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Curriculum & Syllabus for B.Tech

Under Autonomy

Department of Electronics and Communication Engineering

Departmental Vision

DV : To impart **quality education and excel in research** to create **centre of excellence** in the field of Electronics & Communication Engineering to produce **outstanding professionals** to become **future leaders** and **responsible citizens.**

Departmental Mission

- **DM1:** To impart **high quality education** with **innovative teaching-learning methodologies**
- **DM2:** To impart knowledge **on innovative field of engineering** and provide opportunity to work in **a team** on **interdisciplinary projects** for **empowering ability** to become **successful professionals**
- **DM3:** To carry out **high quality research** through **collaboration** and **interaction** with **research organizations** and **industries**
- **DM4:** To **motivate** to follow **professional ethics** and **encourage** to work for the **sustainable growth of the society**

Program Educational Objectives (PEOs)

PEO I: To build up the concept of **core electronics subjects** with a strong foundation in the **engineering fundamentals** to **solve, analyze and design** the **real-life engineering problems**.

PEO II: To impart training on **emerging technologies** and provide opportunity to work in a **team** on **interdisciplinary projects** to inculcate **leadership quality**

PEO III: To foster **interdisciplinary learning environment** to succeed in their **profession, higher education, research** and **entrepreneurial development .**

PEO IV: To imbibe **ethical attitude and life-long learning capability**

Program Outcomes (PO)

Engineering Graduates will be able to

PO 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO)

Graduates of ECE program will be able:

PSO 1: To acquire deep analytical knowledge of Electronics and Communication Engineering to meet requirements of global consumers in Devices and communication sector and contribute to the society through govt. and Non Govt. Sectors.

PSO 2: To develop integrated systems in the field of Electronics and Communication by applying modern tools and skills to meet the challenges in Industry.

PSO 3: To apply innovation in the field of communication for designing IoT based systems along with AI and ML

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Curriculum & Syllabus for B.Tech Under Autonomy

Electronics and Communication Engineering

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21Batch

Course Code	CourseTitle	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
Semester I						
M101	Mathematics-I	3	1	0	4	4
CH101	Chemistry	3	1	0	4	4
EE101	Basic Electrical Engineering	3	1	0	4	4
HU101	Communicative English	2	0	0	2	2
ME101	Engineering Mechanics	3	1	0	4	4
XC181	Extra-Curricular Activity(NSS)	0	0	2	2	1
HU191	Lang. Lab. and Seminar Presentation	0	0	2	2	1
CH191	Chemistry Lab	0	0	3	3	2
EE191	Basic Electrical Engineering Lab	0	0	3	3	2
ME191	Engineering Drawing & Graphics	0	0	3	3	2
Total						26

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21Batch

Semester II						
M201	Mathematics-II	3	1	0	4	4
PH201	Physics -I	3	1	0	4	4
EC201	Basic Electronics Engineering	3	1	0	4	4
CS201	Computer Fundamentals & Principle of Computer Programming	3	1	0	4	4
ME201	Engineering Thermodynamics & Fluid Mechanics	3	1	0	4	4
CS291	Computer Fundamentals & Principle of Computer Programming Lab	0	0	3	3	2
PH291	Physics-I Lab	0	0	3	3	2
EC291	Basic Electronics Engineering Lab	0	0	3	3	2
ME291	Workshop Practice	0	0	3	3	2
MC281	Soft Skill Development	0	0	2	2	0
Total						28

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21 Batch

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical(P)	Total Hours	
Semester III						
M301	Mathematics-III	3	1	0	4	4
M(CS)301	Numerical Methods	3	0	0	3	3
EC301	Solid State Devices	3	0	0	3	3
EC302	Circuit Theory & Networks	3	1	0	4	4
CS(ECE)301	Data Structure	3	0	0	3	3
M(CS)391	Numerical Methods Lab	0	0	3	3	2
EC392	Circuit Theory & Network Lab	0	0	3	3	2
CS(ECE)391	Data Structure Lab	0	0	3	3	2
MC381	Technical Skill Development	0	0	2	2	2Units
Total						23

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21 Batch

Semester IV						
PH(ECE)401	Physics II	3	0	0	3	3
EC401	Signals & Systems	3	0	0	3	3
EC402	Analog Electronic Circuits	3	1	0	4	4
EC403	Digital Electronic And Circuits	2	2	0	4	3
EC404	Analog Communication	3	0	0	3	3
PH(ECE)491	Physics II Lab	0	0	3	3	2
EC492	Analog Electronic Circuits Lab	0	0	3	3	2
EC493	Digital Electronic And Circuits Lab	0	0	3	3	2
EC494	Analog Communication Lab	0	0	3	3	2
HU 481	Technical Report Writing & Language Practice	0	0	2	2	1
Total						25

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21 Batch

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical(P)	Total Hours	
Semester V						
HU 501	Environmental Science	2	0	0	2	2
EC501	Digital Communication Systems	2	2	0	4	3
EC502	Microprocessor & MicroController	3	0	0	3	3
EC503	Digital Signal Processing	3	0	0	3	3
EC504 A/B/C	Power Electronics/Electrical & Electronics Measurement /Telecommunication Systems	3	0	0	3	3
EC591	Digital Communication Systems Lab	0	0	3	3	2
EC592	Microprocessor & Micro Controller Lab	0	0	3	3	2
EC593	Digital Signal Processing Lab	0	0	3	3	2
EC581	Mini Project-I	0	0	4	4	2
MC581	Group Discussion Practice	0	0	2	2	2Units
Total						22

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21 Batch

Semester VI						
EC601	EM Wave Propagation & Antenna	2	2	0	4	3
EC602	Information Theory & Coding	2	2	0	4	3
EC603	Control System	3	0	0	3	3
EC604 A/B/C	Object Oriented Programming / Advanced Microcontroller & Embedded System/Optical Fiber Communication	3	0	0	3	3
EC605 A/B/C	Engineering System Design & Analysis/Material Science & Engineering / Computer Communication & Networks	3	0	0	3	3
EC691	EM Wave Propagation & Antenna Lab	0	0	3	3	2
EC693	Control System Engineering Lab	0	0	3	3	2
EC694 A/B/C	Object Oriented Programming Lab/Advanced Microcontroller & Embedded System Lab /Optical Fiber Communication Lab	0	0	3	3	2
EC681	Mini Project-II	0	0	12	12	6
EC682	Industrial Training (4Weeks)	0	0	0	0	1
Total						28

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21Batch

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical(P)	Total Hours	
Semester VII						
HU705	Principles of Management	2	1	0	3	2
EC701	RF & Microwave Engineering	3	0	0	3	3
EC702	VLSI & Microelectronics	3	1	0	4	4
EC703 A/B/C	Digital Image Processing /Computer Organization & Architecture/Data Base Management Systems	3	0	0	3	3
EC704 A/B/C	Artificial Intelligence & Robotics / Biomedical Electronics & Imaging/Renewable Source & Applications	3	0	0	3	3
EC791	RF & Microwave Engineering Lab	0	0	3	3	2
EC792	VLSI & Microelectronics Lab	0	0	3	3	2
EC793 A/B/C	Digital Image Processing Lab/Computer Organization & Architecture Lab / Data Base Management Systems Lab	0	0	3	3	2
EC781	Project I	0	0		6	3
MC782	Technical Seminar Presentation	0	0	3	3	3Units
Total						24

ELECTRONICS COMMUNICATION ENGINEERING DEPARTMENT
Curriculum for 2016-20 Batch & 2017-21Batch

Semester VIII						
HU 801	Economics for Engineers	2	1	0	3	2
EC801	Advanced Communication Systems	3	0	0	3	3
EC802 A/B/C	Advanced Semiconductor Devices/ EMI & EMC/ Mobile Communication and Network	3	0	0	3	3
EC803 A/B/C	Software Engineering /Physical Design, Verification & Testing/Soft Computing	3	1	0	4	4
EC891	Advanced Communication Lab	0	0	3	3	2
EC881	Project II	0	0	12	12	6
EC882	Grand Viva	0	0	0	0	2
Total						22
Total						198

Paper Name: Mathematics–I
Paper Code: M101
Total Contact Hours:40
Credit:4

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

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

Course outcome:

On successful completion of the learning session of the course, the learner will be able to:

CO 1: Recall the distinctive characteristics of matrix algebra, differential calculus, integral calculus and vector analysis.
CO2: Understand the theoretical working of matrix algebra, differential calculus, integral calculus and vector analysis.
CO3: Apply the principles matrix algebra, differential calculus, integral calculus and vector analysis for the solutions of the problems.
CO4: Analyze the application of matrix algebra, differential calculus, integral calculus and vector analysis.
CO5: Evaluate the result for application to the problems on matrix algebra, differential calculus, integral calculus and vector analysis.

Course Contents:

MODULE I [10L]

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

MODULE II [10L]

Calculus-I (Functions of single variable): Rolle's theorem, Mean value theorem- Lagrange & Cauchy,Taylor'sandMaclaurin'stheorems,ExpansionofsimplefunctionsbyTaylor'sandMaclaurin's Theorems, Fundamental theorem of integral calculus, Evaluation of plane areas, volume and surface area of a solid of revolution and lengths, Convergence of Improper integrals, Beta and Gamma Integrals –Elementary properties and the Interrelations.

MODULE III [12L]

Calculus-II (Functions of several

variables):Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives, Total Differentiation, Derivatives of composite and implicit

functions, Euler's theorem on homogeneous functions, Chain rule, Maxima and minima of functions of two variables – Lagrange‘s method of Multipliers, Change of variables-Jacobians (upto three variables), Double and triple integrals.

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

Text Books:

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

Reference Books:

6. S. Kumaresan, Linear Algebra -A Geometric approach, PrenticeHallofIndia,2000.
7. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition),Wiley Eastern,1980.
8. T G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998.
9. Hughes-Hallett Et Al., Calculus-Single and Multivariable (3rd Edition), John-Wiley and Sons, 2003.
10. J.Stewart, Calculus (5th Edition), Thomson, 2003.
11. J. Bird, Higher Engineering Mathematics (4^{th} Edition,1^{st} India Reprint),Elsevier,2006.
12. L. Rade and B.Westergen, Mathematics Handbook: for Science and Engineering (5th edition,1^{st} Indian Edition), Springer, 2009.
13. Murray R Spiegel and Seymour Lipschutz, Schaum's Outline of Vector Analysis.
14. Richard Bronson, Schaum's Outline of Matrix Operations.

CO-PO mapping:

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO2	PSO
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	1	2	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-

Paper Name: Chemistry

Paper Code: CH 101

Total Contact Hours: 40
Credit: 4

Prerequisites: 10+2 science with chemistry Course

Objective

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

Course Outcome

On successful completion of the learning session of the course, the learner will be :

CO1: Able to remember fundamental concepts of Engineering Chemistry and define relevant terminologies.
CO2: Able to understand principles of thermodynamics, kinetics and physical properties of molecules.
CO3: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries and technical fields.
CO4: Able to analyze and explain the defects in crystalline solids and protective measures of corrosion of metals in industries.
CO5: Able to assess qualitative and quantitative parameters of applied and industrial chemistry.

Course Contents

Module 1 [8L]

Chemical Thermodynamics–I
Concept of Thermodynamic system: Definition with example of dia thermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.
Introduction to first law of thermodynamics: Different statements, mathematical form.
Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

2L

Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression
For change in Enthalpy, Expression for change in enthalpy for ideal gas.

Heat Capacity: Definition, Classification of Heat Capacity (CP and CV): Definition and General expression of Cp-CV. Expression of Cp-CV for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's Law of Constant Heat Summation. 3L

2nd law of thermodynamics: Statement, Mathematical Form of 2^{nd} Law of Thermodynamics (Carnot Cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. 3L

Module 2 [7L]

Reaction Dynamics

Reaction laws :rate and order ; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration),Pseudo uni molecular reaction,Arrhenius equation.
3L

Mechanism and theories of reaction rates (Content beyond the syllabus)

Solid state Chemistry

Introduction to stoichio metric defects (Schottky & Frenkel) and non–stoichio metric defects (Metal excess and metal deficiency).
Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photovoltaic cell, fabrication of integrated circuits. 4L

Module 3 [8L]

Electrochemistry Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). 1L

Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst Equation), single electrode potentials, hydrogen half cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). 3L

Concept of battery

Battery and Commercial electro chemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). 2L

Corrosion and its control

Introduction, cause and effect of corrosion ,types of corrosion: dry, wet and other:Electrochemicalcorrosion,galvaniccorrosion,passivationandprotectivemeasure. 2L

Module 4 [12L]

Structure and reactivity of Organic Molecule

Electro negativity, electron affinity, hybridization ,Inductive effect ,resonance, hyper conjugation, electrometric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions. 3L

Polymers

Concepts, classifications and industrial applications. Polymer Molecular Weight(number avg. weight avg.:Theory and mathematical expression only),Poly disparity Index(PDI).
Polymerization processes: addition and condensation polymerization (mechanism not required),degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm)and amorphicity (Concept of Tg)of polymer.
Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP,PMMA,Polyester,PTFE,Bakelite),rubber(naturalrubber,SBR),fibre(nylon6,nylon6,6),Vul canizationofrubber,Conductingpolymersandbio-polymers.

7L

Nano material

Basic principles of nano science and technology, classification, preparation, properties and application of nanomaterial.

2L

Module 5 [5L]

Industrial Chemistry Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.
Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetanenumber, Aviation Fuel (Aviation Gasoline, Jet Gasoline),Biodiesel.
Gaseous Fuels: Natural Gas, water gas , Coal gas, biogas, CNG, LPG 3L

Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards),Chlorination of Water, Types of hardness-Units, Brief Softening methods. 2L

Short overview of water treatment plants (Content Beyond The Syllabus)

Reference Books

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C.Rakshit
3. OrganicChemistry:Finar,vol-1
4. EngineeringChemistry:B.Sivasankar,TataMcGrawHill,2008
5. A Textbook of Engineering Chemistry:S.S.Dara,10th Edition,S.Chand&CompanyLtd.,NewDelhi,2003.
6. Engineering Chemistry Simplified: S.Nandiand R.Bhattacharyya, Chayy Prakashani Pvt. Ltd.

CO-PO mapping:

	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											2	2	
CO2	3	2	1										1	2	
CO3			2		2							1		1	
CO4	2		1		2								2	1	
CO5	2						3					1	1	2	

Paper Name: Basic Electrical Engineering

Paper Code: EE 101
Total Contact Hours:
41 Credit:4

Prerequisite: Basic 12st standard Physics and Mathematics

Course Objective:

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

Course Outcomes:
On successful completion of the learning session of the course, the learner will be able to:

CO1:Understand Basic Electrical circuits, Power distribution and Safety measures.
CO2: Analyze and apply DC network theorems.
CO3:Analyze and apply the concept of A Circuits of single-phase and three-phase.
CO4:Assess basic principles of Transformers and Rotating Machines

Course Contents:

DC CIRCUITS (7L)

Definition of electric circuit, linear circuit, non-Linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)

Concept of Magnetic circuit, B- Hcurve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)

Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance RLC series and parallel circuit, Q Factor ,bandwidth of resonant circuit.

THREE PHASE CIRCUITS (3L)
Voltages of three balanced phase systems, delta and star connection, relationship between line and phase quantities , phasor diagrams. Power Measurement By Two Wattmeter method.

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

SINGLE PHASE TRANSFORMER (5L)
Constructional Parts, Types of transformers, Emf Equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR(6L)
Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emfandcurrent,Equivalentcircuitandphasordiagram,TorqueSlipcharacteristicstorque-speedcharacteristics Starting of induction motor by star delta starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM(3L)
Power generation to distribution through over headlines and underground cables with single line diagram , Earthing Electrical Equipment, Electrical Wiring Practice

Textbooks

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

Reference Books

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

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	1						3	3	2	
CO2	2	3	3	3	-	-							3	2	
CO3	2	3	1	3	-	-							3	3	
CO4	3	3	2	2	-	2						3	3	1	

Paper Name: Communicative English
Paper Code: HU101
Total Contact Hours: 26
Credits: 2

Prerequisites:

Basic knowledge of high school English.

Course Objectives:

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

Course Outcomes:

On successful completion of the learning session of the course, the learner will be able to:

CO1: Define , identify describe the basics of communication theory and its application
CO2: Recognize ,recall and make use of English Vocabulary And its varied usage
CO3: Developandapplyreadingandwritingskillsinanacademicandglobalbusiness context
CO4: Identify , explain and use the grammatical structures and forms in English
CO5: Analyze, classify and elaborate the forms and formats of business writing

Course Content:

The Proposed Revised Syllabus As Follows:

Module1:Communication :Interface in a Globalized World[5L]

a. Definition Communication Scope of Communication
b. Process of Communication—Models and Types
c. Verbal—Non-Verbal Communication, Channels of Communication
d. Barriers to Communication surmounting them
[to be delivered through case studies involving inter cultural communication]

Module2:Vocabulary and Reading [5L]

a. Word Origin—Roots, Prefixes Suffixes, Word Families, Homonyms and Homophones
b. Antonyms and Synonyms, One-word substitution
c. Reading—Purposes and Skills
d. Reading Sub-Skills—Skimming, Scanning, Intensive Reading
e. Comprehension Practice(Fiction and Nonfiction Prose/Poetry)

(iii) Ruskin Bond,—The Cherry Tree OR—The Night Train at Deoli
(iv) Robert Frost,—Stopping by the Woods on Snowy Evening.
f. Precis Writing
(Use of daily newspapers for reading practice is recommended)

Module3: Functional Grammar and Usage[6L]

a. Articles, Prepositions, Verbs
b. Verb-Subject Agreement
c. Comparison of Adjectives
d. Tenses and their Use
e. TransformationofSentences(Singular-Plural,Active-Passive,Direct-Indirect,DegreesofComparison)
f. Error Correction

Module4: Business Writing[10L]

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

References:

1. Raymond Murphy. *English Grammar in Use*.3rd Edn. CUP,2001.
2. Seidl & McMordie. *English Idioms & How to Use Them*. Oxford:OUP,1978.
3. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
4. Simeon Potter.*Our Language*. Oxford: OUP,1950.
5. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking*. 8th ed. London: Longman, 2001.
6. IIT Kanpur, English Language & Communication Skills(ENG112C)syllabus.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												3	1		2
CO2												3	2		2
CO3						3					1	3	2		3
CO4						3						3	2		2
CO5						3					1	3	2		3

Paper Name: Engineering Mechanics

Paper Code: ME101

Total Contacts Hours: 45
Credit:4

Prerequisites: Higher Secondary with Physics, Chemistry Mathematics.

Course Objective:

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

Course Outcome:

On successful completion of the learning session of the course, the learner will be able to:

CO1.Understand free body diagram and calculate the reactions necessary to ensure static equilibrium.
CO 2. Study the effect of friction in static and dynamic conditions.
CO3.Understand the different surface properties, properties of masses and material properties.
CO4.Analyze And Solve different problems of kinematics and kinetics.

Course Content:

Module 1:

Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of Forces : collinear,

concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Forceis a vector; Transmissibility of a force(sliding vector).

2L

Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications.

3L+1T

Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces

4L+1T

Module 2:
Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations Of Equilibrium.

3L+1T

Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient Of Friction.

3L+1T

Module 3:
Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadra lateral, composite areas consisting of above figures.

4L+1

TMoments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass Moment Of Inertia of symmetrical bodies,e.g.cylinder,sphere,cone.3L+1T

Principle Of Virtual Work With Simple application. 1L+1T

Module 4:
Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic Limit; Ultimate stress; Yielding; Modulus Of Elasticity; Factor Of Safety.

2L+1T

Module 5:
Introduction to Dynamics: Kinematic s and Kinetics; Newton's law s of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. 3L+1T

Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). 2L+1T

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

Books Recommended

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

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2					1				1	1	
CO2	3	3	2	2					1			1			
CO3	3	2	3	2	1				1			1	2	2	
CO4	3	3	3	3					1				2	3	

Paper Name: Lang. Lab. and Seminar Presentation
Paper Code: HU191
Total Contact Hours: 26
Credit:1

Prerequisites: Basic Knowledge Of LSRW skills.

Course Objectives: To train the students in acquiring inter personal communications kills by focusing on skill acquisition techniques and error feedback.

Course Outcome:
On successful completion of the learning session of the course, the learner will be:

CO 1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
CO 2: Able to apply listening, speaking, reading and writing skills in societal and professional life.
CO 3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
CO 4: Able to analyze communication behaviors.
CO 5: Able to adapt to multifarious socio-economical and professional are as with the help of effective communication and interpersonal skills.

Course Contents:

Module1: Introduction to the Language Lab

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

Module2: Active Listening

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

Module3: Speaking

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

Module 4: Lab Project Work

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

References:

1. IIT Mumbai, Preparatory Course in English syllabus
2. IIT Mumbai, Introduction to Linguistics syllabus
3. Sasi kumar et al.*A Course in Listening and Speaking*. New Delhi: Foundation Books,2005.
4. Tony Lynch, *Study Listening*. Cambridge: CambridgeUP, 2004.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2									2		1	
CO2	1		1	2								2			
CO3	1		2	2								2		1	
CO4												2			
CO5	1								3			2			

Paper Name: Chemistry Lab
Paper Code: CH191
Total Contact hour: 36
Credit:2

Prerequisites: 10+2 science with chemistry

Course Objective

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

Course Outcome
On successful completion of the learning session of the course, the learner will be:

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 asa team member
CO3: Able To Analyze Different Parameters Of water considering environmental issues
CO4: Able To Synthesise Nano And Polymer Materials.
CO5: Capable to design innovative experiments applying the fundamentals of chemistry

Course contents

List of experiments:

1. To determine the alkalinity in a 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-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH metrictitration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen presenting a given water sample.
10. To determine chloride ion in a given water Sample by Argentometric method(using chromate indicator solution).

Innovative Experiment:

Preparation of silver nano-particles.

Note: From the listof10(Ten)experiments a minimum of 7(seven)experiments shall have to be performed by one student whichSl.No.4 (Preparation of Bakelite)has to be mandatory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1			2				1	2	
CO2	3	2							3				2	1	
CO3		2				2	3					1		1	
CO4	2	2			2	1							2	1	
CO5	2	2	2		1							1	1	2	

Paper Name: Basic Electrical Engineering LAB
Paper Code: EE191
Total Contact Hours: 36
Credit: 2

Prerequisites:

Basic Physics and applied physics.
Basic Mathematics.
Basic concept of Electric Circuit

Course Objective:

1. Provide knowledge for the analysis of basic electrical circuit.
2. To Introduce Electrical Appliances, machines with their respective characteristics.

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

CO1: Understand common electrical components and their ratings.
CO 2: How to apply Circuit connection by wires of appropriate ratings.
CO3: Understand the usage of common electrical measuring instruments
CO4: Understanding And Applying The Basic characteristics of transformers and electrical machines

Course Contents

LIST OF EXPERIMENTS

1. Characteristics of Fluorescent, Tungsten and Carbon filament lamps
2. Verification of Thevenin's and Norton's Theorem
3. Verification of Superposition Theorem
4. Calibration of Ammeter and Wattmeter
5. Study R-L-C series circuit
6. Open circuit and short circuit test of a single phase Transformer
7. Starting, Reversing a speed control of. Shunt Motor
8. Test on single phase Energy Meter
9. Familiarization of PMMC and Mitype Meter
10. Familiarization With House Wiring Practice

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1					3				3	2	3
CO2	3	3	1	1					3					2	3
CO3	2	2							3				3	3	2
CO4	2	2							3				3	3	2

Paper Name: Engineering Drawing & Graphics

Paper Code: ME191

Total Contact Hours: 36
Credit:2

Prerequisites: Higher Secondary with Physics, Chemistry Mathematics

Course Objective:

1. To Learn Basics of Drafting and Use of drafting tools.
2. To Know about Engineering Scales, dimensioning and various geometric curves.
3. To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
4. To acquire the knowledge of Computer Aided drafting using design software.

Course Outcomes:

On successful completion of the learning session of the course, the learner will be able to:

CO1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.
CO2.Know about engineering scales, Dimensioning and various geometric curves necessary to understand design of machine elements.
CO3.Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
CO4. Become familiar with computer aided drafting useful to share the design model to different sections of industries as well as for research development.

Course Contents:

List of Experiments:

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

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		1	2		1			3			1	3	1	1
CO2	3		2	2		1			3	1		1	3	2	2
CO3	2	2	2	1		1			3			1	3	3	3
CO4	1		2	2	2	1			3	1		1	3	3	3

Paper Name: Extra Curricular Activity (NSS/NCC)
Paper Code: XC 181
Total Contact hours: 20
Credit:1

Course Objectives: The Objectives of The Course are as Follows:
To increase student awareness about the weaker and unprivileged sections of society
To expose students to environmental issues and ecological concerns
To make students self aware about their participatory role in sustaining society and the environment

Course contents

List of Activities:

a) Creating awareness on social issues
b) Participating In Mass Education Programmes
c) Proposal For Local Slum Area Development
d) Waste Disposal
e) Environmental Awareness``
f) Production Oriented Programmes
g) Relief&RehabilitationworkduringNaturalca
lamitiesCreatingawarenessinsocialissues:
1. Women's Development–includes health, income-generation, rights awareness.
2. Hospital Activities–Eg. writing letters for patients, guiding visitors
3. Old age home–visiting the in- mates, arranging for their entertainment.
4. Children's Homes-visiting the young in-mates, arranging for their entertainment
5. LinkingwithNGOstoworkonothersocialissues.(Eg.Childrenofsex-workers)
Gender issues-Developing an awareness, to link it with Women's Cell of college

Participating in mass education Programmes

1. Adult Education
2. Children's Education

Proposal for Local Slum Area Development

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

Environmental Awareness

• Resource Conservation–Awareness To Be Developed On Water, Energy, soil.
• Preservation Of Heritage Monuments-Marches, poster campaigns
• Alternative Energy Consciousness Amongst Younger School-children.

