The historical perspectives of the constitutional amendments in India | 2L |
| 11. | Emergency Provisions: National Emergency, President Rule, Financial Emergency | 3L |
| 12. | Local Self Government – Constitutional Scheme in India | 3L |
| 13. | Scheme of the Fundamental Right to Equality | 2L |
| 14. | Scheme of the Fundamental Right to certain Freedom under Article 19 | 2L |
| 15. | Scope of the Right to Life and Personal Liberty under Article 21. | 2L |

Text Books:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	2	3	-	-	-	2
CO2	-	-	-	-	-	3	2	3	-	-	-	2
CO3	-	-	-	-	-	3	2	3	-	1	-	2
CO4	-	-	-	-	-	3	2	3	-	1	-	2
CO5	-	-	-	-	-	3	2	3	-	1	-	2

6th Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	EE 601	Microprocessor and Microcontroller	3	0	0	3	3
2	PC	EE 602	Power System – II	3	0	0	3	3
3	PC	EE 603	Control System – II	3	0	0	3	3
4	OE	EE 604	A. Data Base Management System	3	0	0	3	3
			B. Embedded Systems					
			C. Software Engineering					
5	PE	EE 605	A. Digital Signal Processing	3	0	0	3	3
			B. High Voltage Engineering					
			C. Computer Architecture					
Total of Theory							15	15
B. PRACTICAL								
6	PC	EE 691	Microprocessor and Microcontroller Laboratory	0	0	2	2	1
7	PC	EE 692	Power System – II Laboratory	0	0	3	3	1.5
8	PC	EE 693	Control System – II Laboratory	0	0	3	3	1.5
9	OE	EE 694	A. Data Base Management System Laboratory	0	0	3	3	1.5
			B. Embedded Systems Laboratory					
			C. Software Engineering Laboratory					
10	PROJ	PR 691	Project – VI	0	0	2	2	1
11	PROJ*	PR 692	Innovative Activities – V	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion – I	0	0	3	3	0
Total of Theory, Practical & Mandatory Activities / Courses							31	22

* Students may choose either to work on participation in all the activities of Institute's Innovation Council for e.g., IPR workshop / Leadership Talks / Idea / Design / Innovation / Business Completion / Technical Expos etc.

Innovative activities to be evaluated by the Programme Head / Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Microprocessor and Microcontroller
Course Code: EE 601
Contact: 3L:0T:0P
Total Contact Hours: 36
Credit: 3

Prerequisites: Knowledge in Digital Electronics.

Course Outcome:

- CO1.** Able to correlate the architecture, instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085.
- CO2.** Able to interpret the 8086 microprocessor-Architecture, Pin details, memory segmentation, addressing modes, basic instructions, interrupts.
- CO3.** Recognize 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.
- CO4.** Apply instructions for assembly language programs of 8085, 8086 and 8051.
- CO5.** Design peripheral interfacing model using IC 8255, 8253, 8251 with IC 8085, 8086 and 8051.

Course Content

Module 1: 8085 Microprocessor [6]

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 [2]

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 [8]

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

Module 4: Assembly language programming with 8086 [3]

Addition, Subtraction, Multiplication, Block, Transfer, ascending order, descending order, Finding largest & smallest number etc.

Module 5: 8051 Microcontroller [7]

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 [4]

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

[6]

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.

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
6. 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
CO1	3	3	3	1	3	1	1	1	1	1	1	3
CO2	3	3	3	1	3	1	1	1	1	1	1	3
CO3	3	3	3	3	3	2	2	1	1	1	2	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3
CO5	3	3	3	3	3	1	2	1	2	2	2	3

Course Name: Power System – II

Course Code: EE 602

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Basic Electrical Engineering, Circuit Theory, Electrical Machines – II, Power System – I.

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

- CO1.** Learn about advance structure of Power System.
- CO2.** Get depth knowledge of different types of power system protection, fault, stability analysis and load flow method.
- CO3.** Design and analysis of different types of substation and implement these ideas in industry or real life problem solve.

Course Content

MODULE – I: Representation of Power System Components [4L]

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, Earthing (system and equipment), feeder and distributors, radial and loop systems.

MODULE – II: Basic Idea of Real and Reactive Power Control [2L]

Introduction to Real and Reactive Power Control (SMIB) Single machine connected to Infinite Bus.

MODULE – III: Load Flow Studies [7L]

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 – IV: 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 – V: Faults in Electrical Systems [7L]

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, L-G fault, L-L fault, L-L-G fault.