• Plantation And Beautification-Plantation Of Trees, their preservation and upkeep, developing NSS parks.

• Waste disposal-Proper methods of domestic waste disposal.Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices

6. Rodent Control And Pest Control Practices;

7. Soil-testing, soil healthcare and soil conservation;

8. Assistance In Repair Of Agriculture Machinery;

9. Work for the promotion and strengthening cooperative societies villages;

10. Assistance And Guidance In Poultry Farming, animal husbandry, care of animal health etc.;

11. Popularization Of Small Savings Fund

12. Assistance In Procuring Bank Loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution fractions, medicine, clothes etc.;

h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;

i) Working with the local people in reconstruction of their huts ,cleaning of wells, building roads etc.;

i) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

Paper Name: Mathematics-II

Paper Code: M201
Total Contact Hours: 40
Credit:4

Pre requisite: Any introductory course on calculus.

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

Course outcome:

On successful completion of the learning session of the course, the learner will be able to:

CO 1: Recall the distinctive characteristics of improper integral, Laplace Transform, ordinary differential equation, graph theory.
CO 2: Understand The Theoretical Working Of Improper Integral, Laplace Transform, ordinary differential equation, Graph Theory.
CO 3: Apply The Principles Of Improper Integral, Laplace Transform, ordinary differential equation, graph theory.
CO4: Analyze the application of improper integral, Laplace Transform, ordinary differential equation, graph theory.
CO5: Evaluate The result for application to the problems on improper integral, Laplace Transform, ordinary differential equation, graph theory.
CO6: Design Graph To Solve Different Real Life Problems

Course contents:

Module I[10L]

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

Module II [10L]

Ordinary differential equations(Higher order):
General linear ODE of order two with constant coefficients, C.F.& PI.,D-operator methods for finding PI. ,Method Of Variation Of Parameters, Cauchy-Euler Equations, Solution of simultaneous linear differential equations, Applications Related To Engineering Problems.

Module III [10L]

Basic Graph Theory: Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph, Walks, Paths, Circuits, Euler Graph, Cut-sets and cut-vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.Tree, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest pathproblem,DeterminationofminimalspanningtreeusingKruskal'sandPrim'salgorithm.
**Extra Lecture Hours Maybe Taken for this module.

MODULE IV:[10L]

Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of t f (t), LT of f (t)/t , LT of derivatives of f (t), L.T. of ∫f(u) du. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition And Its Properties; Convolution Theorem(statement only)and itsapplicationtotheevaluationofinverseLT,SolutionoflinearODEwithconstantcoefficients(initialvalueproblem)usingLT.ApplicationsrelatedtoEngineeringproblems.

Beyond Syllabus:

Combinatory: Fundamental Principles, Permutations, Combinations, Binomial Coefficients.

Text Books:

1. E.Kreyszig, Advanced engineering mathematics (8th Edition),JohnWiley,1999.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications,2009.
3. R.K.JainandS.R.K.Iyengar, AdvancedEngineeringMathematics,NarosaPub.House,2008.

Reference Books:

4. W.E.BoyceandR.DiPrima,ElementaryDifferentialEquations(8thEdition),JohnWiley ,2005.
5. R.K.Ghosh and K.C.Maity,Introduction Differential Equations,NewCentralBookAgency.
6. V.K.Balakrishnan,GraphTheory, Schaum'sOutline,TMH.
7. J. Clark and D.A. Holton, A first course at Graph Theory, Allied Publishers LTD.
8. D.B. West, Introduction to Graph Theory, Prentice-Hall of India.
9. N.Deo, Graph Theory, Prentice-Hall of India.
10. J.Bird, Higher Engineering Mathematics (4th Edition,1st India Reprint),Elsevier,2006.

11. L. Rade and B.Westergren, Mathematics Hand book: for Science And Engineering (5th edition,1stIndianEdition),Springer,2009.
12. Murray R.Spiegel, Laplace Transform, Schaum's Outline Series, McGRAW-HILL.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	2	1	3	-
CO4	2	3	2	2	-	-	-	-	-	-	-	1	3	1	2
CO5	3	2	2	1	-	-	-	-	-	-	-	1	1	1	
CO6	3	2	3	2	-	-	-	-	-	-	-	2	1	1	3

Paper Name: Physics -I
Paper Code: PH201
Total Contact Hours: 41
Credit:4

Prerequisites: Knowledge of Physics Upto 12th Standard.

Course Objective:

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

On successful completion of the learning session of the course, the learner will be able to:

CO 1 Describe different types of mechanical resonance and its electrical equivalence
CO 2 Explain basic principles of Laser, Optical fibers and Polarization of light
CO 3 Apply superposition principle to explain the phenomena of interference and diffraction
CO 4 Analyze different crystallographic structures according to their coordination number and packing factors
CO5 Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

Course contents

Module 1 (8L):-Oscillations
Simple harmonic motion: Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous Figures ,Engineering Applications and related Numerical problems

2L

Module 2 (10L):-

Classical Optics:

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

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

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

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

Module 3 (9L):-Quantum Physics:
Quantum Theory: Inadequacy of Classical Physics; Planck's Quantum Hypothesis-Qualitative (without deductions),particle concept of electromagnetic wave(example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; deBroglie wave; Davisson and Germer experiment.
4L

Quantum Mechanics1:Concept Wave Function, Physical Significance Of Wave function, Probability interpretation; wave function normalization condition and its simple numerical applications; uncertainty principle-applications, Schrödinger equation(nonmathematical derivation). 4L

Module 4 (6L):

X-ray Crystallography
X-rays–Origin of Characteristic and Continuous X-ray, Bragg's Law(No derivation), Determination Of Lattice Constant, Applications, Numerical Problems. 2L

Elementary Ideas Of Crystal Structure-lattice, basis, unit cell, Fundamental Types Of Lattices Bravais lattice, Simple cubic, fcc and bcc, hcp lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor, Applications, Numerical problems. 4L

Module 5(8L):

Modern Optics-I:

Laser: Concepts of various emission and absorption process, working principle of laser, meta stable state,PopulationInversion,conditionnecessaryforactivelaseraction,optical resonator, ruby laser, He-Nelaser , semiconductor laser, Einstein A and B coefficients and equations, industrial and medical applications of laser. 5L

Fibre Optic and Applications: Principle And Propagation Light In Optical Fibers-
Numerical Aperture and Acceptance angle, V number, Types of optical fibers (material, refractive index, mode),Losses In Optical Fibre- attenuation, dispersion, bending, Numerical

Problems. 3L

Recommended Text Books for Physics I
(PH101//201): Oscillations:
1. Classical Mechanics-J.C. Upadhyay(Himalaya Publishers)
2. Classical Mechanics- Shrivastav
3. Classical Mechanics-Tak wale Puranik(TMH)
4. Sound-N.K.Bajaj(TMH)
5. AdvancedAcoustics-D.P.RoyChowdhury(Chayan Publisher)
6. Principles of Acoustics- B.Ghosh (Sridhar Publisher)
7. A Textbook of Sound-M. Ghosh (S. Chand Publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light-K.G. Mazumder B. Ghoshal,(Book & Allied Publisher)
10. R.P. Singh(Physics Oscillations and Waves)
11. A.B. Gupta(College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics-I:
13. A text book of Light-K.G. Mazumder &B. Ghoshs (Book & Allied Publisher)
14. Textbook of Light-Brijlal Subramaniam,(S. Chand publishers)
15. Modern Optics-A.B. Gupta(Book & Allied Publisher)
16. Optics-Ajoy Ghatak (TMH)
17. Optics-Hecht
18. Optics- R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E.Hecht(Optics)
21. E.Hecht(Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R.Dasgupta (DegreePhysicsVol3)

Quantum Physics
24. Introduction to Quantum Mechanics-S.N. Ghoshal (Calcutta Book House)
25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S.P. Kuilla(New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S.Chand Publishers)
28. Quantum Mechanics- Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics- A.Beiser (TMH)
30. Eisberg & Resnickis published by WileyIndia
31. A.K. Ghatak And Lokanathan
32. E.E. Anderson(Modern Physics)
33.Halliday, Resnick &Krane:Physics Volume2 is Published by Wiley India
34. Binayak Dutta Roy[Elements of Quantum Mechanics]

X-ray Crystallography

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

General Reference:

1. Refresher Courses In Physics(Vol.1,Vol.2&Vol.3)-C.L.Arora(S.ChandPublishers)
2. BasicEngineeringPhysics-AmalChakraborty(Chhaya Prakashani Pvt.Ltd.)
3. BasicEngineeringPhysics-I-SujoyBhattacharya,Soumen Paul(TMH)
4. EngineeringPhysicsVol:1-SudiptoRoy,TanushriGhosh,DibyenduBiswas(S.Chand).
5. EngineeringPhysicsVol:1-S.P.Kuila(NewCentral)
4.UniversityPhysics-Sears Zemansky(Addison-
Wesley)5.B. DuttaRoy(BasicPhysics)
6. R.K.Kar(EngineeringPhysics)
7. ManiandMeheta(ModernPhysics)
8. Arthur Beiser(Perspective&ConceptofModernPhysics)

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	3											2	3	3	
CO2	3											2	3	3	
CO3	3	2										2	3	1	
CO4	2	3										2	3	2	
CO5	1	3										2	3	2	

Paper Name: Basic Electronics Engineering
Paper code: EC201
Total Contact Hours: 40
Credits:4

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

Course Objectives:

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

Course Outcomes:
On successful completion of the learning session of the course, the learner will be able to:

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 modeled and analyzed, 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 analyze and design simple circuit containing non-Linear elements such as transistors using the concepts load lines,operating points and incremental analysis.
CO5: Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course Contents

Module-I: Basics of semiconductor 6L
Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current.

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

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

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

Module-III: Bipolar Junction Transistor (BJT) 6L

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

Module-IV: Field Effect Transistor(FET) 4L

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

Module-V: Feedback and Operational Amplifier 10L

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

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

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

Module-VII: Digital Electronics 4L

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

Text Books:

1. D.Chattopadhyay,P.C.Rakshit,ElectronicsFundamentalsandApplications,NewAgeInternational
2. Millman Halkias, Integrated Electronics, Tata Mc Graw Hill.
3. Boylestad Nashelsky: Electronic Devices&CircuitTheory,McGrawHill,1976.
4. Sedra Smith, Microelectronics Engineering

Reference Books:

1. John D.Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics,S.K.Kataria.
3. Malvino: Electronic Principle.
4. Schilling Belove: Electronics Circuits.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	1	1	-	-	1	1	3	1	
CO2	2	2	3	3	1	-	2	2	1	2	-	1	3	1	
CO3	3	3	2	2	-	2	2	1	2	1	-	2	3	2	
CO4	2	3	1	1	-	-	-	-	1	1	2	1	3	2	
CO5	3	2	1	2	-	-	-	-	-	-	-	1	3	1	

Paper Name : Computer Fundamentals & Principle of Computer Programming

Paper Code:CS201
Total No.of Lectures:40
Credits:4

Prerequisites:

1. Number System
2. BooleanAlgebra

Course Objective(s)

1. To Develop The Programming Skills Of Students
2. To Know The Principles Of Designing Structured Programs
3. To write basic programs using
   - i) Selection Statements
   - ii) Repetitive Statements
   - iii) Functions
   - iv) Pointers
   - v) Arrays
   - vi) Strings

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

CO1 Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
CO2 Write, Compile and Debug programs in C language and use different data types for writing the programs.
CO3 Design programs connecting decision structures, loops and functions.
CO4 Explain The difference between call by value and call by address.
CO5 Understand The Dynamic behavior of memory by the use of pointers.

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

Course content

Fundamentals of Computer:(10L)

History of Computer, Generation of Computer, Classification of Computers 1L
Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input &Output devices 2L
Binary and Alliednumbersystemsrepresentationofsigned&unsignednumbers,BCD,ASCII
Binary number Arithmetic – Addition and Subtraction (using 1’s complement and 2's complement) 2L

Logic gates– AND, OR, NOT,NAND,NOR,EX-OR,EX-NOR-onlytruthtables,logicgatesymbolsandlogicequationsforgatesonly 1L

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

Basic concepts operating system like MS DOS,MS WINDOW,UNIX 1L

Problem Solving-Algorithm & flowchart 2L

C Fundamentals:(30L)

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

C Operators Expressions:

Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators-typeconversion,Cexpressions,precedenceandassociativity.
Input and Output: Standard Input And Output, formatted output-printf, formatted input scanf, bit fields 5L

Branching and Loop Statements:

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

Fundamentals and Program Structures:

auto,external,staticandregistervariables
Functions,functiontypes,functionprototypes,functionsreturningvalues,functionsnotreturningvalues,scoperules,recursion,Cpreprocessorandmacro 6L

Arrays, Strings and Pointers:

One Dimensional Arrays, Two-dimensional arrays, Multidimensional Arrays. Passing An Array To A Function
Characterarrayandstring,arrayofstrings,Passingastringtoafunction,StringrelatedfunctionsPointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation 6L

File handling with C:

formattedandunformattedfiles,Commandlinearguments,fopen,fclose,fgetc,fputc,fprintf,fscanf function 4L

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

Text book:

1. Kernighan B.W. & Ritchie D.M. - The C Programming Language Gott fried-Programming with Schaum Kanetkar.
2. LetusC Balagurusamy –Programming in C

Recommended reference Books:

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

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	2				2	3	2	3	3
CO2	2	2	3	2	3		3					3	2	2	3
CO3	2	3	2	2	2		1					3	2	3	2
CO4	3	2	2	2	3		1					3	2	2	2
CO5	2	2	2	2	1	1	2				2	3	3	3	3

Paper Name: Engineering Thermodynamics & Fluid Mechanics
Paper Code: ME201

Total Contact Hours: 48

Credits:4

Pre requisites: Higher Secondary with Physics, Chemistry Mathematics.

Course Objective:

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

Course Outcome:

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

CO1 Know about thermodynamic equilibrium, heat & work transfer, First law and its application.

CO2 Understand basic concepts Heat Engine, Entropy from Second law of Thermo dynamics.

CO3 Know the Thermodynamic Characteristics Of a pure substance and its application in power cycles (Simple Rank in e cycles, Air Standard cycles)

CO 4 Knowledge of basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations

Course content

Module1:

8L+3T

Basic Concepts of Thermodynamics

Introduction: Microscopic and Macroscopic view points
Definition of Thermodynamic systems: closed, open and isolated systems Concept of Thermodynamics state; state postulate.
Definition Of Properties: intensive, extensive specific properties. Thermodynamic Equilibrium
Thermodynamic Processes; quasi-static, reversible irreversible processes; Thermodynamic Cycles. Zeroth Law Of Thermodynamics. Concept Of Empirical Temperature.

Heat and Work

Definition Units of Thermodynamic Work. Examples Of Different Forms Of Thermodynamics Works; example electricity flow as work. Work done during expansion of a compressible simple System Definition of Heat; unit of Heat Similarities & Dissimilarities between Heat &Work

Ideal Equation of State, processes; Real Gas

Definition of Ideal Gas; Ideal Gas Equations of State.Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes.
Equations of State of Real Gases: Vander Waal's equation; Virial equation of state.

Properties of Pure Substances

p-v, T-s& h-s diagrams of pure substance like H2OIntroduction to steam table with respect to steam generation process; definition of saturation, wet & super heated status. Definition of dryness fraction of steam, degree of super heat of steam.

Module2: 4L+3T

1st Law of Thermodynamics

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

Module3: 6L+3T

2nd Law of Thermodynamics

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

Module 4: 6L+3T

Air standard Cycles for IC engines

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

Rank in ecycle of steam

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

Module 5: 9L+3T

Properties & Classification of Fluids

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

Fluid Statics

Pressure at a point
Measurement of Fluid
Pressure Manometers : simple & differential U-tube Inclined tube

Fluid Kinematics

Streamline Laminar & turbulent flow external & internal flow Continuity equation

Dynamics of ideal fluids

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

Measurement of Flow rate: Basic principles

Venturimeter ,Pilottube ,Orificemeter

(Problems are to be solved for each module)

Engineering Thermodynamics

Text:

1 Engineering Thermodynamics- PK Nag, 4thedn,TMH.

References:

1 "Fundamentals of Thermodynamics " published by Wiley India.
2 Engineering Thermodynamics–Russel & Adeliyi (Indian edition),OUP
3 Engineering Thermodynamics – Onkar Singh , New Age International Publishers Ltd.
4 Basic Engineering Thermodynamics– RJoel,5 Ed., Pearson

Fluid Mechanics

Text:

1Fluid Mechanics and Hydraulic Machines-R Bansal

References:

Introduction to Fluid Mechanics and Fluid Machines- S.K. Som andG.Biswas.2 edn, TMH

1. Fluid Mechanics by A.K.Jain.

CO-PO-**PSO** Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2		2	1	1	1		1	2	1	1	
CO2	3	3	2	2		2	2		1		1	2			
CO3	2	2	1	1		2	1					1	2	2	
CO4	3	3	2	2		2	1				1	1	2	2	

Paper Name: Computer Fundamentals & Principle of Computer Programming Lab

Paper Code: CS291

Total Contact Hours: 36
Credit:2

Prerequisites:

Basic Computer Knowledge

Course Objective(s):

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

Course Outcome:

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

CO1. Understand the working of different operating systems like DOS, Windows, Linux.
CO2. Write, Compile and Debug programs in C language.
CO3. Design programs connecting decision structures, loops.
CO4. Exercise user defined functions to solve real time problems.
CO5. Inscribe C programs using Pointers to access arrays, strings, functions, structures and files.

Experiment should include but not limited to the following:

1. Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
2. Writing C Programs on variable, expression, operator and type-casting.
3. Writing C Programs using different structures of if-else statement and switch-case statement.
4. Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
5. Writing C Programs demonstrating concept of Single & Multi dimensional arrays.
6. Writing C Programs demonstrating concept of Function and Recursion.
7. Writing C Programs demonstrating concept of Pointers, address of operator, declaring

pointers and operations on pointers.

8. Writing C Programs demonstrating concept of structures, union and pointer to structure.
9. Writing C Programs demonstrating concept of String and command line arguments.
10. Writing C Programs demonstrating concept of dynamic memory allocation.
11. Writing C Programs demonstrating concept of File Programming.

CO- PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	2								3	1	1
CO2	3	3	2	3	2							2	2	3	1
CO3	2	2		1	1								2		2
CO4	2	3		3	1					1	2		3		1
CO5	2	2	2	2	2									1	

Paper Name: Physics I Lab
Paper Code: PH291
Total Contact Hours: 40
Credit:4

Prerequisites: Knowledge of Physics upto12th standard.

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

CO1 Demonstrate experiments allied to their theoretical concepts
CO2 Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer
CO3 Analyze and 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.
CO5 Develop critical thinking skills to solve for real life challenges.

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.

Any7 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. Determinationofelasticmoduliiofdifferentmaterials(Young'smodulusandRigiditymodulus)

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:
11. Determination of Planck's constant using photo electric cell.
12. VerificationofBohr'satomicorbitaltheorythroughFrank-Hertzexperiment.

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

Probable experiments beyond the syllabus:

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

CO-PO-**PSO** Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO 1	2								3					2	
CO 2				3					3				2	1	
CO 3	2								3				1	1	
CO 4				3					3				1	1	
CO 5	2			3					3				1		

Paper Name: Basic Electronics Engineering Lab
Paper Code: EC291
Total Contact Hours: 36
Credit:2

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

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

Course Outcomes:

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

CO1: Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
CO 2: Analyze the characteristics of Junction Diode, Zener Diode, BJT & amp; FET and different types of rectifier Circuits.
CO 3: Determination of input-off set voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO 4:Able to know the application of Diode, BJT & OPAMP.
CO 5:Familiarization and basic knowledge of Integrated Circuits

Course contents:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.

7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-off set 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 OP AMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB,CE and CC mode transistors.
13. Innovative Experiment

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3				3		3	1	3	1	
CO2	3	3	2	1	3				3		1	2	3	1	
CO3	3	2	2	2	1				3		1	1	1	2	
CO4	2	2	1	2	3				3			1	3	2	
CO5	3	1	2	2	3				3			1	3	1	

Paper Name: Workshop
Practice Paper Code: ME291

Total Contact Hours: 36

Credit:2

Prerequisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

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

Course Outcome:

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

CO 1 Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO 2 Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisel set can performing
Operations like such as Marking, Cutting etc used in manufacturing processes.
CO 3 Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.
CO 4 Get hands on practice of in Welding and various machining processes which give A lot of confidence to manufacture physical prototypes in project works.

Course contents

List of Activities:

Sl. No.	Syllabus	ContactHrs
Module1	Pattern Making	6
Module2	Sheet Metal Work	6
Module3	Fitting	9
Module4	Machining in Lathe	9
Module5	Welding	6

CO-PO-**PSO** Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	-	1	2	-	1	-	2	3	-
CO2	3	-	-	-	-	-	-	2	2	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	1	2	-	-	-	-	2	-
CO4	3	-	-	-	1	-	-	3	2	-	-	2	2	2	-

Paper Name: Soft Skills Development
Paper Code: MC281
Total Contact hours: 26

Course Objectives:

The objectives of this course are as follows:

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

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

MODULE I–

COMMUNICATION TRAINING (2L)

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

MODULE II-

COMMUNICATION TRAINING (ACCENT NEUTRALISATION) (2L)

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

MODULE III–

BUSINESS ETIQUETTE (2L)

Presenting one self in the Business Environment.
Corporate Dressing and Mannerism.
Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
Multi Cultural Etiquette.
Cultural Difference.
E-mail Etiquette.

MODULE IV–

JOB APPLICATION AND CV/VIDEO RESUME (2L)

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

MODULE V-

INTRODUCTION TO CORPORATE LIFE AND PROTOCOLS (2L)

Introduction of Companies (Domain Specific)

Opportunities and Growth Plan.
Performance and Corporate Behavior.
Service Level Agreement and Corporate Jargon.
Networking and Adapting to Culture, Technology and Environment.

MODULEVI–

GROUP DISCUSSION (2L)

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

MODULE VII–

LEADERSHIP SKILL (2L)

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

MODULE VIII –

TEAM WORK(2L)

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

MODULE IX–

PUBLIC SPEAKING AND INTERVIEW BASICS (2L)

Extempore.
JAM.
Interview Skill
Interview over Telephone, Video Conference Interview etc.

MODULE X–

BUSINESS TELEPHONE ETIQUETTE (2L)

Five Phases of a Business Call.
Pitch, inflection, Courtesy and Tone.
Understanding, Rate of Speech, Enunciation.
Hold Procedure.
Cold and Hot Transfer protocols.
Dealing with Different Types of Customers (Irate, Talkative, Turn around etc.)

MODULE XI-

READING SKILL

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

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

LIST OF REFERENCE:

1. Effective Communication and Soft-Skills: Strategies for Success, Nitin Bhatnagar and Mamta Bhatnagar,Pearson,2012.
2. Soft Skills: Know yourself and know the World, Dr.K.Alex, SChand,2009.
3. Soft Skill sat Work: Technology for Career Success, Beverly Amer, Course Technology, 2009.
4. The Pronunciation of English, Daniel Jones, Cambridge University Press,1998.
5. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S.Martin and Lillian H.Chaney, Praeger,2012.
6. The CV Book: Your Definitive Guide to Writing the Perfect CV, James Innes, Pearson.
7. Understanding American Business Jargon: A Dictionary, W.Davis Folsom, Green wood Press, 2005.
8. Navigating Corporate Life, Stanley Tyo.
9. Group Discussion: A Practical Guide to Participation and Leadership, Kathryn SueYoung, Julia T.Wood, Gerald M.Phillips and Douglas J.Pedersen,Waveland PressInc.,2007.
10. The Leadership Skills Handbook, Jo Owen, KoganPage,2006.
11. TeamworkTraining,SharonBoller,ASTDPress,2005.
12. PublicSpeakingforSuccess,DaleCarnegie,Penguin,2005.

13. EffectiveInterviewingSkills,TraceyA.SwiftandIvanT.Robertson,BPSBooks, 2000.
14. Telephone Etiquette: Making Lasting First Impressions, Theo Gilbert-Jamison, Performance Solutions, 2013.
15. Reading Comprehension Strategies: Theories, Interventions and Technologies, DanielleS .McNamara, Lawrence Earlbaum Associates, 2007.
16. www.mindtools.com.

Paper Name: Mathematics III
Paper Code: M301
Contact: 44
Credit:4

Prerequisites: Any introductory course on Calculus and Combinatory.

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

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

CO 1: Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.

CO 2: Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, Probability distribution of a random variable, Calculus of complex variable, partial differential equation and ordinary differential equation.

CO 3: Apply Cauchys integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by identifying probability
distribution that fits the phenomena.

CO 4: 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).

CO 5: Find the Fourier series and Fourier transform of functions by organizing understandings of
underlying principles and also evaluate the integral using Parseval's identity.

Course contents:

MODULEI:

Fourier Series and Fourier Transform:

Sub-Topics: Introduction, Periodic functions: Properties, Even& Oddfunctions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed

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

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine&SineTransformsofelementaryfunctions.PropertiesofFourierTransform:

Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

Discussions on application of the topic related to ECE 10L

MODULE II:

Probability Distributions: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof).Examples. Definitions of Expectation &Variance, properties & examples. Some important discrete distributions: Binomial, Poisson. Continuous distributions: Normal. Determination of Mean, Variance and standard deviation of the distributions. Correlation & Regression analysis, Least Square method, Curve fitting.

Discussions on application of the topic related to ECE

10L

MODULE III:

Calculus of Complex Variable

Introduction to Functions of a Complex Variable, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems.

Complex Integration

Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. Cauchy's theorem (statement only).Cauchy- Goursat theorem (statement only).Examples. Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. Taylor's series, Laurent's series. Examples.

Zeros and Singularities of an Analytic Function & Residue Theorem.

Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, Introduction Conformal transformation, Bilinear transformation, simple problems.

Discussions on application of the topic related to ECE 12L

MODULE IV:

Basic concepts of Partial differential equation (PDE):

Origin of PDE, its order and degree, concept of solution in PDE .Introduction to different methods of solution : Separation of variables, Laplace & Fourier transform methods.

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

PDE I: One dimensional Wave equation.

PDE II: One dimensional Heat equation.

PDEIII: Two dimensional Laplace equation.

Introduction to series solution of Ordinary differential equation (ODE): Validity of the series solution of an ordinary differential equation. General method to solve Po y"+P1 y'+P2 y=0and related problems to Power series method. Brief review on series solution of Bessel & Legendre differential equation. Concepts of generating functions.

Discussions on application of the topic related to ECE

12L

Text Books:

1. Rathor, Choudhari,: Discrete Structure and Graph Theory.
2. Gupta S. Cand Kapoor V K:Fundamentals of Mathematical Statistics-Sultan Chand & Sons.
3. Lipschutz S:Theory and Problems
4. Spiegel MR: Theory and Problems of Probability and Statistics (Schaum's Outline Series)-McGraw Hill Book Co.
5. Goon A.M., Gupta MK and Dasgupta B:Fundamental of Statistics –The World Press Pvt. Ltd.
6. Spiegel MR: Theory and Problems of Complex Variables (Schaum's Outline Series)-McGraw Hill Book Co.
7. Bronson R: Differential Equations(Schaum's Outline Series)- McGraw Hill Book Co.
8. Ross SL: Differential Equations- John Willey & Sons.
9. West D. B.: Introduction to Graph Theory – Prentice Hall
10. Deo N: Graph Theory with Applications to Engineering and Computer Science-Prentice Hall.
11. Grewal BS: Higher Engineering Mathematics (thirty fifth edn)-Khanna Pub.
12. KreyzigE : Advanced Engineering Mathematics-John Wiley and Sons.
13. Jana-Undergradute Mathematics
14. Lakshminarayan-Engineering Math1.2.3
15. Gupta-Mathematical Physics (Vikas)
16. Singh-Modern Algebra
17. RaoB:DifferentialEquationswithApplications&Programs,UniversitiesPress
18. Murray:IntroductoryCoursesinDifferentialEquations,UniversitiesPress

Reference Books:

1. Delampady, M: Probability & Statistics, Universities Press
2. Prasad : Partial Differential Equations, New Age International
3. Chowdhury : Elements of Complex Analysis, New Age International
4. Bhat : Modern Probability Theory, New Age International
5. Dutta: A Textbook of Engineering Mathematics Vol.1 &2, New Age International
6. Sarveswarao: Engineering Mathematics, Universities Press
7. Dhami: Differential Calculus, New Age International

CO-PO-**PSO** Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	2	1	2	-
CO4	2	3	2	2	-	-	-	-	-	-	-	1	3	1	2
CO5	3	2	2	1	-	-	-	-	-	-	-	1	1	1	-

Paper Name: Numerical Methods

Paper Code: M(CS)301

Contact:32

Credit:3

Pre requisites: Concept of Calculus and Algebra.

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

Course Outcome:

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

CO1: Recall the distinctive principles of numerical analysis and the associated error measures.
CO2: Understand the theoretical workings of numerical techniques.
CO3: Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
CO4: Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.

Course Contents:

MODULE I:

NUMERICAL METHOD I :Approximation in numerical computation: Truncation and rounding errors, Propagation of errors, Fixed And Floating-point arithmetic. (2L)

Interpolation: Newton forward/backward interpolation, Stirling & Bessel's Interpolation formula, Lagrange's Interpolation, Divided difference and Newton's divided difference Interpolation. (7L)

Numerical integration : Newton Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Romberg Integration, Expression for corresponding error terms. (5L)

Numerical solution of a system of linear equations: Gauss elimination method, Tridiagonal Matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation(SOR)method. (6L)

MODULE II :

NUMERICAL METHOD : Solution of polynomial and transcendental equations: Bisection

method, Regula- Falsi, Secant Method, Newton-Raphson method. (5L)

Numerical solution of ordinary differential equation: Taylor series method, Euler's method, Euler's modified method, fourth order Runge - Kutta method and Milne's Predictor-Corrector Methods. (6L)

Numerical solution of partial differential equation: Finite Difference Method, Crank–Nicolson method. (2L)

Text Books:

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

Reference Books:

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

CO-PO-**PSO** Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**1**										**2**		
CO2	**3**	**3**	**2**	**1**								**2**			
CO3	**3**	**2**	**3**	**2**								**2**	**1**	**2**	
CO4	**2**	**3**	**2**	**2**								**1**	**2**	**1**	**2**

Paper Name: Solid State Devices

Paper Code: EC301

Contact: 3P

Credits:3
Lectures:40

COURSE OBJECTIVES:

1. To understand the fundamentals of semiconductor behavior and the operation of basic semiconductor devices.
2. Understanding of a top-down view of traditional electronic device.
3. Understanding of a vast array of other more advanced semiconductor devices.
4. Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
5. Develop the basic tools with which newly developed devices and other semiconductor applications can be studied.

COURSE OUTCOME:
On successful completion of the learning sessions of the course , the learner will be able to:

CO1: Able to describe the Energy band diagram, charge carrier transport phenomenon and recombination-generation process of different types of semiconductor materials.

CO2: Able to study the Characteristics & Current flow of semiconductor devices like BJT, JFET, MOSFET, MESFET, HEMT & Metal-Semiconductor Junction & Hetero Junction Devices.

CO3: Able to analyze the design parameters of MOSFET i.e- Channel length & width, depletion width, surface field and potential, ON resistance, trans conductance, equivalent circuits, amplification factors, capacitances, noise margins, scaling & short channel effects MOSFET.

CO4: Able to Illustrate rectifying properties of different types of junction diode, Importance of reverse current in optical detectors, photodiodes, solar cells, Tunnel diode, LED & Thyristors.

Prerequisites: Conductors, Semiconductors and Insulators, electrical properties, band diagrams. Intrinsicandextrinsic,energybanddiagram,electricalconductionphenomenon,PtypeandN-typesemiconductors, drift and diffusion carriers, Diodes and Diode Circuits Formation of P-Njunction, energy band diagram, built-in potential, Formation of PNP /NPN junctions, energy banddiagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics, Biasing and Bias stability, Concept of Field Effect Transistors (channel width modulation),Gate isolation types, JFET Structure and characteristics and CS, CG,CD configurations.

Module I:
Energy Band Theory, Charge Carriers in Semiconductors: [13L]
Energy Band Theory:
Crystalline, non-crystalline and polycrystalline structure with example; direction of planes-Miller Indices (concept only); [1L]

Concept of Schrodinger's equation information of energy bands in crystal, Bloch theorem, Bloch Functions, Review of the Kronig- penney model, Brillouin zones, Number of states in the band, Band Gap in the nearly free electron model, the tight binding model, Formation of allowed and forbidden energy bands. [3L]
Effective mass, Wave vector, Energy-band (E-k) diagram, Relation between E-K diagram & Effectivemass,Debyelength.Direct&indirectband-gapsemiconductors;CompoundSemiconductor. [2L]

Charge Carriers in Semiconductors:
Intrinsic & extrinsic semiconductor. Effect of temperature and energy gap on intrinsic concentration, effect of temperature on extrinsic semiconductor, derivation of equilibrium electron and hole concentration in terms of effective density states and intrinsic level, derivation of electron and hole concentration in a compensated semiconductor ,basic concept on optical absorption , photoluminescence, carrier life time , carrier generation and recombination , continuity equation (expression and significance only).Degeneracy and non-degeneracy of semiconductor.
[3L]

Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of Fermi level, Fermi Level shift with doping & temperature, invariance of Fermi level at equilibrium, intrinsic carrier concentration expression (no derivation). [2L]

Non-equilibrium condition: Effect of temperature and doping concentration on mobility, Effective mobility due to scattering effect, Drift & diffusion of carriers with simple expressions, High field effect drift velocity, Hall Effect and piezoelectric effect, Generation and recombination, quasi-Fermi Energy Level (concept only). [2L]
Module II:

Junction Physics in Semiconductor Devices: [1L]
Semiconductor-Semiconductor Junction: Homo Junction
P-N Junction Diode: Energy band diagram, creation of depletion region; plotting of junction voltage, depletion layer charge and junction field ;current components in forward and reverse biased junction ; derivation of inbuilt potential and depletion width; junction capacitance , Varactor diode ; derivation of diode current equation; Zener break down principle, static and dynamic resistance of rectifier diode , dynamic resistance of Zener diode, effect of temperature on break down voltage. [3L]

Photo Devices: Solar cell – photo-voltaic effect, constructional features of solar cell, conversion efficiency and fill factor; LED; [2L]

Special Diodes: PiN Diode-basic operating principle only, Gunn Diode and IMPATT diode. Tunnel Diode-Energy band diagram & Negative resistance property. [3L]

Semiconductor-Semiconductor Junction: Hetero Junction
Energy band diagram, Classification of Hetero Junction, 2D Electron Gas (Isotype Hetero junction), Anisotype Hetero junction, I-V Characteristics. Numerical Problems. [2L]

Metal-Semiconductor Junction:
Metal-Semiconductor Contact: Ohmic and non-Ohmic contact and explanation using energy band diagram; Schottky diode and its application. [2L]

Module III: Device Physics of Bipolar Junction Transistor: [8L]

Physical mechanism, carrier distribution in forward active mode , terminal current equations, common base current gain (α) , common emitter current gain (β),controlling parameters for β, punch-through and avalanche effect, expression for punch through voltage and avalanche breakdown voltage(no derivation), Solution of continuity equation and Poisson's equation for BJT, Eber's Moll model for Static behavior &Charge controlled model (without derivation) for dynamic behavior, equivalent circuits, Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors), origin of parameters in hybrid-pi model, time delay factors in BJT , alpha and beta cut-off frequency ,idea of photo transistor. Numerical Problems.

Module IV: Field Effect Transistors: [8L]

Junction Field Effect Transistor (JFET):
Construction, field control action and characteristics (recapitulation), pinch-off voltage derivation .Numerical Problems. [2L]
Metal Oxide Field Effect Transistor (MOSFET):
Types of MOSFET, structure of E-MOSFET ,MOS structure under external bias-accumulation ,depletion and inversion phenomenon with energy band diagram ,threshold voltage and flat band voltage ;working of E- MOSFET with characteristics; drain current equation for linear and saturation region with condition(expression only); channel length modulation; derivation of threshold voltage of ideal and non-ideal MOSFET;MOSFETCapacitance-DifferenttypesofMOSFETCapacitances,MOScapacitancevariationwithgateto source voltage under low frequency & High Frequency; large and small signal model of MOSFET(explanation with diagram).Numerical Problems. [6L]

Text Books:
Streetman & Banerjee - Solid State Electronic Devices, PHIS. M. Sze, Physics of semiconductor devices, Wiley

Reference Books:
Milman,Halkias–IntegratedElectronics–TMHSedra&Smith-MicroelectronicCircuits-Oxford
Neamen- Semiconductor Physics and Devices TMH
S.M.Kang and Y.Leblebici.- CMOS Digital Integrated Circuits, Tata McGraw-Hill

CO-PO-PSO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**		**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	
CO2	**3**	**3**	**3**	**3**	**-**	**2**	**-**			**-**	**2**	**3**	**3**	**2**	
CO3	**3**	**3**	**3**	**3**		**-**	**-**	**2**		**2**		**3**	**3**	**3**	
CO4	**3**	**3**	**3**		**2**	**-**	**-**		**3**		**-**	**3**	**3**	**2**	

Paper Name: Circuit Theory & Networks
Paper Code: EC302
Contact :(3L+1T)/Week (Total=42)
Credit:4

Prerequisites: Properties of series and parallel connections, concept of KCL, KVL , complex algebra , current-voltage phasor diagram ,DC and AC ,Charging and discharging of capacitor, Energizing and decaying of inductor

Course Objective: Electrical Circuit is essential everywhere in Electronic and Communication engineering whether it is core electronics applications or communication applications. Therefore objective of this course is to learn circuit analysis technique with the help of networks theorem and methods both for DC and AC consideration.

Course Outcomes(COs):

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

CO1: Anayse series and parallel resonance circuit based on parameters : resonance frequency , band-width , upper & lower cut-off frequency, quality factor and impedance
CO2: Determine current, voltage and power at different branch for DC and AC circuit using various networks theorems and methods
CO3: solve branch current and branch voltage with
CO4:Students able to apply Laplace Transform technique for the determination of current, voltage and power in a magnetically coupled and transient circuit
CO5:Students able to estimate parameters of two port network

Course contents:

MODULEI:
Resonance-
SeriesandParallelresonance,Impedance&AdmittanceCharacteristics,Propertiesofresonance,QualityFactor,HalfPowerPoints,Bandwidth,Phasordiagrams,Transformdiagrams,Practicalresonantcircuits,SolutionofProblems.[5]

MODULEII:
Network Analysis-
Node Voltage Analysis: Kirchoff's Current law, Formulation of Node equations and solutions, Solution of problems with DC and AC sources.
Mesh Current Analysis: Kirchoff's Voltage law, Formulation of mesh equations , Solution of mesh equations by Cramer's rule and matrix method , Solution of problems with DC and AC sources
Network Theorems: Definition and Implication of Superposition Theorem , Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, maximum Power Transfer theorem, Millman's theorem, Star delta transformations, Tellegen's

Theorem, Solutions and problems with DC and AC sources, driving point admittance, transfer Admittance, Driving point impedance, Transfer impedance.[12]

MODULE III:

Graph Theory-Concept of Tree, Branch, Treelink, Incidence Matrix, Cut Set Matrix ,Tie Set Matrix, Formation of incidence, tie set, cut set matrices of electric circuits [4]

MODULE IV:

Magnetically Coupled Circuit - Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Solution of problems. [4]

MODULEV:

Laplace Transform-Concept of Complex frequency, Properties of Laplace Transform, transform of-step, gate, impulse, exponential, periodic functions, over damped surge, critically damped surge, damped and un-damped sine functions, transfer function, poles, zeroes, Initial value theorem and final value theorem, Inverse Laplace Transform using partial fraction method, circuit analysis ins-domain [7]

MODULE VI:

Transient Analysis -Transient analysis of RC, RL, RLC circuit with DC & AC sources, Application of Laplace Transform to transient analysis. [5]

MODULEV II:
Two Port Network-
Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions of Reciprocity and Symmetry, Interrelation between different parameters, Ladder Network & General Network, Solution of Problems. [5]

Text Book:

1. A. Chakrabarti- Circuit Theory :Analysis and Synthesis, Dhanpat Rai &Co.
2. ValkenburgM.E.Van,"NetworkAnalysis",PrenticeHall./PearsonEducation
3. Hayt "Engg CircuitAnalysis"6/e Tata McGraw-Hill
4. D.Roy Chowdhury- Networks And Systems, New Age International

Reference Books:

1.B.L.TherejaandA.K.Thereja-A Text book of Electrical Technology: Basic Electrical Engineeringin S.I. Units (Volume-1) ,S-Chand
2. Sudhakar:Circuits&Networks:Analysis&Synthesis"2/e TMH
3. D.A.Bell-Electrical Circuits-Oxford
4P.RameshBabu-ElectricalCircuitAnalysis-Scitech

5. M.S. Sukhija & T.K.Nag Sarkar-CircuitsandNetworks-Oxford
6. Skilling H.H.:“Electrical Engineering Circuits”, John Wiley & Sons.
7. Edminister J.A.:“Theory & Problems of Electric Circuits”,McGraw- Hill Co.
8. Kuo F.F., “Network Analysis & Synthesis”, John Wiley & Sons.
Sivandam-Electric Circuits and Analysis , Vikas

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	1	2	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	1	2	-	-	-	-	-	-	-	3	2	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	2	-
CO5	3	3	3	2	2	-	-	-	-	-	-	-	3	1	-

Paper Name: Data Structures
Paper Code: CS(ECE)301
Contact: 3
Credit Point: 3
No. of Lectures: 36 Hours

Pre requisite:

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

Course Objective

To learn the basics of abstract data types.

To learn the principles of linear and nonlinear data structures.To build an application using sorting and searching.

Course Outcome(s)

On completion of the course students will be able to

CO1: Understand the Big-O notation and apply arrays and linked list to represent the row major, column major and sparse matrix.
CO 2: Interpret stack and queue to classify the infix to postfix and prefix notations.
CO3: Design binary search tree, threaded binary tree, max & min heap, AVL tree and greedy algorithm to represent and access the data from memory.
CO 4 : Evaluate data using BFS , DFS . Prim's and Kruskal's Algorithm
CO5: Able to apply searching and sorting on the data using Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort, Sequential search, Binary search and Interpolation Search.

Course Content:

Module I:

Linear Data Structure [10L]Introduction (2L):

Concepts of data structures: a) Data and data structure b) Abstract Data Type and DataType. Algorithms and programs, basic idea of pseudo-code (1L)

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations (1L)

Array (2L):

Different representations – row major, column major (1L)

Sparse matrix - its implementation and usage, Array representation of polynomials (1L)

Linked List (6L):

Singly linked list – operations, Doubly linked list – operations (4L)

Circular linked list – operations, Linked list representation of polynomial and applications (2L)

Module II:

Linear Data Structure [6L]

Stack and Queue (4L):

Stack and its implementations (using array and linked list) (1L)

Applications (infix to Postfix, Postfix Evaluation) (1L)

Queue, circular queue, de-queue (1L)

Implementation of queue- linear and circular (using array and linked list) (1L)

Recursion (2L):

Principles of recursion - use of stack, tail recursion. (1L)

Applications - The Tower of Hanoi, Eight Queens Puzzle (1L)

Module III:

Nonlinear Data structures [12L] Trees (8L):

Basic terminologies, forest, tree representation (using array and linked list) (1L)

Binary trees - binary tree traversal (pre-, in-, post- order) (1L)

Threaded binary tree (1L)

Binary search tree- operations (creation, insertion, deletion, searching) (1L)

Concept of Max-Heap and Min-Heap (creation, deletion) (1L)

Height balanced binary tree – AVL tree (insertion with examples only) (1L)

Height balanced binary tree – AVL tree (deletion with examples only) (1L)

m –Way Search Tree, B^+ Tree – operations (insertion, deletion with examples only) (1L)

Graphs (4L):

Graph theory review (1L)

Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts ofedges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)

Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

Module IV:

Searching, Sorting [8L]

Sorting Algorithms (4L):

Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)

Quick sort, Merge sort – with complexity (2L)

Radix sort – with complexity (1L)

Searching (2L):

Sequential search – with complexity (1L)

Binary search, Interpolation Search– with complexity (1L)

Hashing (2L):

Introduction to Hashing and Hashing functions (1L)

Collision resolution techniques (1L)

Recommended books:

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

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1						3	3	3	3
CO2	2	2	3	2	3							3	3	2	3
CO3	2	3	2	2	2							3	3	3	2
CO4	3	2	2	2	3							3	3	2	2
CO5	2	2	2	2	1	1						3	3	3	3

Paper Name: Numerical Methods Lab
Paper Code: M(CS)391
Contacts : 3
Credits : 2

Pre requisites: Any introductory course on C/ MATLAB.

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

Course Outcome:

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

CO1: Recall the distinctive principles of numerical analysis and the associated error measures.

CO2: Understand the theoretical workings of numerical techniques.

CO3: Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

CO4: Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.

Course contents:

List of Experiments

Assignments on Newton forward /backward, Lagrange's interpolation, Sterling &Bessel's Interpolation formula, Newton's divided difference Interpolation.

Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule,Weddle's rule and Romberg Integration.

Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.

Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method

Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.

Assignments on numerical solution of partial differential equation: Finite Differencemethod, Crank–Nicolson method.

Implementation of numerical methods on computer through C/C++ and commercialSoftware Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical AlgorithmsGroup)/Python.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	3					2			1	1		
CO2	3	2	2						2			1	1		
CO3	3	2	2						2			2		2	
CO4	3	3	2						2			1	3	1	2

Paper Name: Circuit Theory and Networks Lab
Paper Code: EC392
Contact: 3P/Week
Credit: 2

Pre requisites:
Theoretical concept on series and parallel connections, concept of KCL, KVL, circuit with electrical components , DC and AC source.

Course Objective:
Objective of this course to acquire hands on experience for designing, development and analysis of electrical circuit using AC and DC source .Also to use modern tools to solve problems on circuit theory and electrical networks .

Course Outcomes (COs):

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

CO1: Students able to analyse series parallel resonance circuit and transient response in RC, RL and RLC circuit using MATLAB tools
CO2: Students able to validate networks theorems
CO3 : Students able to test the effect of inductance on speed of system
CO4: Students able to determine two port parameters, Laplace transform of different time domain functions and partial fraction expansion in s domain
CO5: Students able to originate periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB

Course contents:

List of Experiments

Characteristics of Series & Parallel Resonant circuits
Verification of Network Theorems
Transient Response in R-L & R-C Networks ; simulation / hardware.
Study the effect of inductance on speed of system response; simulation/Hardware
Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, andramp signals using MATLAB
Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s domain and cascade connection of second-order systems using MATLAB
Determination of Laplace Transform, different time domain functions, and Inverse Laplace Transformation using MATLAB Note: An Institution / college may opt for some other hardwareor software simulation wherever possible in place of MATLAB

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3				2			3	3		
CO2	3	3	2	2	3	1			2			3	1		
CO3	3	3	3	2	3				2			3	3	2	
CO4	3	3	3	3	3	1			2			3	3	1	
CO5	3	3	3	3	3				2			3	1	1	

Name of the Paper: Data Structures Lab

Paper Code: CS(ECE)391

Contact : 3

Credit : 2

Pre requisite:

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

Course Objectives:

To write and execute programs in C to solve problems using data structures such as arrays,

Linked lists, stacks, queues, trees, graphs, hash tables and search trees.

To write and execute write programs in C to implement various sorting and searching methods.

Course Outcome:

CO1: Apply single and double linked list to represent data.

CO2: Apply stack and queue to analyse infix and postfix notation.

CO3: Create binary search tree to represent

data for manipulation.

CO4: Realize the insertion, merge, quick, selection sort to implement sorting technique to analysedata sequence.

CO5: Apply the linear and binary search on a sequence to find the location of a data.

Course content:

Module1

Write a C program that uses functions to perform the following:

Create a singly linked list of integers.
Delete a given integer from the above linked list.
Display the contents of the above list after deletion.

Write a C program that uses functions to perform the following:

Create a doubly linked list of integers.
Delete a given integer from the above doubly linked list.

Display the contents of the above list after deletion.

Write a C program to implement Polynomial addition and Polynomial multiplicationusing Linked List.

Write a C program that uses stack operations to convert a given infix expression into itspostfix Equivalent, Implement the stack using an array.

Write C programs to implement a queue ADT using i) array and ii) doubly linkedlist respectively.

Module 2

Write a C program that uses functions to perform the following:

Create a binary search tree of characters.
Traverse the above Binary search tree recursively in Postorder.

Write a C program that uses functions to perform the following:

Create a binary search tree of integers.
Traverse the above Binary search tree non recursively in order.

Module 3

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

Module 4

Write C programs for implementing the following graph traversal algorithms:

Depth first search
Breadth first search

TEXT BOOKS:

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

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	1	3	3								3	3	2	1
CO2	3	2	3	1									1		2
CO3	1	3	3	2								3	1	2	3
CO4	2	1	3	1									1		1
CO5	3	3	3	3									2		2

Paper Name: Physics –II
Paper Code: PH (ECE) 401
Total Contact Hours: 33
Credit: 3

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

Objective of the Physics-II Course:

The Physics-II course will provide

Exposure to the physics of materials that are applied in electronics devices.
An insight into the science & technology of next generation and related technicalities through quantum mechanics
Exposure to nanoelectronic devices
Concept of fundamental particles and associated applications in semiconductors

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

CO1: Understand basic laws of electromagnetism using vector calculus.

CO2: Apply Schrodinger equation to solve quantum mechanical problems.

CO3: Explain the behavior of electromagnetic waves.

CO4: Able to discriminate between different statistics.