MODULE – VI: Power System Protection [12L]

i) Operating Principles and Relay Constructions: 6L

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 and 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) Translay Relay, Directional Relay (Single Phase Directional Relays), Negative Sequence

Relays, Under Frequency Relays, Over Current Relays, Static Relays (Transducer 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 and 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:

6L

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 Breakers. Testing of Circuit Breakers.

Text Books:

1. Electrical Power System, Subir Roy, Prentice Hall
2. Power System Engineering, Nagrath & Kothary, 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.
6. A Course in Power Systems, J.B. Gupta, S.K. Kataria & Sons.

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
CO1	3	-	-	3	-	-	-	-	-	-	-	1
CO2	-	3	2	3	-	-	-	-	-	-	-	1
CO3	3	-	2	-	-	2	-	-	-	-	-	1

Course Name: Control System – II

Course Code: EE 603

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Any introductory course on Matrix Algebra, Calculus, Engineering Mechanics.

Course Outcome:

- CO1.** Express and Solve system equations in state-variable form (state variable models).
- CO2.** Students will be able to analyze and design of discrete time control systems using z transform.
- CO3.** 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 [13L]

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 [13L]

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, McGraw 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
CO1	3	1	-	-	-	1	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1

Course Name: Data Base Management System

Course Code: EE 604A

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

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

- CO1.** Apply the knowledge of Entity Relationship (E-R) diagram for an application.
- CO2.** Create a normalized relational database model.
- CO3.** Analyze real world queries to generate reports from it.
- CO4.** Determine whether the transaction satisfies the ACID properties.
- CO5.** Create and maintain the database of an organization.

Course Content

Module 1: Introduction [3L]

Concept and 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 and Index Structures [6L]

File and 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
CO1	2	2	2	2	3	2	1	1	2	2	3	3
CO2	2	3	3	3	3	1	1	1	2	2	3	3
CO3	3	3	2	3	3	2	2	2	3	3	3	3
CO4	3	3	2	2	2	1	1	1	1	1	2	3
CO5	3	3	3	3	3	2	2	2	3	3	3	3

Course Name: Embedded Systems

Course Code: EE 604B

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Digital Electronics, Microprocessor and Microcontrollers.

Course Outcome:

- CO1.** To familiarize with concepts related to the fundamental principles embedded systems design, explain the process and apply it.
- CO2.** To understand knowledge of the advanced Embedded technology both for hardware and software.
- CO3.** To understand Hardware/Software design techniques for microcontroller-based embedded systems and apply techniques in design problems.
- CO4.** To develop Embedded System programming in C and assembly language using Integrated Development Environments and using debugging technique.

Course Content

Module I: Introduction to Embedded System [12L]

Basics of Embedded computer Systems, Microprocessor and Microcontroller difference, Hardware architecture and software components of embedded system List of various applications [Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.], Difference between embedded computer systems and general-purpose computer Systems. Characteristics of embedded systems, Classifications of embedded system.

Module II: Hardware Software Co-Design [16L]

Co-Design Types: Microprocessors/Microcontrollers/DSP based Design, FPGA/ASIC/pSOC based Design, Hybrid Design. Methodology: i) System specifications; ii) co-specifications of hardware and software; iii) System Design Languages (capturing the specification in a single Description); iv) System modelling/simulation; v) Partitioning (optimizing hardware/software partition); vi) Co-verification (simulation interaction between custom hardware and processor) f) Co-implementation; vii) Embedded Systems Design development cycle. Programming concepts and embedded programming in C.

Module III: Real Time Operating System (RTOS) [8L]

Introduction, Types, Process Management, Memory Management, Interrupt in RTOS, Task scheduling, Basic design using RTOS; Basic idea of Hardware and Software testing in Embedded Systems

Text Books:

1. Embedded system Design: Peter Marwedel, Springer
2. Embedded Systems - Raj Kamal
3. Embedded Systems - K. Shibu

Reference Books:

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
2. R. Kamal, "Embedded System", McGraw Hill Education, 2009.
3. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	1	-	-	-	1	1	-	1
CO2	3	2	2	-	-	-	-	1	2	1	-	1
CO3	3	2	1	2	1	1	-	-	2	1	-	-
CO4	3	2	2	1	1	1	-	1	2	1	-	1

Course Name: Software Engineering

Course Code: EE 604C

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites:

1. An understanding of basic computer software.
2. Object Oriented programming skills.

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

- CO1.** Understand the structure and behaviour a software system the UML class diagrams and state diagrams.
- CO2.** Understand common lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches.
- CO3.** Apply software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level.
- CO4.** Work collaboratively in a small team environment to develop a moderate-sized software system from conceptualization to completion, including requirements elicitation, system modelling, system design, implementation, unit and system testing, integration, source code management configuration management, and release management.
- CO5.** Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery).