Course Contents

Module1: Electricity and Magnetism (15L)

Module 1.01:Vector Calculus

Vector operators, Gradient, Divergence, Curl-Physical significance, Scalar and Vector field, Gauss's divergence theorem (statement only), Stoke's theorem (statement only), expression of gradient, divergence, curl in spherical and cylindrical coordinate system. 3L

Module1.02: Electrostatics

Coulomb's law in vector form, Electrostatic field and its curl, Gauss's law in integral form and conversion into differential form, Equation of continuity, Extend to Poisson's & Laplace's equation, Application to parallel plate, spherical and cylindrical capacitors (equivalent 1D problem). 4L

Module1.03: Magneto statics

Biot-Savart law (non existence of magnetic monopole)-application, Magnetic vector

and scalarpotential.Ampere'scircuitallaw,force on a small current element placed in a magnetic field .force due to parallel and anti-parallel current carrying wire and definition of Ampere, Lorentz force (concept in Hall effect). 5L

Module1.04: Electro-magnetism & Electromagnetic theory

Faraday's law-integral and differential form, Concept of displacement current, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave. 3L

Module2: Quantum Mechanics-II (7L)

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

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

Module3: Statistical Mechanics (4L)

Concept of energy levels and energy states. Microstates, Macro states 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

Module4: Physics of Organic semiconductors & Nanomaterials (7L)

Module4.01:Physics of Organic semiconductors:

Exciton,bi-exciton,polaron,bipolaron,soliton,organicsemiconductors(qualitativediscussions)-Comparison with silicon based semiconductor electronics, applications. 3L

Module4.02: Physics of Nanomaterials (RB)

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 nano materials (CNT, grapheme, electronic, environment, medical). 4L

Reference Books

Insulating Materials: Principles, Materials, Applications, Margit Pfundstein, Roland Gellert,Martin Spitzner& Alexander Rudolphi: Birkhauser Verlag AG; 1 edition (1 April 2008)
High Voltage and Electrical Insulation Engineering, RavindraArora, Wolfgang Mosch: Online ISBN: 9780470947906 DOI:10.1002/9780470947906, Series Editor(s): Mohamed E. El-Hawary
Physics of Oscillations and Waves, N.K. Bajaj ,Publisher: McGraw-Hill Education –Europe
Waves and oscillations, Dr.P.K Mittal & Prof Jai DEV ,AnandHarAnand publications
Fundamental of Statistical Mechanics: B Laud
Introduction to statistical mechanics : .Pathria
Fundamental of Statistical and Thermal Physics: .F. Reif
Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell
Introduction to Electrodynamics- Griffiths David J.
The Feynman Lectures on Physics. 2 (2nd ed.)Feynman, Richard P,Addison- Wesley.
11.Etching of Crystals-Theory, Experiment and Application, K Sangwal
Nanostructure and Nanomaterials, B.K. Parthasarathy
Introduction toNanotechnology, B.K. Parthasarathy
Essentials of Nanotechnology, RishabhAnand
Nanomaterials Handbook(Advanced Materials and Technologies)-YuryGogotsi (Editor)
Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**1**										**1**	**3**	**2**	**1**
CO2	**3**	**2**										**2**	**3**	**3**	
CO3	**2**	**3**										**1**	**3**	**1**	
CO4	**1**	**2**	**2**	**3**								**1**	**3**	**3**	

Paper Name: Signals & Systems
Paper Code: EC401
Contacts:3L
Credits:3
Total Contact:35

Pre requisites

The candidates should learn mathematics, basic knowledge of differential equations and differenceequations, electrical circuits and networks

Course Objectives

To understand the basic properties of signal & systems and the various methods of classification.
To learn Fourier series and Fourier transform and their properties
To know Z transform & DTFT and their properties
To characterize LTI systems in the Time domain and various Transform domains

Course Outcome:

CO 1: Identify the classification of signals in terms of periodic-aperiodic, even – odd, energy-power, Deterministic-random,complexexponential,sinusoidalsignals,unitimpulseandunitstep.

CO2: Determine the mathematical operation on signals and systems using time scaling, time shifting, linearity, causality, time invariance, stability, convolution theorem and Fourier series coefficient with Dirichlet's conditions.

CO3: Discriminate different spectrum analysis techniques and its analysis and characteristics on LTI system using Fourier transform.

CO4: Analyze the Z-transform with the help of properties of ROC, Poles and Zeros , inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion.

CO5: Understand the application of sampling theorem, types of sampling, reconstruction of a signal from its samples, aliasing effect and the effect of random variable with its properties like distribution & density functions, mean values & moments, concepts of correlation, random processes.

Course content:

Module I

Introduction to signals and systems: [13]

Continuous and discrete time signals: Definition and example of continuous signal, Representation of continuous time signals by its sample, Types of sampling, Sampling theorem, Reconstruction of a Signal from its samples, concept of discrete signal, Definitions and Numerical on Unit step, Unit Impulse, Unit Ramp, Exponential and Sinusoid both for continuous and discrete, Representation of signals using graphical, tabular and sequential form. [6]

Classification and convolution of Signals : Definitions and numerical of Periodic & Aperiodic signals, Even & Odd signals, Energy & Power signals, Deterministic & Random signals, Causal, Anti causal and Non causal signals, Complex exponential and sinusoidal signals, convolution of two signals using graphical and matrix method. [4] Some operations on signals: Time reversal, Time shifting, Time scaling. [1]

Systems and its classifications: Definition of systems and its representation, Definition and numerical of Linear & Non linear system, Causal & non causal system, Time variant & invariant system, Stability of the system, Systems with memory and without memory, Invertible and noninvertible Systems. [2]

Module –II

Fourier Series of Continuous-time and Discerete–time Signals [5]

Fourier series analysis & Derivation of Fourier Coefficients Equation(Exponential form only), Fourier Series Properties ,Symmetry Properties of the Fourier Series, Diminishing of Fourier Coefficients, Dirichlet Conditions, Gibbs's Phenomena, Parseval's relation (statement only), Problems on Fourier series & Basic concept of Discrete time Fourier series. [5]

Module III

Signal Transformation [6]

Introduction to Continuous time Fourier Transform (CTFT): Definition, Importance,Relation with Fourier series, Examples. [1]

Computation of Fourier transform of different signals: Exponential, unit step function, Impulse function, sine and cosine wave, rectangular wave and other different waveforms.Computation of magnitude and phase spectrum. [2]

Properties of Fourier Transform
Linearity, Time shifting, Conjugation, Differentiation, Integration, Time scaling, Parseval's theorem, Duality, Convolution. [1]

Discrete time Fourier Transform(DTFT):
Introduction, Definition, Computation of DTFT of different sequences. [1]

Properties of DTFT: Linearity, Time shifting, Frequency shifting, Conjugacy, Time Reversal, Parseval's , Convolution, Multiplication. [1]

Module IV

Z-Transforms [8]

Introduction to Z-Transforms: Definition, Relationship between Fourier transform and Z-transform, Region of convergence (ROC), Properties of ROC, Properties of Z-transform, transfer function, concept of Poles and zeros, Z-transform of different sequences. [5]

Inverse Z-transform:
Inverse Z -transform using residue theorem, power series expansion and partial fraction method.[3]

Module V

Introduction to Random Variables [3]

Definition of Random Signal, Random Variables and Probability Distributions, Examples. [1]

Statistical Properties of Random Signal: Independent and conditional random variables,

StandardDeviation, mean, variance, Examples. [1]

Independent and Dependent Random Variables, Arithmetic Mean. [1]

Text Books:

Linear Signals and Systems by B.P.Lathi-OXFORD university Press
Signals &Systems by A.V.Oppenheim, A.S.Willsky and S.H.Nawab - Pearson
Signals and Systems by P.Ramesh Babu & R.Anandanatarajan - Scitech

References:

Signals &Systems by A.Anand Kumar-PHI
Signals and Systems by S.Haykin & B.V.Veen-John Wiley
Signals and Systems by A.Nagoor Kani- McGraw Hill
Signals and Systems by S Ghosh- Pearson
Digital Signal Processing by M.H.Hays- TMH

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	3	2	-
CO3	3	3	2		-	-	-	-	-	-	-	2	3	2	-
CO4	3	3	2	1	-	-	-	-	-	-	-	2	3	2	-
CO5	3	3	2	1	-	-	-	-	1	-	-	2	3	1	-

Paper Name: Analog Electronic Circuits
Paper Code: EC402
Contact: L+1T
Credit:4

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

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

Course Outcome:

On successful completion of the course the students will be able to

CO1: Understand D.C power supplies.

CO2: Define and Understand transistor amplifier circuit.

CO3: Examine the effects of different feedback mechanism in amplifier circuit.

CO4: Analyze signal generator Circuit.

CO5: Analyze and evaluate power amplifier circuit.

CO6: Review linear and non linear applications of OPAMP(I.C-741).

Course contents:

Module-1:

a) PASSIVEFILTERS&VOLTAGEREGULATORS:Capacitorfilter,π-sectionfilter,estimation ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xxseries,conceptofSMPS,ideaofDCpowersupplies. [4]

b) SINGLESTAGETRANSISTORAMPLIFIER:Biasingtechniques,Q-point&itsStability,SelfBias-CEconfiguration,BiasCompensationtechniques,h-parametermodeloftransistors.Expression for voltage gain, current gain, input and output impedance, power gain, Emitter follower circuit. [4]

Module-2:

a) MULTISTAGE AMPLIFIER: Different coupling techniques, RC coupled amplifier, functionsofallcomponents,derivationofvoltagegain,currentgain,inputimpedanceandoutputimpedance,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. [5]

b) FEEDBACK AMPLIFIERS & OSCILLATORS: Feedback concept, negative& positive feedback, Transconductance Amplifiers, Transresistive Amplifiers, Barkhausen criterion, RCOscillators-PhaseshiftandWienbridgeoscillators,LCOscillator-Colpitts,Hartley's,and Crystal oscillators. [5]

Module-3:

a) POWER AMPLIFIERS: Class A, B, AB, C, Conversion efficiency, Tuned amplifier. [3]

b) FET AMPLIFIERS: Equivalent circuit of JFET and MOSFET, Common-source, Common gate And source follower amplifiers. [4]

c) DIFFERENTIAL AMPLIFIERS: BJT and MOS differential amplifiers, Small signal and large signal operations of differential amplifiers, Differential amplifier with active load and current mirror. [3]

Module-4:

a) OPERATIONAL AMPLIFIER & IT'S APPLICATIONS: Ideal & Non Ideal OPAMP-Electrical equivalent circuit and transfer characteristics, internal circuit of Operational Amplifier, adder & subtractor circuit, practical integrator & practical differentiator circuit, Instrumentation Amplifier, Log & Anti-logamplifiers,multipliers,PrecisionRectifier,Comparator&SchmittTrigger, voltage to current and current to voltage converters, Low pass and high pass active filters. [9]

b) MULTIVIBRATORS: Astable ,Monostable, Bistable multivibrators; Astable and MonostableoperationusingI.C-555timer.VoltageControlledOscillaor. [3]

Text Books:

1. Sedra&Smith-Microelectronic Circuits-OxfordUp
2. Millman&Halkais-IntegratedElectronics,McGrawHill.
3. Boylested&Nashelsky-ElectronicDevicesandCircuitTheory-Pearson/PHI
4. Rashid-MicroeletronicCircuits-AnalysisandDesign-Thomson(CenageLearning).
5. Franco-designwithOperationalAmplifiers&AnalogIntegratedCircuits,3/e, McGraw Hill.

Reference Books:

1. Razavi –Fundamentals of Microelectronics-Wiley
2. J.B.Gupta- Electronic Devices and Circuits- S.K . Kataria & Sons

3. Malvino-ElectronicPrinciples,6/e,McGraw Hill
4. Gayakwad R.A–Op Amps and Linear IC's, PHICO-PO

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2		2		3			3	3	2	
CO2	3	3	3	3	2	2	2		3			3	3	2	
CO3	3	3	3	3	2		2		3	2		3	3	2	
CO4	3	3	3	3	2		2		3			3	3	2	
CO5	2	3	3	3	2		2		3			3	3	1	
CO6	3	3	3		2								3	2	

Paper Name: Digital electronics &Circuits

Paper Code: EC403
Contacts:3L+1T=4
Credits:4
Lectures: 40hours

Course Objectives:

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

COURSE OUTCOME:

On successful completion of the course the students will be able to:

CO1: Understand how to solve problems related to number systems conversions and Boolean algebra and outlining logic circuits using logic gates to their simplest forms using De Morgan's Theorems; Karnaugh Maps.
CO2: Implement of combinational circuits
CO3: Apply State Diagrams Tables in various synchronous and asynchronous sequential circuits
CO4: Analyze EDAC ADC technique and corresponding circuits
CO5: Solve logic family interfaces, switching circuits memory storage devices for planning and executing projects.

Course Content:

Module 1

Binary, Octal and Hexadecimal number system representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Hamming Code. Signed binary number representation with1's,2's,9'sand10's complement methods, Binary arithmetic. Boolean algebra; Various Logic gates-their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method, Quine-McCluskey minimization technique(Tabular Method). [12]

Module-2:

Combinational circuits- Half Adder, Full Adder, Serial & Parallel Adder, Carry Look Ahead Adder, BCD Adder, Half Subtractor, Full Subtractor circuits, Adder-Subtractor Circuit. Encoder,Decoder, Multiplexer, De Multiplexer, Adder & Subtractor Design using decoder & multiplexer, Comparator and Parity Generator-Checker. [11]

Module-3:
Sequential Circuits-latch & Flip Flops- S-R,J-K, D and T, Conversion of Flip Flops, Various types of Shift Registers-SISO, PISO, SIPO, PIPO, Bidirectional & Universal Shift. Modulus Counters-Synchronous, Asynchronous, Irregular, Self Correcting Ring & Johnson Counter. Application of Counter (Stepper motor control) [11]

Module-4:
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 & Binary Weighted Resistor Type. Logic families-TTL,ECL, MOS and CMOS, their operation and specifications. TTL Equivalent Circuit.

[6]

Text books:

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

Reference:

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

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	1	2			1	1		2	3	1	
CO2	3	3	1	3	1	2			1	1		1	3	2	
CO3	3	3	1	3	1	2			1	1		2	3	3	
CO4	3	3	1	3	1	2			1	1		1	3	2	
CO5	3	3	1	3	1	2			1	1		2	3	2	

Paper Name: Analog Communication
Paper Code: EC404
Total Contact Hours: 40
Credit:4

Prerequisites:
Periodic signal and trigonometric Fourier series , Exponential Fourier series , Parsevel's Theorem for Fourier series, Fourier transform and its properties, Energy and power signal

Course Objective:
To introduce the concepts of analogue communication systems, and to equip students with various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Outcome (CO):

On successful completion of the course the students will be able to:

CO.1 Able to understand the generation of amplitude modulation and its representation in time and frequency domain.
CO.2 Able to evaluate the effect of DSB-SC, SSB and VSB in terms of modulation index and bandwidth efficiency.
CO.3 Able to apply the demodulation techniques of amplitude modulated signal.
CO.4 Able to remember the generation and detection of frequency modulation techniques.
CO.5 Able to analyse the noise performance of AM and FM signals.
CO.6 Able to create the performance of PAM, PWM and PPM Techniques

Course Contents:

MODULE-I
Introduction to Analog Communication: (13L)
Elements of communication system-Transmitters, Transmission channels & receivers, Concept of modulation, its needs [1L]. Review Fourier Transform and its properties [1L], Concept of Hilbert Transformation and its properties[3L].
Continuous Wave Linear Modulation:
a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone and multitone messages), modulation index [2L],frequency domain (spectral) representations, illustration of the carrier and side components; transmission bandwidth for AM; Phasor diagram of an AMsignal;[1L]

Calculation of Transmitted power & sideband power & Efficiency; concept of under, over and critical modulation of AM-DSB-FC.[1L]

b) Other Amplitude Modulations: Double sideband suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. [1L] Single sideband modulation (SSB)SC, VSB, Filter Transfer function, Spectra and band-width. [3L]

MODULE-II

Generation & Detection of Amplitude Modulation: (9L)

a) Generation of AM: Concept of i) Gated (switching and collector modulation methods)and ii)Square law modulators, Balanced Modulator.[2L]

b) Generation of SSB: Filter method, Phase shift method and the Third method [2L] Demodulation for Linear Modulation:

Demodulation of AM signals: Detection of AM by envelope detector [1], Concept of squaring synchronizer, Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections.[2L]

Principle of Superheterodyne receivers: Superheterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. [2L]

MODULE-III

Angle Modulation: (9L)

a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions (2L); Phasor diagram(1L);

b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM,Concept of VCO & Reactance modulator (2L)

c) Demodulation of FM and PM: Concept of frequency discriminators (1), Phase Locked Loop (2L) Ratio Detector (1L)

MODULE-IV

Noise (7L)

Random Signals and Noise in Communication System:

i)Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit.(2L) iii)Noise performance in Analog Communication systems: SNR calculation for DSB/FC, DSB-SC, SSB-FC, SSB-SC&FM.(3L)

MODULE-V

Pulse Modulation (2L)

Sampling theorem, Generation and detection of PAM / PWM / PPM, Aliasing effects (2L)

Text Books:

1. Taub and Schilling, "Principles of Communication Systems", 2nd ed., Mc-Graw Hill

2. B. P. Lathi- Communication Systems - B S Publications

3. V Chandra Sekar – Analog Communication - Oxford University Press

References:

1. Carlson—Communication System, 4/e, Mc-GrawHill

2. Proakis & Salehi Fundamentals of Communication Systems - Pearson

3. Singh & Sapre—Communication Systems: 2/e, TMH

4. P K Ghosh- Principles of Electrical Communications- University Press

5. L.W. CouchIi, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing

6. Blake, Electronic Communication Systems- Cengage Learning

7. S Sharma, Analog Communication Systems- Katson Books

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3			1						3	3	2	
CO2	3	3		3		2						3	3	2	
CO3	3	3	3	3		2						3	2	2	
CO4	3	3	3	2								3	3	2	
CO5	3	3		3		2						2	3	1	
CO6	3	3	3			2						3	3	2	

Paper Name: Physics–II
Lab Paper Code: PH (ECE)491
Total Contact Hours: 33
Credit:2

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

Objective of the Physics-II Course:

The Physics-II course will provide

- Exposure to the physics of materials that are applied in electronics devices.
- An insight into the science & technology of next generation and related technicalities through quantum mechanics
- Exposure to nano electronic devices
- conceptoffundamentalparticlesandassociatedapplicationsinsemiconductors

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

CO1:Able to understand the motion of electrons in crossed electric and magnetic field.

CO2:Able to explain the photoelectric effect.

CO3: Able to demonstrate the Hall effect in conductors and semi-conductors.

CO4:Able to measure the band gap for semiconductors.

Course Contents

*Atleast 7 experiments to be performed during the semester

ExperimentsonModule1: Electric and Magnetic properties of materials (8L)
1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferro magnetic 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 Module2: 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 photovoltaic 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.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magneto resistance of a given semiconductor

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

Probable experiments beyond the syllabus:
1. DeterminationofthermalconductivityofabadconductorbyLeesandChorlton'smethod.
2. DeterminationofthermalconductivityofagoodconductorbySearle'smothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO-PSO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**											**1**	**2**	**1**	
CO2	**2**	**1**		**3**									**2**	**2**	
CO3			**2**									**1**	**2**	**1**	
CO4									**3**				**1**	**2**	

Paper Name: Analog Electronic Circuits Lab
Paper Code: EC492

Any 8 Experiments has to be done

1. Study 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 it's 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 differential amplifier circuit using BJT.
8. Study of Integrator using OPAMPIC 741
9. Study of Differentiator usingOPAMPIC741
10. Design of low pass and high pass active filter using OPAMP and study of its frequency response.
11. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
12. Study of voltage controlled oscillator.
13. Design a simple function generator using IC.

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

CO1: Students will be able to construct hal-fwave , full-wave and bridge rectifier circuits and voltage regulator circuit.

CO2: Students will be able to design transistor based single stage R-C coupled voltage amplifier, differential amplifier and different classes of power amplifier circuit with given specification.

CO3: Students will be able to design transistor based RC oscillator (Wien bridge and RC phase shift oscillator) circuit.

CO4: Students will be able to construct a stable and mono-stable mode timer circuit using IC 555.

CO5: Students will be able to design Integrator, differentiator and low pass & high pass active filter circuit using Op-Amp (I.C-741)

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2		2		3	-		2	3	3	
CO2	3	3	3	3	2		2	-	3	2		2	2	2	
CO3	3	3	3	3	2		2	-	3	-		3	2	3	
CO4	3	3	3	3	2		2	-	3	-		3	2	2	
CO5	3	3	3	3	2		2	-	3	-		3	1	1	

Paper Name: Digital Electronic & Circuits Laboratory

Paper Code : EC493
Contacts: 3P
Credits: 2

Prerequisites: Knowledge in Electronics and Communication

COURSE OBJECTIVE:

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

COURSEOUTCOME:

On successful completion of the course the students will be able to:

CO1: Gain knowledge the fundamental concepts and techniques used in digital electronics.

CO2: Understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.

CO3: Apply 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: Understand different digital circuits using Programmable Logic Devices.

CO5: Analyze how to interface digital circuits with ADC &DAC.

LIST OF EXPERIMENTS:

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 & DeMultiplexer 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-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1			2	2					3	2	
CO2	3	3	3	1			2		2				3	2	
CO3	3	3	3	3			2	2					3	2	
CO4	3	3	3	3			2	2					3	2	
CO5	3	3	3	3			2	2	2				3	1	

Paper Name: Technical report writing & language practice
Paper Code: HU481
Contact Hours/Week (P): 2
Credit: 2

Pre-requisites:

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

Course objective:

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

Course Outcomes:

By the end of the course the student should be able to

CO1: Understand and make use of a wide taxonomy of listening skills & sub-skills forcomprehending & interpreting data in English
CO2: Speak in English, using appropriate vocabulary and pronunciation in contextualizedsituations
CO3: Understand and put into effective practice the pragmatics of Group Discussion
CO4: Understand and write a detailed technical report as per organizational needs
CO5: Understand and interact in professional presentations and interviews

Course Content

Module 1:

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

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

Module 2:

Power Listening [2L+3P]

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

Module 3:

Speaking Skills [2L+6P]

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

Module 4:

Group Discussion [2L+6P]

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

Module 5:

Writing a Technical Report[2L+6P](a)Organizational Needs for Reports and types (b)Report Formats

(c)Report Writing Practice Sessions and Workshops

Module 6:

SWOT Analysis [2L+3P](a) SWOT Parameters (b)Organizational SWOT

Module 7:

Presentation [2L+6P] (a)Teaching Presentation as a Skill (b)Speaking Strategies and Skills (c)Media and Means of Presentation (d)Extended Practice and Feedback Module 8: Personal Interview [2L+3P]

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

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2					2	3						
CO2		2							3			2			
CO3			2					2	3		3				
CO4		2						2	3		2				
CO5			3					2	3		2	2			

Paper Name: Analog Communication
Lab Paper Code: EC494
Total Contact Hours:30
Credit:2

Prerequisites: Knowledge in Electronics and Communication

Course Objective:

To provide the basic skills required to understand, develop, and design of various engineering applications involving analog communication theory. To provide basic laboratory exposures for communication principles and applications.

Course outcome:

By the end of the course the student should be able to

CO.1 Analyze the effect in terms of power efficiency and modulation index of DSB-WC,DSB-SC,SSB modulation techniques.
CO.2 Evaluate the performance in terms of BW of the demodulated signals.
CO.3 Remember the power and bandwidth efficiency of FM signal.
CO.4 Create the PLL using VCO to measure the capture and locking range.
CO.5 Understand selectivity, sensitivity and fidelity of a superhetrodyne receiver.
CO.6 Apply modulation And Demodulation Of PAM, PWM technique.

List of experiments:

1. Measurement of modulation index of AM signal.
2. Measurement of output power with varying modulation index AM signal(for both DSB-&SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal(for both DSB-SC&SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.
6. Design a FM demodulator using PLL.
7. Measurement of selectivity,sensitivity and fiedility of a superhetrodyne receiver.
8. Study of pulse amplitude modulation (PAM) and demodulation.

9. Study of pulse width modulation (PWM)and demodulation.

10. One innovative experiment.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO2	3	3		3	3		2				2	3	3	2	
CO3	3	3	3	3	2				2			3	3	2	
CO4	3	3	3	3	3		2				2	3	3	2	
CO5	3	3		3	3							3	3	1	
CO6	3	3	3				2	2	2			3			

Paper Name: Environmental Science
Paper Code: HU501
Contact: 24
Credit: 2

Prerequisites: qualified B.Tech 1st year

Course Objective(s)

Be able to understand the natural environment and its relationships with human activities.

Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.

Be able to understand environmental laws and regulations to develop guide lines and procedures for health and safety issues.

Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome(s)

CO1: understand the natural environment and its relationships with human activities.

CO2: apply the fundamental knowledge of science and engineering to assess environmental and health risk.

CO3: To develop guidelines and procedures for health and safety issues, obeying the environmental laws and regulations.

CO4: Acquire skills for scientific problem-solving related to air, water, noise & amp; land pollution.

SYLLABUS

General 6L

Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy
Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography
Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,

Structure and function of the following ecosystem: Foresteco system, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

Environmental Management:Environmental impact assessment,Environmentallawsandprotection act of India(The Environment protection Act, Air pollution Act, Water Act, WildlifeProtectionAct),Hazardouswaste(managementandHandling)Rules.

Air pollution and control 7L

Sources of Pollutants: point sources, non point sources and manmade sources, primary & secondary pollutant

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),

Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury),

Water Pollution 7L

Classification of water (Ground & surface water)

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavymetals, pesticides, volatile organic compounds.

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].

Groundwater: Aquifers, hydraulic gradient, ground water flow (Definitiononly), ground water pollution (Arsenic & Fluoride; sources, effects, control)

Quality of Boilerfed water: DO, hardness, alkalinity, TDS and Chloride 3.7 Layout of waste water treatment plant (schemeonly).

Land Pollution 2L

Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

Waste management: waste classification, waste segregation, treatment & disposal

Noise Pollution 2L

Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index).

Noise pollution control.

Text Books

A Text book of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

References/Books

Environmental Studies, Dr. J P Sharma, University Science Press

Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**1**					**3**	**3**					**3**	**1**		
CO2						**3**					**2**				
CO3								**2**		**2**		**3**			
CO4									**2**						
CO5															

Paper Name: Digital Communication Systems
Paper Code: EC501
Contact hour: 2L+2
Total contact hour-40
Credits: 3

Prerequisite: Analog Communication, Probability & Statistics

Course Objective:

To present the fundamentals of modern digital communication system design and to evaluate the performance of digital signalling schemes on realistic communication channels. Emphasisis placed on physical layer digital communications, including waveform analysis, transmitter design and receiver design. The student will learn about theoretical bounds on the rates of digital data transportation systems.

Course outcome:

On completion of the course students will be able to:

CO1: Able to apply the knowledge of probability and statistical calculations on random signal analysis.

CO2: Able to analyze signal vector representation of various digitally modulated signals by creating signal constellation

CO3: Able to remember the concepts of sampling pulse Modulation techniques and their comparison and demonstrate the effects of ISI and compare Eye pattern analysis

CO 4: Able to understand various types of coherent and non-coherent digital modulation techniques, analyze immunity parameters and calculate their error probabilities

CO5: Able to evaluate various digital communication techniques, can compute the bit-error performance and compare their advantages and limitations.

Module-I

Probability Theory and Random Processes: 8L

Probability definition, axioms, histogram, Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function,–Uniform, Binomial, Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density, Binary Symmetric Channel.

Module-II

Signal Vector Representation: 8L

Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, Rayleigh's energy theorem, Parseval's theorem, Fourier transform pair Power spectral density vs Autocorrelation likelihood functions, Schwarz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule,decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors.

Module-III

Sampling theorem and Pulse Modulation: 5L

Concept of sampling, Pulse Amplitude Modulation (PAM), Sample and hold circuit, aliasing effect, interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization,quantization noise, A-Law and μ-law companding, Predictor circuit design, differential PCM, delta modulation and adaptive delta modulation.

Module-IV 5L

Digital Data Transmission: Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding –polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Optimum(Matched) Filter design and Probability of error calculation, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction and the synchronization.

Module-V 10L

Digital Modulation Techniques: Types of Digital Modulation, coherent and non-coherent ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. DPSK and DEPSK, Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK,power spectra ofMPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset (OQPSK) vs. Non-offset (NO QPSK) Quadrature Phase shift keying, Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Quadrature Amplitude Shift keying (QASK), Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying (GMSK), basic concept of OFDM, constellation diagram.

Module-VI 4L

Performance issues for different digital modulation techniques: Eye Pattern and Relative Constellation Error (RCE), Conceptualise for Vector Signal Analyzer (VSA).

TEXT BOOKS:

1. Digital Communications, S.Haykin, Wiley India.
2. Principles of Communication Systems, H.Taub and D.L.Schilling, TMH Publishing Co.
3. Wireless Communication and Networks: 3G and Beyond, I. Saha Misra, TMH Education.
4. Communication Systems, A. Bruce Carlson, Paul B.Crilly TMH Education.

REFERENCE BOOKS:

1. Digital Communications Fundamentals and Applications, B. Sklar and P. K. Ray, Pearson.
2. Modern Digital and Analog Communication Systems, B. P. Lathi and Z. Ding, Oxford University Press.
3. Digital Communication, A. Bhattacharya, TMH Publishing Co.
4. Digital Communications by Dr. Sanjay Sharma SK Kataria and Sons
5. Digital Communications, J. G. Proakis, TMH Publishing Co.

CO-PO-PSO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3		1	1							3	2	
CO 2	3			3	3		2						3	2	
CO 3	3	3	3	3	2	2							3	2	
CO 4	3			2	3		2						3	2	
CO 5	3	2	3	3	2	2							3	1	

Paper Name: Microprocessor and Microcontroller
Paper Code: EC502
Contact: 3P
Credits: 3

Prerequisites: Knowledge in Digital Electronics

Course Objective:

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

Course Outcome:

Upon the completion of the course the students will be able to

CO1: Understand the architecture, instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085

CO2: Understand the 8086 microprocessor-Architecture, Pin details, memory segmentation, addressing modes, basic instructions, interrupts

CO3: Learn 8051 microcontroller 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: Analyze peripheral interfacing model using IC 8255, 8253, 8251 with IC8085, 8086 and

8051

Course Contents:

Module 1: 12L

8085 Microprocessor: 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: 2L

Assembly language programming with 8085: Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallestnumber, Look-up table etc. Programming using interrupts (programming using INTR is not required).

Module 3: 5L

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

Module 4: 2L

Assembly language programming with 8086: Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc.

Module 5: 4L

8051 Microcontroller: 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: 3L

Assembly language Programming using 8051: 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; Arithmeti coperations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimalarithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns.

Module 7: 6L

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

Module 8: 1L

Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout.

Text Books:

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

References:

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-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	1	1				1	3	3	3	
CO2	3	3	3	1	3	1	1				1	3	3	2	
CO3	3	3	3	3	3	2	2				2	3	3	1	
CO4	3	3	3	3	3	2	2				1	3	2	3	
CO5	3	3	3	3	3	1	2				2	3	1	2	

Paper Name : Digital Signal Processing
Paper Code: EC503
Contacts: 3L
Credits: 3
Total Contact: 35

Course Objectives:

To study the z-transform, convolution, correlation and applications of z-transform.

To introduce students with transforms for analysis of discretetime signals and systems.

To understand the digital signal processing, sampling and aliasing.

To use and understand implementation of digital filters.

To study filter design techniques.

To study Discrete Fourier Transforms.

To study Fast Fourier Transorms.

To study fixed point and floating point digital signal processors.

COURSE OUTCOMES:

CO1 Able to Understand discrete time systems in frequency domain and their region of convergence using Z-Transforms.

CO2 Able to Define discrete systems in the Frequency domain using Fourier analysis tools like DFT, FFT.

CO3 Able to Analyze discrete time signals and systems in frequency domain.

CO4 Able to Examine the digital signal processing, sampling and aliasing.

CO5 Able to Build digital filters.

PREREQUISITE:

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

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

MODULE–I

Discrete Fourier Transform and Fast Fourier Transform:

Definition of DFT and IDFT, Twiddle factors and their properties, multiplication of DFTs,circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, aliasing error, filtering of long data sequences using Overlap-Save and Overlap- Add methods.

Difference between DFT and FFT .Radix-2 algorithm, Decimation-In-Time, Decimation-In-Frequency algorithms, signal flow graphs Butterflies, Bitreversal.

MODULE– II

Filter Design:

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

MODULE–III

Finite word Length Effects in Digital Filters:

Input Quantization error, Product Quantization error, Coefficient, Quantization error, Zero- input Limit cycscillations, Deadband,limit cycle Oscillations.

MODULE– IV

Application of DSP:

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

TEXT BOOKS:

1. Digital Signal Processing–Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C.Gnanapriya, TMH Publishing Co.
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 FilterDesignChi-Tsong Chen,Oxford University Press
2. Texas Instruments DSP Processor user manuals and application notes.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	2	1		2	2	3	3	2	2
CO2	3	2	2	1	2	1	1	2		1	2	3	3	2	2
CO3	3	2	1	3	-	3	-	-	2	-	-	3	3	2	2
CO4	2	2		1	-	2	2	1	-	2	2	1	3	2	1
CO5	2	3	3	-	3	3	-	1	3	-	-	2	3	1	1

Paper Name: Power Electronics
Paper Code: EC504A
Contacts: 3L
Credits: 3
Total: 34 hrs

Course Objective:

To provide the students a deep insight into the working of different switching devices with respect to their characteristics

To analyze different converters and control with their applications.

To study advanced converters and switching techniques implemented in recent technology

Prerequisites: Introductory physics, Electric networks, Basic electronics devices.

Couse Outcome:

CO 1: Articulate the basics of power electronic devices and the characteristics of SCR, BJT, MOSFET and IGBT.

CO 2: Express the design and control of rectifiers, inverters.

CO 3: Design of power electronic converters in power control applications

CO 4: express communication methods.

CO 5: design AC voltage controller and Cyclo Converter, Chopper circuits.

Syllabus:

Module-1 [10L]

Introduction, Applications of power electronics, Power electronics devices: Characteristics of power devices– characteristics of SCR, diac, triac, GTO, PUJT, power transistors – power FETs – LASCR – two transistor model of SCR Protection of thyristorsagainst over voltage – over current, dv/dt and di/dt. Power Semiconductor Switches: Rectifier diodes, fast recovery diodes.

Module-2 [9L]

Triggering techniques: Turn on circuits for SCR– triggering with single pulseand train of pulses synchronizing with supply – Thyristor turn off methods, natural and forcedcommutation, self-commutation series and parallel operations of SCRs. Rectifiers: Single phaseand three phase controlled Rectifiers with inductive loads, RL load.

Module-3 [9L]

INVERTERS Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC choppers– DC to DC converters– Buck, boost and buck–boost.

Module-4 [6L]

AC Voltage Controllers, Single phase and three phase Cyclo-conveters Industrial applications DC and AC Drives DC Motor Speed control Induction Motor Speed Control.

TEXTBOOKS:

1. P.S.Bhimbra, "Power Electronics", Khanna publications.
2. M.D.Singh & K.B.Kanchandhani, Power Electronics, Tata McGraw–Hill Publishing company, 1998.
3. M.H.Rashid, Power Electronics: Circuits, Devices and Applications,–Prentice Hall of India, 2nd edition,1998

REFERENCEBOOK:

1. Mohan Ned, Undel and Tore Mand Robbins William P, Power Electronics: Converters, Applications and Design, 3rd Edition, John Wiley, 2003. (TK7881.15.M6972003)
2. Krein PhilipT, Elements of Power Electronics, 1st Edition, Oxford University Press, 1998. (TK7881.15.K92)
3. Erickson Robert Warren and Maksimovic Dragan, Fundamentals of Power Electronics, 2nd Edition, Kluwer Academic/Springer, 2001. (TK7881.15.E682001)

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1				1		2	2	3	3	2	2
CO2	3		2	1	2		1				2	3		2	2
CO3	3	2	2	3		3			1			3	3		2
CO4	3	2				2	2	1		1	2	1	2	2	1
CO5	3	3	2		3	3		1	3			2	3	1	1

Paper Name: Electrical & Electronics Measurement
Paper Code: EC504B
Contact: 3P
Credits: 3
Lectures: 34

Prerequisites: Basic analog and digital electronic circuits and principles. Basic electronics engineering, Basic electrical engineering,

Course objectives:

The objective of this course is to acquire knowledge about the construction and working of Bridges to measureresistance, capacitance, inductors, analog and electronic measuring instrument, Sensor-transducer system, telemetry system, data acquisition system and some advance instruments like OTDR, virtual instrument and PLC

Course Outcomes (COs)

CO1: Able to explain the characteristics, construction and working principle analog instruments like: PMMC, MI, Electrodynamo meter type and Energy meter

CO2: Able to demonstrate the principle to measureresistance, capacitance, inductance with the help of Bridge balancing technique

CO3: Able to describe the construction and working principle of electronic instrument like: DSO, DMM, spectrum analyzer, distortion meter

CO4: Able to illustrate the functionality of sensor and transducer element

CO5: Able to demonstrate the principle of working of Telemetry System, Display device, Interface Standard , Data Acquisition system , Advanced Instruments Like OTDR,virtual instrument and PLC.

Module 1: 3L

Characteristics of Instruments, Errors in Measurement, Units:Measurement Methods: Direct and Indirect Characteristics of Instrument &Measurement System: Static and dynamic, accuracy, precision, sensitivity, resolution, dynamic range, linearity, Hysteresis, repeatability, loading effect.

Types of Error (concept): Gross Errors, Systematic Errors, Random Error

Units and Standard in measurements–Concept of Calibration

Module 2: Analog Instruments: 6L

Construction and operation of PMMC and Moving Iron type Instrument: Its application to measurecurrent, voltage and resistance.

Basic Construction and operation of Electrodynamometer type, rectifier type, thermocouple type instrument.

Construction and operation of Electrodynamometer type wattmeter and single phase induction type energy meter

Module 3: 6L

Measurement of resistance and AC Bridges: Wheatstone

bridge, Kelvin double bridge ,measurement of high resistance ,Earth resistance measurement , localizing ground and short circuit fault. Potentiometer.

A.C. Bridges : Maxwell's Bridge –inductance , inductance –capacitance, Anderson's Bridge ,De Sauty's Bridge ,ScheringBridge,Wien'sBridge

Module 4: ElectronicInstrument: 6L

Construction and operation of DMM, Function Generator, DSO, Frequency Counter, L-C-R and Q-Meter, Distortion Meter, Spectrum Analyser , resolution, sensitivity and accuracy specification of digitalmeters.

Module 5: 4L

Sensing Element and Transducer: Components of transducer, Classification of electrical transducer with example , Workingand application : Strain Gauges ,Pirani Gauges , Semiconductorstrain gauges, Thermistors,Thermocouple, IC temperature sensor, Inductive transducer, LVDT, Capacitive transducer, Piezo-electric transducer, LDR.

Module 6: 4L

Telemetry System, Display,Interface Standard: block diagram– land and R.F telemetry, Display Devices-Application of LED in display system ,Fourteen Segment Display, Dot Matrix Display-3×5 dot , 27 dot , 5×7 dot, Application LCD indisplay system, Bus interface standard –GPIB interface bus(IEEE488)

Module 7: 5L

Data Acquisition and Advanced Instruments: Components of Modern digital data acquisition system, Basic concept of PLC & Virtual Instrument, Fibre Optic Measurement– Splicing, OTDR, end to end loss measurement.

Text Book:

1. M.r Asku. Saajiwth Bnaeriy, Electrical and Measuring, Dhanpat Rai &Sons
2. Helfrick, Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI Publication

ReferenceBook:

1. J.B.Gupta, Electrical & Electronics Measurement and Instrumentation, SK Kataria Sons
Kalsi, Ellecttronic Insttrumenttattiion,Tatta McGraw-Hill

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	-	-	-	1	1	1	2	2	3	2
CO2	3	2	1	2	1	-	-	-	1	2	1	2	2	2	2
CO3	3	3	3	2	3	-	-	-	1	2	2	3	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	1	3	3	3	1
CO5	3	2	2	2	3	2	2	2	3	2	3	3	2	3	2

Paper Name: Telecommunication Engineering
Paper Code: EC504C
Contact: 3P
Credits: 3
Lectures: 35

Prerequisites: EC404 (AnalogCommunication), Students should have prior knowledge of basic Modulation techniques and Signal Digitization

Course Objectives:

To provide students with basic knowledge of components of telecommunication system.

To understand basic operation and techniques of telecommunications switching systems and transmission systems.

To develop knowledge and problem solving ability in the field of traffic engineering areas.

To understand telephone network and optical network.

To understand the basic concepts of Broad band and IP telephony.

Course Outcome:

After completion of this course the students will be able to:

CO1: Identify all the elements of the telecommunication System.

CO2: Define and distinguish electromechanical, electronic, digital and analog switching systems.

CO3: Apply different parameters in designing telephone switches.

CO4: Alyze traffic engineering, transmission systems and telephone networks.

CO5: Evaluate Time Division Multiplexing Services, Broadband, IP telephony and Optical Network.

Course Contents:

Module 1: 4L

Signal Characteristics, Introduction to Telephone Systems-Bandwidth Requirement of Various Applications, Components and Examples of Telecommunication systems; Carbon Microphone and Headphone, Tonedialing; Telephone Instruments- push button types.

Module 2: 4L

Telecommunication Transmission Lines:- Copper, Co-axial, and Fiber opticcables; Transmission Bridge- Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.

Module 3: 8L

Switching System: Electro-mechanical switching-Basic idea of Strowger, Crossbar (Multi Stage Switching); Circuit Switching & Packet Switching, Digital Switching systems–Concept of Speech Digitisation & Transmission, Time division Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching; TS,ST,STS,TSTsystems;

Module 4: 3L

Telephone Network-Subscriber Loop Systems: BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7. (only Basic Idea), Numbering Plan

Module 5: 3L

Stored Program Control: Software architecture, Application software; Electronic Exchanges Digital PABX

Module 6: 4L

Traffic Engineering: Blocking network, blocking probability, Grade of service, traffic load, Erlang-Band Ccongestion formulas

Module 7: 4L

Broad band transmission ISDN, DSL and ADSL, ISDN and B-ISDN

Module 8: 3L

IPTelephony: Voice over IP,Session initiation protocol

Module 9: 2L

Optical Network–SONET, SDH (Basic Idea, Transmission Media and Calculation of Speed)

Text Book:

2. T.Viswanathan, “Telecommunication Switching Systems & Networks”, PHI
3. J.Cbellany “Digital Telephony”- Wiley India
4. O. Hersent, D Gurle, J P Petit “IP Telephony” Pearson
5. J.E Flood “Telecommunication Switching, Traffic and Networks”, Pearson
6. RL Freeman “Telecommunication System Engineering” Wiley India
7. A Gokhle “Introduction To Telecommunication”, Cengage Learning
8. P.Gnanasivam “Telecommunication Switching & Networks” New Age International Publishers
9. Martin P.Clark “Network And Telecommunications” Wiley Publisher.
10. David Gurle, Olivier Hersent “IPTelephony: Deploying Voice Over IP Protocols” Wiley Publisher

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3								3	3	2	2
CO2	3	2	3	3									3	2	2
CO3	3	3	2									1	3	2	2
CO4	3	3	3	3								3	3	2	1
CO5	2	3	3	3								1	3	1	1

Paper Name: Digital Communication Systems Lab
Paper Code: EC591
Contact: 3P
Credits: 2

Prerequisites: knowledge of digital electronics and communication system

Course Objective:

To provide the basic skills required to understand, develop, and design various engineering applications involving digital communication theory. To provide basic laboratory exposure to communication principles and applications.

Course Outcome:

On completion of the course students will be able to

CO1: Analyse the concept of digital communication techniques and their applications.

CO2: Understand to the practical methods of the use of generating communication signals.

CO3: Evaluate practical methods of the use of demodulation communication signals.

CO4: Create the significance of signal constellation and spectral width and evelop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.

CO5: Evaluate in sight into the relations between the input and output signals in various stages of a transmitter and a receiver.

CO6: Understand distinguish between contemporary digital communication techniques.

List of Experiments:

Study of PAM and demodulation.

Study of PCM and demodulation.

Study of delta modulator and demodulator

Study of adaptive delta modulator and demodulator

Study of ASK modulator and demodulator

Study of BPSK modulator and demodulator

Study of BFSK modulator and demodulator.

Study of QPSK modulator and demodulator.

Innovative project: Breadboard realization of digital communication circuit for voice communication

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	1			2				3	2	
CO2	3			3	3		2		2				3	2	
CO3	3	3	3	3	2	2			2				3	2	
CO4	3			2	3		2		2				3	2	
CO5	3	2	3	3	2	2			2				3	1	

Paper Name: Microprocessor and Microcontroller Lab
Paper Code: EC592
Contact: 3P
Credits: 2

Prerequisites: Knowledge in Digital Electronics

Course Objective:

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

Course Outcome:

CO 1: Able to solve small assignments using the 8085 basic instruction sets and memory mapping through trainerkit and simulator.

CO 2:Able to write 8085 assembly language programs like Addition, Subtraction, Multiplication, Square, Complement, Lookup table, Copying a block of memory,Shifting, Packing and unpacking of BCD numbers, Ascending order, Descending order etc. using traine rkit.

CO 3: Able to validate the interfacing technique using 8255 trainer kit through subroutine calls and IN/OUT instructions like glowing LEDs accordingly, stepper motor rotation etc.

CO 4: Able to test fundamental of 8051 programs using the trainer kit.

Course Contents:

1. Familiarization with 8085 register level architecture, the basic instruction sets (datatransfer, 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, Lookup table, Copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Addition of BCD numbers, Binary to ASCII conversion,Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.
5. Program for serial communication between two trainer kits.
6. Interfacing of 8255: Keyboard, Stepper motor rotation.
7. Study of 8051Microcontroller kit and writing programs.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	1	1	2		1	3	2	2	
CO2	3	3	3	3	2	1	1	1	2		2	3	2	2	
CO3	3	3	3	3	2	2	1	1	2		2	3	2	2	
CO4	3	3	2	2	2	1	1	1	2		2	3	2	2	
CO5	3	3	2	2	2	1	1	1	2		2	3	2	2	

Paper Name: Digital Signal Processing Lab
Paper Code: EC593
Contacts: 3L
Credits: 3
Total Contact: 35

Course Objectives:

To develop and Implement DSP algorithms in software using a computer language such as MATLAB.

To analyze and Observe Magnitude and phase characteristics of different signals.

To analyze and observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.

Course Outcomes:

CO1: Able to compute the system output using convolution method with MATLAB Software package.

CO2: Able to verify the system characteristics.

CO3: Calculate DFT, FFT, IDFT using MATLAB.

CO4: Analyze Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR Butterworth.

CO5: Develop and Implement DSP algorithms in software using a Computer language such as C with TMS320C6713 floating point Processor.

List of Experiments:

1. Convolution of two sequences using graphical methods and using commands-verification of the properties of convolution.
2. Systems (Causal and Non_causal, Time-Invarient andTime-varientetc.) verification using MATLAB.
3. Z-transform of various sequences –verification of the properties of Z-transform.
4. DFT using twiddle factors.
5. DFTs/IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.

7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap–add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.
10. Frequency responses of anti-imaging and anti-aliasing filters.
11. Develop and Implement DSP algorithms in software using a computer language such as C with TMS320C6713 floating point Processor, TMS5416 kit and ASM along with C.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	1	1		1		1		3	3	2	2
CO2	2	2	3	1	1			1				3	3	2	2
CO3	1	3		2	1			1			1	3	3	2	2
CO4	3	1	3	2	2	1	2	2	3	1	2	3	3	2	1
CO5	3	1	3	3	2	1	2	2	3	1	2	3	3	1	1

Paper Name: Mini Project-I
Paper Code: EC581
Contact hour: 4P
Total contact hour- 40
Credits: 2

Prerequisite: knowledge of analog, digital electronics and communication system

Course Objective:

Prepare students with foundation knowledge in a project domain through surveying, designing, implementing, observing and reporting.

Methodology:

Thinking: Discussionon innovative idea.

Exploring: Survey of recent research.

Implementing: Project guidance to basic prototype implementation.

Documenting: Guidance on reporting and conference paper writing.

Each Mini Project–I group should submit the following under their semester project report

Submission

1.Title, certificates, declaration by student, acknowledgement, Table of Contents, abstract, keywords, Introduction, Literature Survey, System Analysis (if applicable), SystemDesign (if applicable), Coding, Testing (if applicable), Conclusion, Future Scope of work), reference

Course outcome:

CO.1: Understand the knowledge acquired through survey of recent research to set the project goal.

CO.2: Understand the way of implementation of prototype

CO 3: Analyze the fault issue through various case study

CO.4: Create the prototype using modern tools

CO.5: Evaluate the project design by presenting the idea in conference/ workshop/ seminaretc.

CO.6: Create the project design for the benefit to societal issues

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	3	3	1	1		3	2	2	
CO2	3	3	3	3	3						2	3	2	1	2
CO3	2		3	3	2	2	3	3	2	2		3	2	1	
CO4	1	3	3	2	3		3	3			2	3	3	3	2
CO5	3		2	3	3	2			2	2		3		2	
CO6	3	3	3	2		2	3	3	2	2		3	3	3	2

Paper Name: EM Wave Propagation & Antenna
Paper Code: EC601
Contacts: 3L
Credits: 3
Total Contact: 33

Course Objectives:

To understand the basic properties of Plane wave propagation in different mediums.

To learn wave propagation in transmission line.

To know the fundamentals of antenna and its characteristics.

To understand radio wave propagation phenomena in communication system.

Course Outcome:

After successful completion of this course, tudents should be able to do:

CO1: Acquired knowledge of transmission lines which play an important role in high-speed digital design and signal integrity of PCBs

CO2: Understanding the fundamentals of antenna theory.

CO3: Applying and analyzing different types of antennas and the radiation mechanism.

CO4: Analyzing and experimenting the atmospheric and terrestrial effects on radiowave propagation.

Prerequisite:

The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostatics from Physics-II

Module I [6L]

Maxwell equation, Boundary between media interface, Helmholtz's equation, Plane Wave in lossy dielectric, loss-less dielectric, good conductor, free-space; Poynting theorem, power flow, Poynting Vector, Skin Depth, Surface Resistance.