Course Content

Module I: Introduction

3L

Definition of SE, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs SE, Human cognition mechanism, SE principle- abstraction and decomposition.

Module II: Software life-cycle models

4L

Water fall model, V Model, Prototyping Model, Spiral Model, RAD Agile Model.

Module III: Software Project Management

10L

Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning.

Module IV: Requirement analysis and specification

4L

SRS, Requirement gathering and specification, Functional requirement, Traceability, 4GL.

Module V: Software Design

7L

Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Object oriented design- class and relationship, Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements

Module VI: Coding and Testing**10L**

Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclomatic Complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing.

Module VII: Software Reliability and Quality Management**5L**

Reliability, Hazard, MTTF, Repair and Availability, Software quality, SEI CMM and ISO-9001. Software reliability and fault-tolerance, Six sigma

Module VIII: Computer-aided software engineering (CASE)**4L**

Environment and benefit, Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001.

Text Books:

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition.

Reference Books:

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	1	1	-	-	-	-	-	3
CO2	3	3	-	3	-	-	2	-	1	2	2	3
CO3	3	3	2	3	3	2	-	-	-	3	3	3
CO4	3	3	1	2	-	-	-	-	2	-	2	3
CO5	3	3	-	1	2	-	1	-	-	1	3	3

Course Name: Digital Signal Processing

Course Code: EE 605A

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 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, Parseval's relation, Inverse Z-transform by Residue method, power series & partial-fraction expansions.

Course Outcome:

- CO1.** Able to define discrete systems in the Frequency domain using Fourier analysis tools like DFT, FFT.
- CO2.** Able to interpret the properties of discrete time signals in time domain and frequency domain.
- CO3.** Able to describe finite word length effects and digital filters.
- CO4.** Able to analyse convolution for long sequences of data.
- CO5.** Able to implement digital filters.

Course Content

MODULE – I: Discrete-time Signals and Systems

6L

i) Discrete-time signals:

Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences, periodic, energy, power, unit-sample, unit step, unit ramp and complex exponentials, arithmetic operations on sequences.

ii) LTI systems:

Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems.

MODULE – II: Z-Transforms

4L

Definition, mapping between s-plane and Z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z-transform, initial value theorem, Parseval's relation, inverse Z-transform by contour integration, power series and partial-fraction expansions with examples and exercises.

MODULE – III: Fourier Transforms

10L

i) Discrete Time Fourier Transform (DTFT):

Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.

ii) Discrete Fourier Transform:

Concept and relations for DFT/IDFT, Relation between DTFT and DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences Overlap-Save and Overlap-Add methods with examples and exercises.

iii) Fast Fourier Transforms:

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT and DIF FFT, Butterfly computations and exercises.

MODULE – IV: Filter Design**10L**

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

MODULE – V: Digital Signal Processor**6L**

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language to measure A.C. and D.C. voltage, current, power and energy.

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.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. 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
CO1	3	3	1	1	-	2	-	2	2	2	2	3
CO2	3	2	2	1	2	3	-	2	2	1	2	3
CO3	3	3	1	3	2	3	1	2	2	1	2	3
CO4	3	2	1	3	-	3	1	3	1	1	1	3
CO5	3	2	-	1	-	-	1	1	1	2	2	1

Course Name: High Voltage Engineering

Course Code: EE 605B

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisites: Concept of Basic Physics, Measurement and Instrumentation, Fundamentals of Power System, Switchgear, Travelling waves.

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

- CO1.** Understand the basic physics associated with various breakdown processes in different insulating materials.
- CO2.** Knowledge of generation and measurement of A. C., D.C., Impulse voltages and currents.
- CO3.** Knowledge of tests on H.V. equipment and on insulating materials, as per the standards.
- CO4.** 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 6L

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 4L

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

8L

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. Bgumudre, 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
CO1	3	3	1	-	-	-	-	-	-	-	2	3
CO2	3	3	1	-	-	-	-	-	-	-	2	3
CO3	3	2	2	-	-	-	-	-	-	-	2	3
CO4	3	3	2	-	-	-	-	-	-	-	2	3

Course Name: Computer Architecture
Course Code: EE 605C
Contact: 3L:0T:0P
Total Contact Hours: 36
Credit: 3

Prerequisites: Digital Electronics and Computer Organization.

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

- CO1.** Learn pipelining concepts with a prior knowledge of stored program methods.
- CO2.** Learn about memory hierarchy and mapping techniques.
- CO3.** Study of parallel architecture and interconnection network.