Module II [11L]

Concept of lumped parameters, Transmission line equation & their solution, Propagation constant, characteristic Impedance, wavelength, velocity of propagation for distortion less line and loss-lessline;ReflectionandTransmissioncoefficients,StandingWave,VSWR,InputImpedance; SmithChart;Some impedance techniques- Quarter wave matching, Single stub matching; Reflection in miss-matchedload;T-lineintimedomain,Lattice diagramcalculation,PulsepropagationonT-line.

Module III [11L]

Antenna Characteristics: Radiation Pattern, Beamwidth, Radiation resistance, Directivity, Gain, Efficiency, Impedance, Polarization, Noise temperature; Friis transmission equation.

Radiation characteristics of Hertzian dipole antenna; Duality principle.

Properties and Typical application: Half-wave Dipole, Monopole, Loop antenna, Parabolic & Corner Reflector antenna, Helical Antenna, Pyramidal Horn antenna, Micro-Strip patch antenna, Array: Yagi-Uda, Log-Periodic.

Module IV [5L]

Reflection of plane wave at Normal and Oblique incidence; Diffraction and Scattering Phenomena, multipath fading and its characteristics.

Text Books

1. Principles of Electromagnetics, 6thEdition, Matthew O Sadiku, Oxford University Press.
2. Antenna Theory: Analysis & Design, Constantine A.Balanis; Willcy, 4thEdition.
3. Antenna and Wave Propagation, 1stEdition, S.K.Das and A.Das, Tata-McGraw-Hill Education Pvt.Ltd 2013.

Reference Books

1. Electromagnetics with applications, 5th Edition, J. D. Kraus and D.Fleisch, McGrawHill, 1999.
2. Engineering Electromagnetics, Hayt and Buck, 7th edition, McGrawHill.
3. Fields & Wave in Communication Electronics, S.Ramo, J.R.Whinnery & T.Van Duzer, John Wiley.
4. Electromagnetics, 2nd Edition– JA Edminister, Tata-McGraw-Hill.
5. Engineering Electromagnetics, 2ed Edition- NathanIda, Springer India.
6. Elements of Electromagnetics, 4th Edition, Matthew O'Sadiku, Oxford University Press.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2							1	2	3	1	
CO2	3	3	3	2							2	1	3	2	
CO3	3	2	3	2							2	2	3	3	
CO4	2	2	3	3							2	1	3	2	

Paper Name: Information Theory & Coding
Paper Code: EC602
Contact hour: 2L+2T
Total contact hour-40
Credits: 3

Course Objective:

This course provides a basic understanding of the fundamental theories and laws of information theory and coding theory and the construction of both source codes and error-detection-correction codes and application in digital communication systems.

Course outcome:

On completion of the course students will be able to

CO 1: Remember the concepts of information, mutual in formation and entropy and various source coding techniques.

CO 2: Understand the need for error control techniques in a digital communication system channel models, channel capacity and channel coding techniques.

CO 3: Apply linear algebra, concept of Galois field, conjugate roots, minimal polynomial in channel coding techniques for error control.

CO 4: Analyse different error control codes like linear block codes, cyclic codes, BCH codes, and perform error detection and correction.

CO 5: Design the circuit for different error control coding techniques.

Module 1 [6L]

Source Coding

Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes. Shannon-Fano Coding

Module 2 [6L]

Channel Capacity and Coding

Channel models, channel capacity channel coding, KraftIn equality, information capacity theorem, The Shannon limit

Module 3 [5L]

Linear and Block Codes For Error Correction

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block, Standard array and syndrome detection code, perfect codes, Hamming codes.

Module 4 [7L]

Cyclic Codes

Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Decoding cyclic codes, Encoding and Decoding circuit,Golay codes.

Module 5 [8L]

BCH Codes

Set, group, fields, Galois field Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Module 6 [8L]

Convolutional Codes: Encoding, state diagram,

Tree codes, trellis codes,polynomialdescription of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, Viterbi decoding, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

TEXT BOOKS:

1. Information theory, coding and cryptography- Ranjan Bose; TMH.
2. Introduction to Error Control Codes- Salvatore Gravano, Oxford

REFERENCE BOOKS:

1. Information and Coding- N Abramson; McGrawHill.
2. Introduction to Information Theory- M Mansurpur; McGrawHill.
3. Information Theory- RB Ash; PrenticeHall.
4. Error Control Coding- Shu Lin and DJ Costello Jr; PrenticeHall.
5. Todd K Moon,- Error Correction Coding: Mathematical Methods and Algorithms, John Wiley & Sons.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1							1	3	3	2	2
CO2	3	3	3	1							1	3	3	2	2
CO3	3	3	3	3							2	3	3	2	2
CO4	3	3	3	3							1	3	3	2	1
CO5	3	3	3	3							2	3	3	1	1

Paper Name: Control Systems
Paper Code: EC603
Contacts: 3L
Credits: 3
Total Contact: 36

Prerequisite:

Concepts in Electrical Circuits (Studies in Basic Electrical).

Fundamental concepts on Laplace Transformation (studied Mathematics)

Course Outcome

On completion of the course students will be able to

CO 1: Understand open loop, closed loop control system and system modeling.

CO 2: Analyze time responses of different systems.

CO 3: Evaluate the importance of gain, location of poles and zeros.

CO 4: Examine the absolute and relative stability of different systems.

CO 5: Design different controllers, compensators to meet the desired specifications

Module I: Introduction To Control Systems & Modelling

Basic Elements of Control System, Linear, Non-Liner and Discrete Time System (Introduction & Concept) Open Loop and Closed loop systems – Differential equation – About transfer function and its generation technique,Modelling of Electrical and mechanical systems - Block diagram reduction Techniques - Signal flow graph, mason's gain formula. [7L]

Module II: Time Response Analysis

Time response analysis –Different input deterministic test response – Order and Type of the systems incorporation with time response-First Order Systems - Impulse and Step Response analysis of second order systems- Steady state errors and others characteristics– P, PI, PD and PID Compensation. [7L]

Module III: Stability Analysis

Routh-Hurwitz Criterion, Root Locus Algorithm, Construction of RootLocus, Effect of addition pole and zero on the rootlocus, Application Root Locus Diagram. [6L]

Module IV: Frequency Response Analysis

Concept of Frequency Response of a system, Bode Plot Computational Algorithm, Construction of Bode Diagram, Polar Plot, Phase Gain margin Nyquist Plot, Interpretation of Bode and Nyquist plot, Frequency Domain specifications from the plots and Computational Algorithm - Lead, Lag, and Lead LagCompensators. [10L]

Module V: STATE SPACE ANALYSIS OF CONTINUOUS TIME SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts Controllability and Observability.Concept of state feedback. [6L]

Text Books:

1. Automatic Control Systems 8th edition– by B. C.Kuo 2003–JohnWileyand son's,
2. Control Systems Engineering– by I.J.Nagrathand M.Gopal, New Age International (P) Limited, Publishers, 2nd edition.
3. Control Systems–by Ramesh Babu

Reference Books:

Modern Control Engineering– by Katsuhiko Ogata–Prentice Hall of India Pvt.Ltd., 3rd edition, 1998.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2						1	1		1	3	2	2
CO2	3	2	2						2	1		1	3	2	2
CO3	3	2	1	2	1	1			2	1			3	2	2
CO4	3	1			1	1			2	1		1	3	2	1
CO5	1	1	3	2	1	1	1	1	2	1	1	1	3	1	1

Paper Name: Object Oriented Programming using Java
Paper Code: EC604A
Total Contact Hours: 40
Credit: 3

Prerequisites: Basic knowledge of computers, basic knowledge of programming

Course Objective: The Objective of the course is

Understand basic of Object Oriented Programming

Understanding the features of Java

Enable students to write Java program and develop projects.

Course Outcomes: After completion of this course students will be able to

CO 1: Understand the key concepts of object oriented programming and have an ability to design OOprograms and appreciate the techniques of good design;

CO 2: Understand advanced features of Java.

CO 3: Analyze complex programming problems and optimize the solutions.

CO 4: Apply an understanding of ethical principles to problems which commonly arise in the Information Technology Industry.

Course Content:

MODULE I: [3L]

Object oriented design

Concepts of object oriented programming language, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation

MODULE II: [3L]

Object oriented concepts

Class, object, message passing, inheritance, encapsulation, polymorphism, Difference between OOP and other conventional programming–advantages and disadvantages.

MODULE III: [2L]

Understanding Java programming language:

History of Java Programming languages, Purpose of invention of Java. Structure of a basic Java Program, Component of Java Development Kit-API, JRE, Understanding the steps to run a complete Java Program.

MODULE IV: [2L]

Basic Components of Java Program:

Java Tokens-Literals, identifier, keywords, operator, separator, Data types, variables, constant, Type casting-defining type casting, requirement of type casting, implicit and explicit type casting. Control structure. Access specifier.

MODULE V: [6L]

Class & Object proprieties:

Defining class and object, Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection,Array-Declaring and defining array, accessing array elements, length properties, 2D array, anonymous array, array of Objects. Understanding method-method returning object, passing objects, method passing and returning arrays, use of method overloading. Static-Static block and nonstatic block, static variable, static method. Nested & inner classes.

MODULE VI: [6L]

Reusability properties:

Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keyword swithsuper () method, dynamic method dispatch, use of abstract classes & methods, interfaces.Creation of packages, importing packages, member access for packages.

MODULE VII: [2L]

String Handling:

Basic string handling concepts-String (discusschar At(), compare To(), equals(), equals Ignore Case(), index Of(), length(), substring(), to Char Array(), to Lower Case(), to String(), to Upper Case(), trim(), value Of() methods) & String Buffer classes (discuss append(), capacity(), charAt(), delete(), delete Char At(), ensure Capacity(), get Chars(), index Of(), insert(), length(), set CharAt(), set Length(), substring(), to String() methods), concept of mutable an dimmutable string, command line arguments

MODULE VIII: [5L]

Exception handling & Multithreading Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, mainthread, thread lifecycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, dead locks for threads, suspending & resuming threads.

MODULE IX: [3L]

Basic IO Operation and File Handling

Understanding unformatted and formatted IO. Reading and writing files.

MODULE X: [4L]

Swing Programming

Swing Origins, Components and containers, Difference between AWT and swing, small swing programs, swing apps, concept of delegation event model and listener.

MODULE XI: [4L]

Applet Programming (using swing)

Basics of applet programming, applet lifecycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets.

CO–PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO2	3	3	3	3	2	-	-	-	-	-	2	3	3	2	2
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	3	3	2	1
CO5	2	3	3	3	2	-	-	-	-	-	-	3	3	1	1

Paper Name: Advanced Microcontroller and Embedded system
Paper Code: EC604B
Contacts: 3L
Credits: 3
Total Contact: 36

Prerequisite:

Concepts in 8085, 8086 Microprocessor

Concept of MCS51 series of Microcontroller.

Course Objectives:

To familiarize the students with concepts related to the fundamental principles embedded systems design, explain the process and apply it.

To understand knowledge of the advanced microcontroller technology both for hardware and software.

Student will able to understand Hardware/Software design techniques for microcontroller-based embedded systems and apply techniques in design problems.

Student will able to develop microcontrollers programming in C and assembly language using Integrated Development Environmentsa nd using debugging technique.

Course outcome:

After completion of this course students will be able to

CO1: Analyze the performance of PIC microcontroller.

CO2: Design the systems based on ARM controllers.

CO3: Develop the systems based on ARM controllers

CO4: An ability to use the techniques, skills, and modern engineering tools in embedded system.

Module I: INTRODUCTION TO PIC MICROCONTROLLER : PIC18F4550

Microcontroller – Hardware Architecture & GPIOs ((Pin Diagram, Memory Organization, SFRs description, Program Counter, Accumulator (or Working Register), Reset, Clock Cycle, Machine Cycle, Instruction Cycle, Interrupts, SFRs &GPRs, Stack, Stack Pointer, Stack Operation, Timers and serial communication in PIC 16F877A). Microcontroller PIC Assembly Language, Programming in Embedded C, Introduction to programming software, Examples programs for PIC.

Module II: INTERFACING PIC16F877A WITH INPUT OUTPUT DEVICES:

LED Display, 7-Segment, DIPS witch, Intelligent LCD Display, Matrix Keyboard, Stepper Motors and Types of Stepper Motors, Serial Communication Concepts, Practices on interfacing circuits, serial and parallel communication devices, wireless communication devices, timer and countingdevices, watchdog timer, real time clock, serial bus communication protocols, USB, Bluetooth, Practices of ICP, ADC, EEPROM, Opto-Isolators, Relay, I2C, SPI Protocol, Serial Memory, On-chip Peripherals PWM.

Module III: ARM ARCHITECTURE AND PROGRAMMING:

Introduction of ARM Processors, Evolution of ARM, 32-bit Programming. ARM7 Architecture, Instruction Set Architecture, LPC21xx Description, Memories & Peripherals. ARM Processor Programming in C, Using ARM Programming Tools.

Module IV: INTRODUCTION TO EMBEDDED SYSTEM:

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.

ModuleV: HARDWARE SOFTWARE CO-DESIGN:

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 modeling/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.

MODULEVI: REALTIME OPERATING SYSTEM (RTOS):

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

Text Books:

1. Steve Furber, ‘ARM system on chip architecture’, Addision Wesley
2. Microchip's PIC microcontroller is rapidly becoming the microcontroller of choice through out the world, Myke Predco
3. Embedded system Design: Peter Marwedel, Springer
4. Embedded Systems- Raj Kamal
5. PIC Microcontroller– Mazidi and Mazidi

Reference books:

1. Andrew N.Sloss, Dominic Symes, Chris Wright, John Ray field‘ARMSystem Developer’s Guide Designing and Optimizing SystemS oftware’, Elsevier 2007.
2. ARM Architecture Reference Manual

CO–PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2		2		2	1		3	3	2	2
CO2	3	3	1	3	2	2	2		2		2	3	3	2	2
CO3	3	2	2	3	2		2		2	2		3	3	2	2
CO4	3	3	2	2	2		2	2	1		1	3	3	2	1

Paper Name: Optical Fiber Communication
Paper Code: EC604C
Contacts: 3L
Credits: 3
Total contact: 35L

Pre-requisite

Basic Concepts of communication, basic concepts of solid state device and band theory (direct-indirect semiconductor, degenerate semiconductor), basics of Physics, Photodiode, LED etc.

Course Objective

The students should be familiar with the basic Blocks and principles of communication system, advantages of Optical Fiber communication and current industry trends

The student should have knowledge about optical fibre waveguide

The students should be familiar about the optical sources and detectors; structure, efficiency, gain etc.

Students should have basic knowledge about WDM, different optical amplifiers and networks

Students should be able to understand the fibre optical measurement system

Students should know how to perform Refractive Index Profile Measurements, NA measurements, Polarization Depression Measurements, BER Measurements.

Course Outcome

CO1: Recognize and classify the structures of Optical fiber and types.

CO2: Discuss the channel impairments like losses and dispersion.

CO3: Classify the Optical sources and detectors and to discuss their principle.

CO4: Familiar with Design considerations of fiber optic systems. To define the Wavelength Division Multiplexing.(WDM) principles and concepts.To perform characteristics of optical fiber, sources and detectors

CO5: To analyse optical fibre measurement systems

Module I: Introduction to Optical Fibre Communication System [7L]

Introduction to communication systems: Principles, components Different forms of communications in brief, advantages of optical fiber communication, spectral characteristics. Brief about current Industry trends in optical communication system

Optical Fibre waveguide: Structure, Single and Multimode operation: basic concept with mathematical expression (no derivationis needed). Attenuation, Material and waveguide dispersion.

Module II: Optical Sources & Optical Detectors [8L]

Optical Sources: Light Emitting Diode; principle, structures, power and efficiency, coupling tofibres. Laser diodes; principle, double hetero structure, gain and index guiding, distributed lasers. *Quantum Well Lasers;* Modes and narrow linewidth lasers. Modulation; Bandwidth for modulation, Optical transmitters: components.

Optical Detectors: Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers;noise sources, signal to noise ratio.

Module III: Optical Network [11L]

Point-to-point link and Wavelength Division Multiplexing: Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier. Dispersion compensation and management.

Optical Network: LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking: SDH/SONET.

Different forms of access networks:

Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC, FTTH and FTTN networks.

Module IV: Fiber Optics measurements [9L]

Correlation of NA aperture measurements and mode field diameter. Measurements of distance using phase measurement, Displacement measurement, Optical disks, recording of audio & video signals on optical disks,mass replication by optical disk, direct read after write (DRAW), data readout, erasable optical disk, Holography, Attenuation measurements, Dispersion measurements, Refractive Index Profile Measurements, NA measurements, Polarization Depression Measurements, BER Measurements

Text Book

1. Optical Networks– Rajiv Ramaswami, K.N.Sivarajan, Galen H.Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication: John M.Senior (Pearson)
3. Optical Communications: N.Bala Saraswathi, I. Ravi Kumar (Laxmi Publications)

Reference Books

1. Optical Communication Systems: John Gawar (PHI)
2. Optical Fibre Communication: Gerd Kaiser (TMH)
3. Fiber optics communication by G.P Agrawal.
4. Raman Amplifiers for communications by M.N. Islam (Ed).

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	-	-	-	-	-	-	3	2	2
CO2	3	2	3	1	2	-	-	-	-	-	-	1	3	2	2
CO3	3	3	2	1	1	-	-	1	-	1	-	-	3	2	2
CO4	3	3	2	1	2	1	1	-	1	-	1	-	3	2	1
CO5	3	2	3	1	2	1	-	1	-	1	2	1	3	1	1

Paper Name: Engineering for System Analysis and Design
Paper Code: EC605A
Contacts: 3:0:0
Credit: 3
Total contact: 34

Course Objective:

This subject aims to as to introduce variety of new software used by analysts, designers tomanage projects, analyze anddocument systems, design new systems and implement their plans.

Course Outcome: Student will be able to

CO 1: Understand the principles and tools of systems analysis and design and Understand the professional & ethical responsibilities of practicing the computer professional including understanding the need for quality.

CO 2: Solve a wide range of problems related to the analysis, design and construction of information systems & analysis and design of systems of small sizes.

CO 3: Plan and undertake a major individual project, prepare and deliver coherent and structured verbal and written technical reports

Syllabus:

Module 1: Introduction-Systems, Elements of a system, Types of systems, Subsystems, Supersystems, Need for system analysis and design, CASE tools for analysis and its limitations. [5]

Module 2: System Analysis- Methods of system analysis, system development life cycle, structured approach, development tools, data base and networking techniques. [6]

Module 3: Mathematical and Statistical Models- Probability concepts, Queuing Models, Methods for generating random variables and Validation of random numbers. [5] Module 4: System design-Design technologies, Design principles, Design tools and methodologies, feasibility survey, conversion and testing tools, design management and maintenance tools. [6]

Module 5: Experiments-Simulation of different systems, Analysis, validation and verification of input and output simulated data, study of alternate techniques. [6]

Module 6: Casestudy-Developing simulation model for information centers, inventory systems and analysis of maintenance systems. [6]

Text books:

a. Silver and Silver, System Analysis and Design, Addison Wesley, Last Edition
b. Systems Analysis and Design Author(s): Kenneth E.Kendall and Julie E.Kendall Publisher: Prentice Hall PTR, 5th Edition, 2001

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	-	1	-	1	-	-	3	2	2
CO2	3	2	3	1	2	-	-	1	-	-	1	1	3	2	2
CO3	3	3	2	1	1	-	-	2	-	1	1	-	3	2	2

Paper Name: Material Science & Engineering
Paper Code: EC605B
Contacts: 3L
Credits: 3
Total Contact: 36

Course Objectives:

The objective of this course is to provide students a fundamental understanding of electrical, magnetic and optical properties of materials and to apply those fundamentals for selecting and developing materials for different engineering applications.

COURSE OUTCOMES:

After the completion of this course, the student will be able to:

CO1: Understand the conducting, semiconducting, superconducting, dielectric, ferro-eleletric and piezoelectric behavior of materials

CO2: Differentiate between diamagnetic, paramagnetic, ferromagnetic, ferromagnetic, and anti-ferromagnetic behavior of materials

CO3: Synthesis and processing of semi-conducting materials for engineering applications

CO4: Study the effect of composition, structure and temperature on the properties of the materials.

CO5: Describe the interactions of light with materials and its effects at the interface

CO6: Understand the working principles of different Electronic Materials, Nanomaterials, solid state devices,

PREREQUISITE:

Knowledge of Engineering Chemistry, Physics, Thermodynamics, Basic electronics, Solid state devices.

MODULE– I

Structure of Solids: Atoms and their binding, Bonds, Crystal Systems, Bravais Lattice Miller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Technologically important properties of materials-Physical, chemical, mechanical, thermal, optical, environmental and electrical properties of materials, Material properties and Engineering Design parameters; Lattice defects-Qualitative ideas of point, line, surface and volume defects. [6]

MODULE–II

Electrical and Dielectric Materials: Review of electrical conduction - resistivity and dielectric phenomena - Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications. [5]

MODULE–III

Magnetic Properties: Introduction to dia, para, ferri and ferro magnetism, anti ferromagnetic and Ferrimagnetic behaviour of materials; soft and hard magnetic materials- applications of hard and soft magnetic materials –Giant magnetoresistance, Magnetic Domains, SQUID. [3]

Optical properties: Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photo refractive effects, color of materials, applications of optical phenomena-luminescence, photo conductivity, lasers,optical fibers in communications, LED and Laser Materials,Optical Fibre. [4]

MODULE– IV

Semiconducting and Superconducting Materials: Review of semiconducting materials - concept of doping – simple and compound semiconductors-amorphous silicon, oxide semiconductors; amorphous semiconductors-FER, MOSFET and CMOS - Concept of super conductivity, Transition temperature, Meissner effect High-T superconductors [5]

MODULE–V

Electronic Materials: Review of electronic materials - methods of crystal growth for bulk single crystals – zone melting-refining, leveling-synthesis of epitaxial films by VPE, PVD, MBE and MOCVD techniques-lithography; production of silicon-starting applications. [4]

Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magnetoelectronic Materials, CD, DVD, CCD. Materials for Display Devices: CRT, LED, LCD, TFT, Plasma Display. [4]

MODULE–VI

Advanced Materials: Metallic Glasses, Nanomaterials: scale / dimensional aspects, Top-down and bottom-upapproaches for preparing nano materials Advantages and limitations at the nano level – thermodynamic aspects at the nano level, health and environmental issues. [5]

TEXT BOOKS:

1. Electrical Engineering Materials –A.J.Dekker (PHI)
2. Material Science and Engineering–A First Course–V.Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices–S.Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics- Charles Kittel (JohnWiley&sons)
5. An Introduction to Electronic Materials for Engineers–W.Kao, Z.Lee and N.Sannes (World Scientific)
6. Pradeepfuley, Electrical, magnetic, and Optical Materials, 1stedition, CRC press, 2010.
7. Dekker A.J, Solid State Physics, Mac Millan India,1995

REFERENCE BOOKS:

1. J W Mayer and S S Lau– Electronic Materials Science –Maxwell Macmilan International Editions, Singapore
2. R E Hummel–Electronic Properties of Materials–Narosa Publishing House, New Delhi.

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	2	-	2	2	2	2	3	3	2	2
CO2	2	2	2	1	2	2	-	2	2	1	2	2	3	2	2
CO3	3	3	-	3	2	2	1	2	1	1	2	3	3	2	2
CO4	2	2	1	1	-	3	1	3	1	1	1	1	3	2	1
CO5	3	2	-	1	-	-	1	1	1	2	2	1	3	1	1
CO6	2	3	3	-	3	2	2	3	2	2	3	2	1	2	2

Paper Name: Computer Communication and Networking
Paper Code: EC605C
Contacts: 3L
Credits: 3

Course Outcome:

CO1: Remember various protocols used in data communication.

CO2: Understand networking structure in data communication.

CO3: Analyze and transmit data securely from one place to another.

CO4: Evaluate the advantages and challenges of modern technologies.

Module-I Overview of Data Communication and Networking: [2L]

Introduction; network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [4L]

Transmission media (guided unguided); Circuit switching: time division space division switch, TDM bus

Module-II Data Link Layer: [5L]

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-NARQ, Selective repeat ARQ, HDLC

Medium Access sublayer: [4L]

Point to Point Protocol, Token Ring; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);

Module-III Network Layer: [6L]

Internetworking Devices: Repeaters, Hubs, Bridges (Basic Idea), Switches, Router, Gateway; Addressing: IPaddressing, subnetting; Routing: techniques, static vs. dynamic routing, Source and Hop-by-Hop routing (Dijkastra, Bellman Ford Algorithm), Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6

Transport Layer: [3L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets (Concept); Leaky bucket algorithm, Token Bucket Algorithm,

Module-IV Application Layer [6L]
Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Moderntopics: ATM, DSL technology, Architecture & Operations brief Wireless LAN: IEEE 802.11(WSN), Introduction to blue-tooth, Zigbee.

Text Books:

1. B.A. Forouzan– "Data Communications and Networking (3rd Ed.)"– TMH
2. A.S. Tanenbaum– "Computer Networks (4th Ed.)"– Pearson Education/PHI
3. W. Stallings– "Data and Computer Communications (5th Ed.)"– PHI/PearsonEducation
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Ross– "Computer Networking- A top down approach featuring the Internet"–Pearson Education
2. Leon, Garica,Widjaja–"Communication Networks"–TMH
3. Walrand–"Communication Networks"–TMH.