Course Content

Module – 1: Introduction	[5L]
Introduction to basic computer architecture.	1L
Stored Program Concepts: Von Neumann & Harvard Architecture	1L
RISC VS CISC	1L
Amdahl's law.	1L
Performance Measure: MIPS, Benchmark Programs (SPECINT, SPECFP).	1L
Module – 2: Pipelining	[6L]
Pipelining: Basic concepts, Linear vs. Non Linear, Static vs. Dynamic, Unifunction vs. Multifunction.	2L
Instruction Pipeline.	1L
Arithmetic pipeline.	1L
Hazards: Data hazards, control hazards and structural hazards.	1L
Techniques for handling hazards.	1L
Module – 3: Instruction-level parallelism	[4L]
Instruction-Level Parallelism: Basic Concepts	1L
Techniques For Increasing ILP, Superscalar, Super Pipelined	1L
VLIW Processor Architectures	1L
Array and Vector Processors	1L
Module – 4: Memory	[5L]
Memory Hierarchy: Internal Memory, Main Memory, Cache Memory, Secondary memory.	2L
Mapping Technique in cache memory: Direct, Full Associative and Set Associative.	2L
Performance Implementation in Cache Memory.	1L
Module – 5: Multiprocessor Architecture	[16L]
Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW, CREW, CRCW)	6L
Interconnection Network (Omega, Baseline, Butterfly, Crossbar)	6L
Multi-Core Processor with case study (INTEL)	2L
Different Classification scheme: Serial Vs. Parallel, Pipeline vs. Parallel	2L

Text Books:

1. Patterson D.A. and Hennessy, J.L. "Computer architecture a quantitative approach", 2nd ed., Morgan Kaufman, 1996

2. Stone, H.S., “Advanced Computer”, Addison Wesley, 1989
3. Siegel, H.J., “Interconnection Network for Large Scale parallel Processing”, 2nd Ed., McGraw Hill, 1990

Reference Books:

1. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH
2. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill
3. Design and Analysis of Parallel Algorithm-Schim G. Akl

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	-	-	-	-	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-

Course Name: Microprocessor and Microcontroller Laboratory
Course Code: EE 691
Contact: 0L:0T:2P
Credit: 1

Prerequisites: Knowledge in Digital Electronics.

Course Outcomes:

- CO1.** Able to handle arithmetic and Logical operations, using assembly language programming in 8085 & 8086 Trainer Kits.
- CO2.** Able to Program using arithmetic, logical and bit manipulation instructions of 8051.
- CO3.** Able to validate the interfacing technique of 8255 Trainer kit with 8085 & 8086 through Subroutine Call and IN/OUT instructions like glowing LEDs accordingly, to control stepper motor rotation, interfacing Seven Segment Display and to display a string etc.
- CO4.** Able to program and verify Timer/Counter and Interrupt handling in 8051.

List of Experiment:

Demonstration Programs for 8085 Trainer Kit

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.

Demonstration Programs for 8086 Trainer Kit

4. Addition, Subtraction, Multiplication & division of two 16-bit numbers using 8086 trainer kit
5. Factorial of two 16-bit numbers using 8086 trainer kit
6. Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method using 8086 trainer kit.

Interfacing with 8086

7. Interfacing Stepper motor with 8086 trainer kit using 8255
8. Interfacing Seven Segment Display using 8086 trainer kit and to display a string

Interfacing with 8051

9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051
11. Program and verify Interrupt handling in 8051

Additional Programs

12. Read a character from a keyboard and display it on Screen
13. Display a string on screen
14. To check for a Password

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3	1	1	1	1	1	1	3
CO2	3	3	3	1	3	1	1	1	1	1	1	3
CO3	3	3	3	3	3	2	2	1	1	1	2	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3

Course Name: Power System – II Laboratory
Course Code: EE 692
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: Circuit Theory, Electrical Machines – I, Power System – I.

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

- CO1.** Analyse the testing, operation and response of protection of electrical instruments.
- CO2.** Conduct experimental investigation and gain knowledge of various parts of relays and its operation.
- CO3.** Able to incorporate the measuring error with actual value and calibrate the instrument transformers.
- CO4.** Enhance the capability of software analysis by load flow solution in ETAP, MATLAB etc.

List of Experiment:

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, MAT Lab 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 Micon 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
CO1	-	3	-	-	-	1	-	-	-	-	-	-
CO2	-	3	3	-	-	1	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	3	-	3	2	-	-	-	-	-	-	-	-

Course Name: Control System – II Laboratory

Course Code: EE 693

Contact: 0L:0T:3P

Credit: 1.5

Prerequisites: Knowledge of MATLAB.