CO–PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			2							3	3	2	2
CO2		2		3	3						2	3	3	2	2
CO3	2	3	2	0	2							3	2	2	2
CO4	3	3	3	3	2							3	3	2	1

Paper Name: EM Wave Propagation Antenna Lab
Paper Code: EC691
Contacts: 3P
Credits: 2

Course Objectives:

To learn EM wave propagation transmission lines.

To know the fundamentals of antenna and its characteristics.

CourseOutcome:

After Successful Completion of Discourse, students should be able to:

CO1: Able to understand the theory of transmission lines which EM waves propagate.

CO2: Able to analyze the fundamentals of antenna theory.

CO3: Able to evaluate the different types of antennas and the radiation mechanism.

CO4: Able to examine and identify the different signals in hardware setup.

Prerequisite:

The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostatic from Physics-II

[At Least THREE experiments from Module I and FOUR experiments from Module II]

Module I:

1. Familiarization of basic elements of the Transmission Line.
2. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
3. Unknown load Impedance of a terminated transmission line using shift in minima technique.
4. Study of application of Smith chart by using characteristic of transmission line.
5. StudySinglestubimpedancematchingtechnique.

Module II:

Familiarization of basics of Antennas.

Radiation Pattern of dipole antenna and Mono-pole with ground plane.

Radiation Pattern of a folded-dipole antenna.

Radiation pattern of a Log-Periodic Antenna.

Beamwidth, gain and radiation pattern of a 3-element, 5-element and 7-element.Yagi-Uda antenna–Comparative study.

Radiationpattern, Gain, Directivity of a Pyramidal Horn Antenna.

Measurement of signal power, bandwidth, harmonics, Adjacent channel power ratio using Spectrum Analyzer.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1		1		1	2			3	2	
CO2	3	2	1	1	1				1	2		2	3	2	
CO3	3	1	1	1	1		1	2	1	2		1	3	2	
CO4	3	1	1	1	1		1	2	1	2		1	3	2	

Paper Name: Control System Lab
Paper Code: EC693
Contact: 3P
Credits: 2

Name of the Experiment

1. Familiarization with MATLAB and Control System tool Box.
2. Introduction to SIMULINK tool box.
3. Determination of step response for 1st order, 2nd order &3rd order system with unity feedback & calculation of control system specifications (Evaluation of steady-state error, peak time, rise time, setting time, percentage peak overshoots) – using MATLAB programming and SIMULINK toolbox.
4. Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB.
5. Determination of root locus and effect of addition of poles and zeros to the systems.
6. Determination of Bode-plot andc omputation of gain crossover frequency, phase crossover frequency, gain margin and phase margin using MATLAB.
7. Study of closed loop stability using Nyquist plot and computation of gain crossover frequency, phase crossover frequency, gain margin and phase margin.
8. Determination of PI, PD, and PID controller action on 1st order simulated process.
9. Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin and phase margin with addition of lead compensator in forward path transfer function using MATLAB.
10. Study of position control system using servomotor
11. Study Tuning of controller.

Project implementation of control system.

Course Outcome:

CO1: Able to apply Laplace transform, transfer functions and state variable to analyze different types of electrical, mechanical electromechanical systems.

CO2: Determine Transient and Steady State behavior of different types of systems using standard test signals.

CO3: Able to determine the importance of gain, location of poles and zeros to design a system.

CO4: Able to check the absolute and relative stability of the systems using the concept ofdifferent stability criterion.

CO5: Gain experience using modern software tools to design the systems according to the desired specifications or requirements using different types of controller and compensator.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2						1	1		1	3	2	2
CO2	3	2	2						2	1		1	3	2	2
CO3	3	2	1	2	1	1			2	1			3	2	2
CO4	3	1			1	1			2	1		1	3	2	1
CO5	1	1	3	2	1	1			2	1		1	3	1	1

Paper Name: Object Oriented Programming Lab
Paper Code: EC694A
Total Contact Hours: 30
Credit: 2

Prerequisites: Basic concepts to handle computers Keyword familiarization

May be known how to write code.

Course Objective: The objective of the course is to

Enable students to use basic object oriented features in coding

Enable students to develop small projects

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

CO 1: Define object oriented programming concepts in designing programs

CO 2: Understand different dimensions of a problem and provide optimal solutions.

CO 3: Apply the advance features of JAVA in designing of projects

CO 4: Analyze exception handling, multithreading, SWING applications.

Course Content:

MODULE I:

Writing simple javaprogram, compiling and running. Understanding the main() method.

MODULE II:

Using basic java token, control structurtes.

MODULE III:

Illustrating class objects, constructor, final, finalize. Understanding Arrays and hands on application using array.Understanding and writing methods. Static and nonstatic concepts.

MODULE IV:

Class Relationship.Using inheritance

Creating abstract classes, interfaces.

MODULE V:

String Handling

MODULE VI:

Illustrating exception handling

Illustrating multithreading applications.

MODULE VII:

Basic IO and File IO operation

MODULE VIII:

AWT andSwing applications

MODULE IX:

Applet programming.

CO–PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1	1			3			2	3	2	2
CO2	2	3	2		3	1			3				3	2	2
CO3	3	3	2		3	2			3	2			3	2	2
CO4	2	3	1		2	3		2	3				3	2	1

Paper Name: Advanced Microcontroller and Embedded System Lab
Paper Code: EC694B
Total Contact Hours: 30
Credit: 2

PIC based experiment (Any Five)

Familiarization of PIC kit.

Interface and control a LED, LCD, Keyboard, ADC & DAC using PIC. Connect two PIC kit and transfer data serially.

Design a Digital watch based on PIC.

Control a stepper motor and display temperature from a temperature sensor on a LCD.

ARM based experiment (Any Four)

Familiarization with ARM evaluation system

Familiarization with Raspberry Pi

Interfacing with a real time clock using a serial port to display time.

Interface a Keyboard and display the key strokes on a LCD, LED. Familiarization of image processing using ARM

FPGA based experiment

Design a 3 to 8 decoder circuit.

Design an UP/DOWN counter and display the count on a 7-segment display.

Designing an ALU and verify with mathematical operations.

Innovative Project.

Paper Name: Optical Fiber Communication Laboratory
Paper Code: EC694C
Credits: 2
Total contact hour: 30

Course Outcome:

CO1: Basic knowledge about the input output characteristics

CO2: Able to define and analyse the attenuation constant, bending loss

CO3: Able to define, analyze and draw V-I characteristics of optical fiber

CO4: Able to define, analyze and draw P-I characteristics of optical fiber

Perform any four out of eight experiments:

Demonstrate and study of different types of Optical fibres and connectors.

To establish and study of a 650 nm fibre optic analog link and digital link.

Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre

To calculate attenuation constant, bending loss.

I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

To measure propagation loss in optical fibre using optical power meter.

To measure the Numerical Aperture (NA) of the fibre

Course objectives:

Determination of the input/output characteristics of long optical fibre

To learn and obtain attenuation constant, bending loss and numerical aperture of optical fibre

To observe the current-voltage characteristics of optical fibre

To observe the P-I characteristics of optical fibre

To gain knowledge about fibre optic analog and digital link.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	3	-	-	3	2	2
CO2	3	2	2	-	-	2	-	-	2	-	3	-	3	2	2
CO3	3	2	2	1	-	-	2	2	-	-	3	-	3	2	1
CO4	2	2	2	-	-	-	-	-	-	3	3	1	3	1	1

Paper Name: RF & Microwave Engineering
Paper Code: EC701
Contact: 3L
Credits: 3
Lectures: 34

Course Objective:

Distinguish the RF & Microwave spectrum, Planar transmission lines and High frequency circuit elements.

Determine the Microwave passive components and Scattering matrix representation.

Illustrate the Microwavetubes, Semiconductor Microwave Devices.

Justify the microwave applications and typical microwave test bench.

Course Outcome:

The students will be able to:

CO1: Understand the Microwave Frequency range and their application.

CO 2: Develop fundamental understanding of the Two–port RF network and matching techniques.

CO3: Learn the Scattering matrix for microwave passive components.

CO 4: Understand the Microwave tubes and devices along with their fundamental principle of operation.

CO5: Learn the microwave measurements techniques.

Module I:

Introduction RF & Microwave Spectrum, Typical applications of RF and Microwave-RADAR & Missile, Safety considerations. [1+2]

Microwave Waveguide and Waveguide Resonator Rectangular Waveguide-Designconsideration, TE & TM modes, TE10 mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wallcurrent; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation. [6]

Planar Transmission line Micro-strip lines, Coplanar waveguide, Slot line-design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines. [3]

Module II:

High frequency Circuit Elements Difference in High frequency and relatively low frequency behavior of Lumped circuit components. Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components. [4]

Waveguide Passive Components and their S-matrix Representation N-portnetworks-Properties of S matrix, Transmission matrix & their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magictee, hybridring, Circulators, Isolators; Design procedure of filter (maximally flat and equal ripple) using insertion loss method-specification, low pass prototype design, scaling and conversion, implementation.

[8]

Module III:

Microwave Tubes Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and non-resonant (TWT & BWO) microwave active devices: Typical characteristics & applications (only physical explanation is required, no mathematical derivation required). [4]

Semiconductor Microwave devices TED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode characteristics & applications; Microwave bipolar transistor, Microwave field effect transistor (MESFET). [5]

Microwave Amplifier Design Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure; Matching network design using lumped elements and L-Section. Brief introduction to NBA, LNA. [4]

Module IV:

Typical Microwave Test Bench & measurement VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high, Frequency measurement. [4]

Text Books:

1. Annapurna Das and Sisir K Das,“Microwave Engineering”,Tata McGraw Hill Inc., 3rd Edn.2015.
2. Samuel Y Liao, “Microwave Devices & Circuits”, Prentice Hall of India,2006.
3. D. M. Pozar, “Microwave Engineering.”, John Wiley & sons, Inc., 2006.

Reference Books:

1. Robert E.Colin, 2ed “Foundations for Microwave Engineering”, McGraw Hill, 2001
2. M. M.Radmanesh, RF & Microwave Electronics Illustrated, Pearson Education, 2007.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1							2	1	3	2	
CO2	3	3	2	1	2				3		2	2	3	2	
CO3	2	2	1	3								2	3	2	
CO4	2	2		1							2	1	3	2	
CO5	3	3	3		3							2	3	1	

Paper Name: Principles of Management
Paper Code: HU705
Credits: 2
Total Contact Hours: 24

Course objectives:

To understand and apply management principles into manufacturing organization.

To understand concepts of work study, method study, and time study to improve productivity of any manufacturing organization.

Course Outcomes:

CO1: To understand the managerial functions and will remember the basic knowledge on international aspect of management

CO2: To analyze the planning process in the organization

CO3: To understand and apply the concept of organization

CO4: Demonstrate the ability to directing, leadership and communicate effectively

Module I Evolution of Management Practices:

Characteristics, objectives Functions, Principles and Types of Management., Scientific Management- Contribution of F. W. Taylor, Henry Fayol Gantt, Maynard and Indian contributors to theManagement thought. Organization: Definition, Principles, Function and Types of organization structure, Managerial Functions

Module II Motivation:

Human Needs and Types of Motivation, Theories of Motivations- Maslow's theory, McGregor's Theory of X and Theory of Y, Herzberg's Theory of two factor, David C.McCelland's Theory of Achievement, Expectance/valence Theory of Victor Vroom, Porter & Lawler's Model. Group dynamics: Types, characteristics, objectives of Group Dynamics Leadership: Definition, styles & functions of leadership, qualities for good leadership, role of the leader, Theories of leadership, Managerial grid, professional and business ethics.

Module III Entrepreneurship development:

Characteristics of successful entrepreneurs, communications skill, problem solving skill and process, Basic element of Business plans, Sources of finance, Selection of Business location, Record keeping system, Analysis financialperformance, Break even analysis, Technology and Business, Strategies for Business Growth,Concept related to start- up and Intellectual Property Rights (IPR).

Module IV Wages and incentives:

Concept of wages, factors affecting wages, Job evaluation, meritrating.

Module V

Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Terminology & Tools, Use of stop watch procedure in making Time Study. Time Study Forms, Performance rating, allowances and its types.Calculation of Standard Time.Work sampling

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1	1	1						2	1	2	2	
CO2			2	1	2						2	2	2	2	
CO3				1	1						1	2	2	2	
CO4				1							2	1	1	2	

Paper Name: VLSI & Microelectronics
Paper Code: EC702
Total Contact Hours: 45 (3L+1T/Week)
Credit: 4

Prerequisite:

Concept of courses Solid State Devices (EC301), 3rdSem; Analog Electronic Circuit (EC402), 4thSem; Digital Electronic and Circuit (EC403), 4thSem.

Course Objective: Objective of the course VLSI & Microelectronics, Code: EC702 is tomotivate students to design VLSI circuits in the areaof digital, analog and also to encourage for the design of IC with lowpower and high speed.

Course Outcome:

CO1: Able to describe scale of integration–SSI, MSI, LSI, VLSI, Moor's Law, scaling, short channel effect, VLSI design flow, FPGA architecture and construct gate level circuit with PAL & amp; PLA concept.

CO2: Able to analyze CMOS inverter voltage transfer characteristics with the parameters –VIL, VIH, VOL, VOH, Vth and based on the knowledge of digital circuit design methodology like–CMOS, Pass transistor, TG, DCVSL, dynamiclogic, NORA and construct schematic of combinational, sequential circuit, SRAM, DRAM cell using MOSFET

CO3: Able to apply the fundamental concept of MOSFET characteristics and model, able to calculate value of resistance of current source, MOS diode, current of current mirror circuit, voltage of references (voltage divider, threshold voltage and bandgap), emulate resistance of switch capacitor circuit, gain of switch capacitor integrator and 1st order switch capacitor filter.

CO4: Able to analyze MOS transistor model and calculate the value of parameters to design CMOS differential amplifier and two stage OP-AMP.

CO5: Able to describe fabrication steps of IC and construct stick diagram & amp; layout of CMOS inverter and basic gates based on lambda and micron design rules.

CO6: Able to calculate gate delay, dynamic power, short circuit power and leakage power and total power consumption across CMOS inverter circuit evaluate delay and power based on the derived expressions.

Course Content:

Module–I: Introductionto IC (8L)

Integrated Circuits– Advantages, disadvantages, limitations; Scale of Integration–SSI, MSI, LSI, VLSI, ULSI; Moor's Law; Scaling of MOSFET-Constant field scaling and constant voltage scaling, Short Channel Effects; VLSI design flow, Y-Chart, IC Classification–Standard IC and ASIC, PAL, PLA, FPGA Architecture.

Module-II: Digital VLSI Circuit Design (5L+8T)

Inverter Characteristics (2L): Resistive load inverter– Voltage transfer characteristics (VTC, significance of parameters (only expression, no derivation) –V_{IL}, V_{IH}, V_{OL}, V_{OH}, V_{th}; CMOS inverter-VTC, Noise margin and aspect ratio of symmetric CMOS inverter.

Combinational Logic Circuit Design (3L+5T):Circuit design using Static CMOS style –basic gates, design of circuit for product of sum(POS) and sum of product (SOP) expression, Complex logic circuit, full adder ; Circuit design using pseudo NMOS logic, DCVSL Logic, TG Logic, Pass Transistor Logic, Complementary pass transistor logic, Dynamic logic, domino logic, NORA logic.

Sequential Circuit and Semiconductor Memory Design (3L+2T): Bistable Circuit-Design of CMOS S-R & J-K Latch, CMOS Clocked SR & JK Latch /Master –slave JK Flip-flop, CMOS D Flip-flop; 6T SRAM cell and 3T DRAM cell design.

Module-III: Analog VLSI Circuit Design (10L+2T)

Small Signal model of MOSFET; Analog sub-circuits -MOS Switch , Active resistors/ MOS Diode, Current source and Sink ,Current Mirror ; Current and voltage references-voltage divider , MOS equivalent of P-N junction Voltage reference ,Threshold voltage reference , Band gap reference (Basic Principle) ;Switch-Capacitor Circuit –resistance emulation of series , parallel and series-parallel circuit, Switch capacitor integrator and filter (1^{st}order only); CMOS differential amplifier –design parameters; Output amplifier (basic circuit) ;Two-Stage CMOS OP-AMP design.

Module–IV: Layout Design Rules and Fabrication Steps of ICs (6L+2T)

Micron and lambda design rules; Stick diagram and Layout- CMOS Inverter, NAND and NOR gate; Fabrications steps of IC – Wafer preparation, Oxidation, photolithography, etching, diffusion, ion-implantation, metallization and packaging. CMOS N-Well Process, overview of P-well and twin-tub process.

Module-V: Introduction to Low Power and High Speed VLSI Circuit Design (4L) Dynamic power, short circuit power and leakage power in CMOS Inverter; Timing parameters (concept only)– Critical path, arrival time, slack, skew, set-up time, hold time, gate delay and path delay, delay time expression of CMOS inverter (expression only), Adiabatic logic (basic concept)

Text Books:

1. Digital Integrated Circuit, J. M. Rabaey, Chandrakasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuits Analysis and Design, S. M. Kang & Y. Leblebici,TMH.
3. CMOS Analog Circuit Design, Allen & Holberg, Oxford
4. Design of Analog CMOS Integrated Circuits, Behzad Razavi,TMH.

Reference Books:

1. Microelectronic Circuits, Sedra & Smith, Oxford
2. Introduction to VLSI Circuits and System, Uyemura,Wiley
3. VLSI Design, Debaprasad Das, Oxford
4. VLSI Design and EDA Tools, Angsuman Sarkar, Swapnadip De, C.K. Sarkar, Scitec.
5. VLSI DesignTechniquesforAnalogandDigitalCircuits,Geiger,Allen,Strader,TMH

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	-	-	1	2	1	1	1	3	2	1
CO2	3	3	3	3	1	-	-	1	2	1	1	3	3	2	1
CO3	3	3	3	2	1	-	-	1	2	1	1	3	3	2	1
CO4	3	3	3	1	1	-	-	1	2	1	1	3	3	2	1
CO5	3	3	3	1	1	-	-	1	2	1	1	3	3	2	1
CO6	3	3	3	2	1	-	-	1	2	1	1	2	3	2	1

Paper Name: Digital Image Processing
Paper Code: EC703A
Contact hour: 3P
Total contact hour: 35
Credits: 3

Course Objective:

To become familiar with digital image fundamentals

To learn Transform of Digital Images and its applications.

To get familiar with simple image enhancement techniques in both spatial and frequency domain.

To become familiar with image compression and recognition methods

To learn concepts of image restoration techniques and image segmentation and representation techniques.

To study the Edge detection in Digital Image Processing.

To become familiar with basics of Security in Digital Image Processing

Course Outcome:

CO 1: Define basic idea on digital image fundamentals and Importance of Digital Image Transform.

CO2: Understanding the importance of Digital Image enhancement in spatial and frequency domain and filtering techniques

CO3: Analyze the requirements and types of Image Compression and its standards.

CO4: Classify the basic concepts of Digital Image Restoration and Segmentation of Digital Images

CO 5: Explain Edge detection techniques and concepts on security in Digital Image Processing

Course Content:

Module 1:

Digital Imaging Fundamentals: Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing 3L

Transform of Digital Images: Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area. 4L

Module 2:

Digital Image Enhancement: Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bitplane slicing, Histogram, Histogram Equalization, Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images–LPF, HPF and BPF. 6L

Module 3:

Digital Image Compression: Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression. 6L

Module 4:

Digital Image Restoration: Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering 3L

Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm, 5L

Module 5:

Edge detection in Digital Image Processing: Importance of Edge Detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator. 4L

Security in Digital Image Processing: Importance of Digital Image Security, Watermarking, Image encryption in spatial and Frequency domain, Steganography. 4L

TEXT BOOK:

1. Rafael C.Gonzales, Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.
2. S. Annadurai, R.Shanmugalakshmi, “Fundamentals of Digital Image Processing”, Pearson Education, 2006

REFERENCES:

1. Rafael C.Gonzalez, Richard E. Woods, Steven L.Eddins,“Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt.Ltd., 2011.
2. Anil Jain K.“Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1			2	1		2	2	3	3	2	2
CO2	3	2	2	1	2	1	1	2		1	2	3	3	2	2
CO3	2	2	1	3		3			2			3	3	2	2
CO4	3	2		2		2	2	2		3	2	1	3	2	1
CO5	2	3	3		3	3		1	3			2	3	1	1

Paper Name: Computer Organization and Architecture
Paper Code: EC703B
Contact: 3L
Credits: 3

Pre-requisite: Basic Electronics, Introduction to Computing, Digital Electronics & Integrated Circuits, Microprocessor and Microcontroller.

Course Objective:

Enrich the knowledge of the students on basic components of a computing system and their working principles.

Obtain a basic level of Digital Electronics knowledge and set the stage to per form the analysis and design of complex digital electronic circuits.

Course Outcome:

CO 1: The students will be able to know about basic of computer architecture, existing architectures and design related computing systems.

CO 2: The students will be able to design about basic of computer memory structures and RAM, ROM architecture.

CO 3: The students will be able to know about different CPU architecture & amp; Processor-memory communication technique.

CO 4: The students will be able to knowabout pipelining techniques and design related architectures.

CO 5: The students will be able to know about ILP, Super scaler, VLIW architectures.

CO 6: The students will be able to know the basic concepts of VHDL.

Course Content:

Module 1: Introduction to Computer Organization & Architecture:

Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration],Harvard & Von Neumann architecture, BUS architecture fundamentals, ALU designs, IEEE-754 format for floating point numbers, truncation technique, Instruction set: Instruction format & types. [9L]

Module 2: Memory Organization:

Memory system overview, Cachememory organizations and Cachemisses, Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, RAM (static and dynamic) and ROM architecture. [7L]

Module 3: CPU Organization:

Fundamentals, Processor-memory communication [Clock cycles and Timing diagram], Instruction cycle, RISC & CISC based architecture. [4L]

Module 4: Pipelining:

Basic concepts, instruction and arithmetic pipeline, data hazards, controlhazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD,SIMD, MISD, MIMD architectures [5L]

Module 5: Instruction-level parallelism:

Basic concepts, techniques for increasing ILP, Basics of super scalar and VLIW processor architectures, Array and Vector processors, Systolic Array. [5L]

Module 6: Overview of HDL:

VHDL basics programming concept, Structural, dataflow, behavioral &mixed style modeling techniques. [6L]

Text & Reference books:

1. William Stallings - "Computer Organization & Architecture Designing for performance", 8/e, Pearson
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky- "Computer Organization", 5/e, MGH
3. M.M. Mano- "Computer System Architecture", 3/e, Pearson
4. Kai Hwang and Naresh Jotwani-"Advanced Computer Architecture Parallelism, Scalability, Programmability", 2/e, MGH
5. Pedroni- "Circuit Design And Simulation With VHDL", 2/e, PHI
6. J.Bhaskar- "A VHDL Primer", P.T.R.Prentice Hall
7. Charles Roth--"Digital Systems Design using VHDL", PWS Publishing Company

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2	2	1		1				3	3	2	2
CO2			3		2	1		1				3	3	2	2
CO3	3		2		1			1				3	3	2	1
CO4	3	3	2		1	1						3	3	1	1
CO5	3			2	1							3	2	2	2
CO6	3	2	2	1	3							3	1	2	3

Paper Name: Data Base Management System
Paper Code: EC703C
Contact: 3L
Credits: 3

Prerequisite:

Logic of programming language

Basic concepts of data structure and algorithms

Course Objectives

To learn the data models, conceptualize and depict a data base system

To design system using E-R diagram.

To learn SQL & relational data base design.

To understand the internal storage structures using different file and indexing techniques.

To know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcomes (COs)

On completion of the course students will be able to

CO 1: Apply the knowledge of Entity Relationship (E-R) diagram for an application.

CO 2: Create a normalized relational database model

CO 3: Analyze real world queries to generate reports from it.

CO 4: Determine whether the transaction satisfies the ACID properties.

CO 5: Create and maintain the database of an organization.

Module 1:

Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [11L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module 3:

SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:

Relational Database Design [8L]

Functional Dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study

Module 5:

Internals of RDBMS [9L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization.Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module 6:

File Organization & Index Structures [6L]

File &Record Concept, Placing file records on Disk, Fixed andVariable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multi level Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.GrawHill.
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 J D., “Principles of Database Systems”, Galgottia Publication.

Reference:

1. Jain: Advanced Database Management System Cyber Tech
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-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3						3	3	2	2	2
CO2	2	3	3	3	3						3	3	2	2	2
CO3	3	3	2	3	3						3	3	2	2	2
CO4	3	3	2	2	2						2	3	2	1	2
CO5	3	3	3	3	3						3	3	2	3	2

Paper Name: Artificial Intelligence and Robotics
Paper Code: EC704A
Credits: 3
Total lecturers: 37

Prerequisites:

Linear algebra and probability theory. Basic understanding of control systems and computing.