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

- CO1.** Conduct experiments on Position Control with proper tuning of P, PI and PID controller.
- CO2.** Demonstrate Lead-Lag Compensators.
- CO3.** Investigate the response of a Real Time System using State Variable Analysis.
- CO4.** Analyse Performance of Discrete-Time System an Non-Linear System.

List of Experiment:

- 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 Cacsad Tools:**
Plant transfer function will be provided. Step response is to be obtained. (PSPICE, MATLAB, SciLab may be used).
- 4. State Variable Analysis using Cacsad Command Tool:**
Familiarization and use of CACSAD 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 CACSAD 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 Cacsad 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. CACSAD block diagram tool will be used (PSPICE, MATLAB, SciLab may be used).

Note: From the list of experiments a minimum of 7 (seven) experiments shall have to be performed by each student.

Reference Books:

1. Herniter, Programming in MATLAB, Vikas
2. Ogata K : Modern Control Engg. 4e, Pearson/PHI

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	-	-	2	1	3	3
CO2	3	3	2	3	2	1	-	-	2	-	1	2
CO3	3	3	3	3	3	2	-	-	2	-	1	2
CO4	3	3	2	3	3	2	-	-	2	2	3	3

Course Name: Data Base Management System Laboratory
Course Code: EE 694A
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

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

- CO1.** 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.
- CO2.** 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.
- CO3.** Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
- CO4.** Analyse database system concepts and apply normalization to the database.
- CO5.** Apply and create different transaction processing and concurrency control applications.

List of Experiment:

- A. 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 Using Aggregate Functions
 - e) Combining Tables Using JOINS
 - f) Sub-queries
 - 4. Database Management
 - a) Creating Views
 - b) Creating Column Aliases
 - c) Creating Database Users
 - d) Using GRANT and REVOKE
- B. PL/SQL
- C. Database design using E-R model and Normalization
- D. 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
CO1	2	2	2	2	3	2	1	1	2	2	3	3
CO2	2	3	3	3	3	1	1	1	2	2	3	3
CO3	3	3	2	3	3	2	2	2	3	3	3	3
CO4	3	3	2	2	2	1	1	1	1	1	2	3
CO5	3	3	3	3	3	2	2	2	3	3	3	3

Course Name: Embedded Systems Laboratory

Course Code: EE 694B

Contact: 0L:0T:3P

Credit: 1.5

Prerequisites: Concept of Digital Electronics Lab, Microprocessor and Microcontroller Lab.

Course Outcomes:

- CO1.** Familiarization with PIC Microcontroller, ARM Microcontroller, FPGA and their interfacing.
- CO2.** Design of different types real time projects with digital controllers.

List of Experiment:

1. PIC based experiment (Any Five)

- a) Familiarization of PIC kit.
- b) Interface and control a LED, LCD, Keyboard, ADC & DAC using PIC.
- c) Connect two PIC kit and transfer data serially.
- d) Design a Digital watch based on PIC.
- e) Control a stepper motor and display temperature from a temperature sensor on a LCD.

2. ARM based experiment (Any Four)

- a) Familiarization with ARM evaluation system
- b) Familiarization with Raspberry Pi
- c) Interfacing with a real time clock using a serial port to display time.
- d) Interface a Keyboard and display the keystrokes on a LCD, LED.
- e) Familiarization of image processing using ARM

3. FPGA based experiment

- a) Design a 3 to 8 decoder circuit.
- b) Design an UP/DOWN counter and display the count on a 7-segment display.
- c) Designing an ALU and verify with mathematical operations.
- d) Innovative Project.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	2	3
CO2	3	3	3	3	3	1	-	-	3	1	3	3

Course Name: Software Engineering Laboratory
Course Code: EE 694C
Contact: 0L:0T:3P
Credit: 1.5

Prerequisites: For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Outcomes:

- CO1.** To handle software development models through rational method.
- CO2.** To prepare SRS document, design document, test cases and software configuration management and risk management related document.
- CO3.** To Develop function oriented and object oriented software design using tools like rational rose.
- CO4.** To perform unit testing and integration testing.
- CO5.** To apply various white box and black box testing techniques.

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 Books:

1. Software Engineering: Apractitioner'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
CO1	3	3	3	-	1	1	-	-	-	-	-	3
CO2	3	3	-	3	-	-	2	-	1	2	2	3
CO3	3	3	2	3	3	2	-	-	-	3	3	3
CO4	3	3	1	2	-	-	-	-	2	-	2	3
CO5	3	3	-	1	2	-	1	-	-	1	3	3