Course Outcome:

CO1: Understanding Basic idea about AI

CO2: Analyzing Problem solving and searching AI Problems

CO3: Applying Neural network to solve AI problems

CO4: Understanding fundamental idea of Robots mechanics

CO5: Exemplyflying Robot based sensors and assessing robot path planning

Module-I

Introduction:

Foundations and History of Artificial Intelligence & Robotics, Turing Test, Intelligent Agents, classification and usage of robots. [2]

Module-II

Searching and Problem Solving:

Problem formulation with suitable examples,-8puzzleproblem,TowerofHanoi, Data driven and goal driven search, Uninformed search strategies -Breadth-first search, Depth firstsearch, Bidirectional search, Hill climbing, simulated annealing. [5]

Module-III

Knowledge Representation and Reasoning: Introduction to data, information and Knowledge, Propositional logic, first order predicate logic (FOPL), Rule of inference, Inference engine, knowledge representation technique, Forward and Backward reasoning, Bayes'rule and Bayesian Networks. [5]

Module-IV

Learning:

General model of learning agents, Inductive learning, Learning decision trees, decision trees as performance elements, induction decision trees from example, Neural Networks (Network structures, Single layer feed-forward neural network, Multilayer feed-forward neural network, learning weights), classification & clustering concept. [6]

Module-V

Elements of robots:

Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators– stepper, DC servo motors, Purpose of sensors– tacho meters, strain gauge based force-torque sensors, proximity sensors and vision. [6]

Module-VI

Kinematics of robots: Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, work space of a serial robot, Inverse kinematics of constrained and redundant robots, Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators.

[8]

Module-VII

Motion planning and control: Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes. [5]

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, OXFORD University Press.
3. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

REFERENCE BOOK:

1. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishers
2. S.R.Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2		2		3			3	3	2	2
CO2	3	3	3	3	2	2	2		3		2	3	3	2	2
CO3	3	2	3	2	2		2		3	2		3	1	2	2
CO4	3	3	3	3	2		2	2	3			3	3	2	1
CO5	2	3	2	3	2		2		3			3	3	1	1

Paper Name: Biomedical Electronics and Imaging
Paper Code: EC704B
Contacts: 3L
Credits: 3
Total Contact: 36

Prerequisite:

Concepts in Analog Electronics (Studied in Basic Electronics Engineering).

Fundamental concepts on mathematics.

Concepts in Digital signal Processing

Course Objectives:

To familiarize the students with concepts related to medical electronics and imaging.

To understand medical measurement systems and system modelling.

To understand time domain and frequency domain analysis of realtime biomedical signals like ECG, EEG etc.

To understand the different medical imaging techniques like CT Scan, PET, ultrasound and understand the different types of data acquisition electrodesandamplifiers.

Course Outcome

CO.1: Explain Bioelectric signals, human physiological system and different types of transducers.

CO.2: Understand different types of medical measurement system.

CO.3: Able to understand deferent types of biomedical signal acquisition electrodes and different types of signal amplification techniques and able to design the amplifiers.

CO.4: Able to examine the data handling, filtering techniques of bio-medical signals and able to analysis of time and frequency domain.

CO.5: Able to understand medical imaging techniques and implement Different algorithms to feature extract the signals.

Module I: Introduction of Medical Electronics:

Origins of Bioelectric signals, Electrocardiogram (ECG), Electromyogram (EMG), Recording Electrodes-Silver-silver Electrodes, Electrodes for ECG, EEG and EMG , Physiological Transducers- Pressure Transducers,Temperature sensors, Pulse sensors; Sources of bioelectric potential, resting potential, action potential, propagation of action potentials in nerves, Rhythmic excitation of heart. [6L]

Module II: Medical Measurement systems:

Specifications of instruments, static & dynamic characteristics, classification of errors, statistical analysis.Introduction to reliability,accuracy, fidelity, speed of response, linearization of technique, data acquisition system. Detection of physiological parameters using impedance techniques: Impedance and current distribution, bipolar and tetra polar circuits, skin impedance, galvanic skin response measurement, total body impedance, cardiac output, neural activity, respiratory activity, impedance plethysmography- resistance and capacitance type. [8L]

Module III: Bio-amplifier and Bio-potential electrodes

Need for bio-amplifier-single ended bio-amplifier, differential bio-amplifier –right leg driven ECG amplifier. Band pass filtering, isolation amplifiers –transformer and optical isolation -isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference. Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode Non polarizable electrodes. Types of electrodes -surface, needle and micro electrodes and their equivalent circuits. Recording problems-measurement with two electrodes. [8L]

Module IV: Medical Signal Processing

Biomedical signal origin & dynamics (ECG), Biomedical signal origin & dynamics (EEG, EMG etc.), Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average) Illustrations of problem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length. [8L]

Module V: Medical Imaging Techniques

CT scan, ultrasound, NMR and PET, Experiments are based on` acquisition of biomedical signals, Implementation of algorithms covered in the coursetocharacterizethesesignals. [6L]

Reference Books:

1. Wavelets andTime frequency methods for Biomedical signal Processing- M.Akay, IEEE Press,
2. Digital Processing of speech signals- L. Rabinar, Pearson Education
3. Biomedical Instrumentation and Measurements- Cromwell, Weibell and Pfeiffer, PHI

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	1	-	-	1	1	-	1	3	2	2
CO2	3	2	2	-	-	-	-	-	2	1	-	1	3	2	2
CO3	3	2	1	2	1	1	-	-	2	1	-	-	1	2	1
CO4	3	1	-	-	1	1	-	-	2	1	-	1	3	1	1
CO5	1	1	3	2	1	1	-	-	2	1	-	1	2	2	2

Paper Name: Renewable Source & Applications
Paper Code: EC704C
Total Contact Hours: 42
Credit: 3

Prerequisite: Renewable energy resources, Technical applications, Advantage and Disadvantage.

Course Objective:

The purpose of this course is to provide knowledge on different renewable energy sources for energy production in details for understanding the need & role of renewable energy sources for future growth and development.

Course Outcomes:

CO1: Able to understand the importance of Renewable energy over conventional process

CO2: Able to explain different methods of Power generation from the Non- conventional sources like Solar, Wind Energy, Biomass, Geothermal energy, OTEC, Tidal energy, MHD Power generation schemes.

CO3: Able to illustrate the different techniques of grid integration of the power generated from renewable energy sources with the initiation of power electronic converters and drives.

CO4: Able to design different hybrid energy systems and energy storage systems

Course Contents:

MODULE 1 2L

INTRODUCTION TO ENERGY SOURCES:

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

MODULE 2 10L

SOLAR ENERGY:

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

SOLAR THERMAL COLLECTORS & HEATING : Flat plate collectors, Concentrating collectors, Solar air heaters-types, storage of solar energy-thermal storage, solar water heaters, solar distillation, solar cooker, solar heating & cooling of buildings,

SOLAR PHOTOVOLTAIC SYSTEMS: Theory of solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Concept of module, array. Classificationof PV systems, Advantages and disadvantages. Efficiency and cost of PV systems & its applications.

MODULE 3 6L

WIND ENERGY:

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

MODULE4

HYDEL ENERGY: 2L

Electricity generation from micro hydelplants, location, auxiliaries and associated problems. Advantages & disadvantages.

MODULE 5 5L

BIOMASS ENERGY:

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

MODULE 6 3L

GEOTHERMAL ENERGY:

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

MODULE 7 4L

ENERGY FROM OCEAN:

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

MODULE 8 3L

MAGNETOHYDRODYNAMIC POWER GENERATION:

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

MODULE 9 3L

HYDROGEN ENERGY:

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogengas, hydrogen as alternative fuel fo rvehicles.

MODULE 10 2L

FUEL CELL:

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

MODULE 11 2L

HYB RID SYSTEMS:

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

Text Books

1. Non Conventional Energy Resources by S Hasan Saeed, D K Sharma, S. k. Kataria & Sons
2. NON CONVENTIONAL RESOURCES OF ENERGY, G. S. SAWHNEY, Eastern Economy Edition
3. Non Conventional Energy Resources, B.H Khan, McGraw Hill Education (Chennai)
4. Non Conventional Energy Resources, N. K. Bansal,Vikas.

Reference Books

1. Non Conventional Energy Resources, Shobh Nath Singh, PEARSON.
2. Non Conventional Energy Resources And Utilisation.Er R.K Rajput, S Chand Publishers.
3. Rai G.D., “Non–ConventionalEnergySources”, Khanna Publishers, 1993.
4. Rai G.D., “Solar Energy Utilisation”, Khanna Publishers, 1993.

CO-PO-PSO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	-		3	1	-	-	3	3	3	2	
CO2	3	1	2	2	-		3	-	-	-	2		2	3	
CO3	2	2	2	-	-		3	-	-	-	2		2	2	
CO4	2	2	2	-	-		3	-	-	-	2	3	2	2	

Paper Name: RF & Microwave Engineering Lab
Paper Code: EC791
Contact: 3P
Credits: 2

Course Outcome:

Students will be

CO1: Able to define, identify and list out special type transmission line, its characteristics in microwave frequencies and concept of load tools

CO2: Able to recognize, memorize, categorize, arrange and implement suitably the various microwave passive devices with the utilization of engineering mathematics.

CO3: Able to analyse and use the various sources of microwave energy and the characters of its operation.

CO 4: Students Able to use, compute, solve, demonstrate and apply various hardware, software tools and measuring instruments in the field of Radio Frequencies, for the betterment of communication engineering, medical science andvarious domestic and commercial engineering. Expansion insdomain

Experiments

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [$\omega-\beta$ Plot].
2. Measurement of unknown impedance using shift in minima technique
3. Using a waveguide test bench/Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
4. Study of the characteristics of a Reflex Klystron oscillator
5. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
6. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench setup.
7. Scattering matrix of a magic tee / E-plane tee / H-plane tee using Waveguide test bench at X-band.
8. Experimental / Simulation Study of filter (LPF, HPF, BPF) response.
9. Measuring of dielectric constant of a material using waveguide test bench at X-band.

Reference Books

1. M L Sisodia & G S Raghuvanshi Basic Microwave Techniques and Laboratory Manual; Wiley Eastern Limited 1987
2. E L Gintzton Microwave Measurements, McGraw-Hill Book Co.
3. M Sucher and J Fox, Handbook of Microwave Measurements, VolI, Wiley-Interscience Inc.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2		2		3			3	3	2	
CO2	3	3	3	3	2		2		3			3	3	2	
CO3	3	3	3	3	2		2		3			3	3	2	
CO4	3	3	3	3	2		2		3			3	3	2	

Paper Name: VLSI & Microelectronics Lab
Paper Code: EC792
Contacts: 3P/Week
Credit: 2

Course Objective: Objective of the course VLSI & Microelectronics Lab, Code EC792 is tomotivate students for the design and analyzes circuit performance in the domain of digital, analog using SPICE tools. Also to mentor students to design layout and design using VHDL for FPGA based system design.

Course Outcomes (COs)

The students will be able to

CO1: Simulate VTC of CMOS inverter, measure V_{IL},V_{IH},V_{OL},V_{OH} and calculate noise margin

CO2: Measure and analyze gate delay and average power consumption of CMOS inverter forV_{DD}≤1.2V and with the nano dimensional channel length of MOS transistor through transient analysis

CO3: Design combinational circuit - CMOS AND/ NAND, OR/NOR, XOR/XNOR gate , CMOS full adder circuit, sequential circuit-CMOS SR latch, clocked SR latch & D flip-flop at schematic level for functional verification with the help of SPICE tools.

CO4: Construct layout of CMOS inverter, CMOS NAND, CMOS NOR gate using layout design tools of SPICE based on design rules.

CO5: Design of combinational circuits - logic gates , Full adder using half adder, 4:1 MUX using 2:1 MUX, Sequential circuits- S-R Flip-Flop, 8 bit synchronous counter, 8 Bit bi- directional register with tri-stated input output using VHD Land4:1MUXusingFPGA

CO6: Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at schematic level.

List of Experiments

1. SPICE simulation of CMOS inverter to plot voltage transfer characteristics (VTC) for different values of ratio for V_{DD}=1V and nano dimensional channel length Measurement of critical voltages V_{IL},V_{IH},V_{OL},V_{OH} from VTC. Calculation of noise margin from critical voltages. [3P]
2. Functional verification, gate delay and average power consumption analysis of CMOS inverter circuit for V_{DD}≤ 1.2V and with the nano dimensional channel length of MOS transistor through SPICE simulation. [3P]
3. Design and testing of functionality of the following gate and combinational circuit with the help of SPICE tools at schematic level.
   CMOS AND/NAND, OR/NOR, XOR/XNOR gate, CMOS full adder circuit [6P]
4. Layout design and functional verification of CMOS inverter, CMOS NAND, CMOS NOR gate using layout design tools of SPICE based on design rules. [6P]
5. Design and examination of functionality of these quential circuits-CMOS SR latch, clocked SR latch & D flip-flop

at schematic level using SPICE tools. [6P]

6. Design andsimulation with the help of VHDL applying suitable modelling style (structural, behavioral, dataflow, mixed) for the following combinational circuits
   - **a)** Logic gates
   - **b)** b) Full adder using half adder
   - **c)** c) 4:1MUX using 2:1MUX [6P]
7. Design using VHDL for the following Sequential circuits
   - **a)** S-R Flip-Flop
   - **b)** 8 bit synchronous counter
   - **c)** 8Bit bi-directional register with tri-stated input output [6P]
8. Familiarity with FPGA based system design and realization of 4:1 Mux using FPGA. [3P]
9. Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at the level of schematic. [3P]
10. Innovative experiment.

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			2	2		1	3	3	2	
CO2	3	3	3	3	3			2	2		1	3	3		1
CO3	3	2	3	3	3			2	2		1	3	3		1
CO4	3	3	3	3	3			2	2		1	3	3		
CO5	3	2	3	3	3			2	2	3	1	3	3	2	
CO6	3	3	3	3	3			2	2		1	3	3	2	

Subject Name: Digital Image Processing Lab
Subject Code: EC793A
Contact hour: 3P
Credits: 2

Course objective:

To prepare the students to have a basic knowledge with digital image fundamentals and Transformation of Digital Images.

To build knowledge on simple image enhancement techniques in both spatial and frequency domain.

To become familiar with image compression and recognition methods

To understand characteristics of image restoration and image segmentation techniques.

To build ideas on Edge detection in Digital Image Processing.

To provide Security in Digital Image using cryptography or watermarking technique

Course Outcome:

CO.1: Build knowledge on Digital Imaging fundamentals and Digital Image Transform.

CO.2: Understanding Digital Image enhancement techniques in spatial and frequency domain

CO.3: Explaining the requirements and types of Image Compression and its standards.

CO.4: Demonstrate the Digital Image Restoration and Segmentation of Digital Images

CO.5: Build ideas on Edge detection techniques and concepts on Digital Image security

List of Experiments:

1. Convert RGB Digital Images into Gray scale Images and show result.
2. Transform a grayscale image into frequency domain and show its magnitude and phase angle.
3. Display histogram of a digital image and equalized the image.
4. Apply LPF and HPF in a Gray scale Digital Image and display result.
5. Apply Mean and Median filtering in a Grayscale Digital Image and display result.
6. Compressandreconstructa GrayscaleDigitalImagesinspatialdomain.
7. Compress and reconstruct a Grayscale Digital Image in frequency domain.
8. Apply segmentation technique (anyone) in a Digital Image and display result.
9. Apply Edge detection technique in a Digital Image and display result.
10. Apply any cryptography or watermarking technique for image encryption and display result.
11. Innovative experiment

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	3	2	3	2	2	3	2	2	3	2	2
CO2	2	2	2	2	3	2	2	2	3	2	3	2	3	2	2
CO3	2	2	2	3	3	2	3	2	3	1	3		2	3	3
CO4	2	2		3	1		2	2	3	2	3		3	3	2
CO5	2	2		3	3	3	2	2	3	2	3	2	2	3	2

Subject Name: Computer Organization and Architecture Lab
Subject Code: EC793B
Contact: 3P
Credits: 2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

Pre-requisite: Digital Electronic & Integrated Circuits

Introduction to HDL programming (includes different modeling styles and programming structure)

Programming of basic gates (AND, OR, NAND, NOR, XOR, XNOR) with HDL

Design of half adder, half subtractor, full adder and full subtractor

8-bit Adder (Parallel Adder), Subtraction (Parallel Subtractor / 1'scomplement / 2'scomplement technique)

Multiplication (Array based design/ Radix-2 Booth's algorithm / Karatsuba technique), Division (Restoring/ Non-Restoring algorithm) Design of flipflops (D, T and JK)

8-bit Register design (with left and right shift feature)

8 bit RAM design with opcode fetching and data fetching

8-bit simple ALU design

8-bit simple CPU design

Course Outcome:

CO1: The students will be able to design different digital circuits using HDL.

CO2: The students will be able to design different sub-systems of the computer using HDL.

CO3: The students will be able to design simple as well as complex CPU architecture.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	1	1	1	1	1	2	3	3	3	2
CO2	2	3	3	2	3	1	1	2	1	1	2	3	3	3	2
CO3	2	2	2	3	3	1	1	2	1	2	2	3	3	3	2

Subject Name: Database Management System Lab
Subject Code: EC793C
Contact: 3P
Credits: 2

Prerequisite:

Logic of programming language

Basic concepts of datastructure and algorithms

Course Objectives

To learnthe datamodels,conceptualize and depict a database system

To learn the fundamental concepts of SQL queries.

To understand the concept of design in database with the necessary attributes.

To know the methodology of Accessing, Modifying and Updating data & information from the relational databases

To learn database design as well as to design user interface and how to connect withdatabase.

Course Outcome(s)

On completion of the course students will be able to

CO 1: Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CO 2: Understand the introductory concepts of some advanced topics in data management like distributeddatabases, data warehousing, deductive databases andbe aware of some advanced databases like partial multimedia and mobile databases.

CO 3: Differentiate between DBMS and ad vanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CO 4: Analyze database system concepts and apply normalization to the database.

CO 5: Apply and create different transaction processing and concurrency control applications.

Structured Query Language

Creating Database Creatinga Database

Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes

Table and Record Handling INSERT statement

Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements

Retrieving Datafroma Database The SELECT statement

Using the WHERE clause

Using Logical Operators in the WHERE clause

Using IN, BETWEEN, LIKE, ORDERBY, GROUPBY and HAVING Clause Using Aggregate Functions

Combining Tables Using JOINS Sub-queries

Database Management

CreatingViews

Creating Column Aliases

Creating Database Users Using GRANT and REVOKE

PL/SQL

Database design using E-Rmodel and Normalization

Design and implementation of some online system [Library Management System] TextBook:

SQL, PL/SQL by Ivan Bayross, BPB Publications

Oracle PL/SQL Programming, 6th Edition- O'Reilly Media By Steven Feuerstein, BillPribyl

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3				2			3	2	2	1
CO2	2	3	3	3	3				2			3	2	2	2
CO3	3	3	2	3	3				2			3	3	2	2
CO4	3	3	2	2	2				2			3	2	1	3
CO5	3	3	3	3	3				2			3	3	2	2

Paper Name: Advanced Communication systems
Paper Code: EC801
Contact hour: 2L+2T
Total contact hour-45
Credits: 3

Prerequisite: Analog Communication and Digital Communication, Probability & Statistics

Course Objective:

To present the fundamentals of modern communication system aspects like Mobile communication, Satellite communication, AdHoc networks, the technology applied, modulation techniques and their performance analysis. Emphasisis placed on physical layer aspects of a communication system and their performance over the channel effected by fading noise.

Course outcome:

CO1: Apply the knowledge of probability and statistical calculations to analyse the performance of a digital communication system.

CO2: Develop in sight on the various spreads pectrum techniques and their application.

CO3: Evaluate the various physical layer issues in the mobile and wireless communication systems

CO4: Understand the concepts of satellite communication systems

CO5: Analyse and design the satellite uplink and downlink and link budget

Module-I ProbabilityTheory:

Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels. Statistical Modelling of Signal & Noise.

Module-II Cellular Systems and Infrastructure- based Wireless Networks:

Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Similarities and differences between wireless and wired communication systems and application Cellular architecture design, Frequency reuse, Dynamic resource allocation, Area spectral efficiency, Interference model, Power control impact on interference, Mobile Ad Hoc Networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and SensorNetworks, Issues in designing a routing and Transport Layer protocol for Ad hocnetworks-proactive routing ,reactive routing (on-demand)

Module-III Spread Spectrum Communication:

Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SSsystems.

Module-IV PHY Layer Issues in Wireless Communication:

Path-loss and Shadowing: Radio wave propagation, Transmit and receive signal models, Free-space path loss, Ray tracing, Simplified and empirical path loss model, Shadow fading. Combined path loss and shadowing, Outage probability under path loss and shadowing.

Module-V Statistical Multi-path Channels:

Time-varying channel impulse response, Narrow band fading models, Wide band fading models, Discrete-time model, Spatio-temporal models.

Module-VI Performance of Digital Modulation over Wireless Channels:

AWGN channels: Error probability for BPSK, QPSK, MPSK, MPAM, MQAM, FSK, CPFSK, Doppler spread, Inter-symbol interference.

Module-VII Multi-Carrier Modulation and Spread-Spectrum:

OFDM, Discrete implementation of OFDM, Spread spectrum modulation, Pseudo random (PN) sequences (Spreading codes), Direct sequence spread spectrum, RAKE receivers, Frequency-hopping.

Module-VIII: Satellite Communication:

Satellite orbits, Kepler's Laws, Newton's law, orbital parameters, orbitalperturbations, station keeping, geo stationary and non geostationary orbits Look angle determination Limits of visibility, eclipse sub-satellite point-sun transit outage.

Module-IX:

Space segment and satellite link design. Spacecraft Technology- Structure, Primary Power, Attitude and Orbit Control, Thermal Control and Propulsion, Communication Pay load and Supporting Subsystems, Telemetry, Tracking And Command. Satellite Uplink and Downlink Analysis and Design, Link Budget, E/N Calculation-Performance Impairments-System Noise, Inter Modulation and Interference, Propagation Characteristics And Frequency Considerations- System Reliability and Design Lifetime.

Text books:

1. K.Pahalvan and P.Krishnamurthy, "Principles of Wireless Networks: A Unified Approach", Pearson Education.
2. W. Stallings, "Wireless Communications and Networking", Pearson Education.
3. Goldsmith, Wireless Communications, Cambridge University Press.
4. Dennis Roddy, "Satellite Communication", 4th Edition, McGraw Hill International, 2006.
5. Modern Digital and Analog Communication Systems, B.P. Lathi and Z.Ding, Oxford University Press.
6. Upena Dalal, "Wireless Communication and Networks", Oxford.
7. S.Haykin and M.Moher, "Modern Wireless Communication", Pearson Education.
8. T. Pratt,"Satellite Communication", John Wiley and Sons
9. T T Ha, "Dgtal Satellte Commncaton", Tata McGraw-Hill Education-2009.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									3	3	3	
CO2	3	3	3	3							2	3	3	2	
CO3	3	3	3	3								3	2	2	
CO4	3	3	3	2							2	3	3	2	
CO5	3	3	3	3								3	3	1	

Paper Name: Economics for Engineers
Paper Code: HU801
Credit: 2
Contact Hours: 36

Pre-requisites: MATH –College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Objective: This course emphasizes the strong correlation between engineering design and manufacturing of products/systems and the economic issues they involve.

Course Outcome:

CO1: Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.

CO2: Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.

CO3: Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems.

CO4: Evaluate the profit of a firm, carry out the break even analysis and employ this tool to make production decision.

CO5: Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

Course Content:

MODULE I

Introduction [4L]

Managerial Economics- Relationship with other disciplines- Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis.

MODULE II

Demand and Supply Analysis [7L]

Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.

MODULE III

Cost Analysis [7L]

Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis–PV ratio.

MODULE IV

Elementary economic Analysis [8L]

Inflation-Meaning of inflation, types, causes, measures to control inflation. National Income-Definition, Concepts of national income, Method of measuring national income.

MODULE V

Financial Accounting [5L]

Concepts and Definition of Accounting, Journal, Ledger, Trial Balance. Trading A/C, Profit & Loss A/C and Balance Sheet.

MODULE VI:

Investment Decision [5L]

Time value of money- Interest – Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Text Books:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.

Reference Books:

1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C.Patric Koelling, Pearson
2. R.Paneer Seelvan, "Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics", S.Chand & Company Ltd
4. Jhingan, M.L.,"Macro Economic Theory"
5. Macro Economics by S.P.Gupta,TMH
6. Haniff and Mukherjee, Modern Accounting, Vol-1, TMG
7. Modern Economic Theory–K.K.Dewett (S.Chand)

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1	1								3	1		1
CO2		1	1	1								3		1	
CO3											2	3			
CO4												1			
CO5												2			

Paper Name: Advanced Semiconductor Devices
Paper Code: EC802A
Total Contact Hours:
Credit: 3

Prerequisite: EC301 Solid State Devices, Physics of semiconductors and properties of SiGe and Group III-V compound semiconductors.

Students should be able to:

Course Objective:

Distinguish the basic physics under lying the operation of various device architectures

Critique chief technical challenges and critical materials issues for modern devices

Examine the state of the art of modern semiconductor device technology

Use engineering tools to predict the incorporation of candidate materials and the specific properties required for electronic devices

Course Outcome:

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

CO1: To understand all the aspects of operation and design for modern semiconductor devices, highlighting traditional, nano scale and excitonic/organic device physics

CO2: To analyze the semiconductor physics and the development of devices, with an interest in how they have changed to accommodate novel materials: organic semiconductors, graphene and layered materials, and quantum dots.

CO3: To expand their understanding of fundamental principles of modern electronic devices, while gain in gexposure to cutting edge technology.

CO4: To gain updated knowledge in the most advanced development of low dimensional semiconductor heterostructures and their applications.

Course Contents:

MODULE I

Advanced HBT Devices: SiGe, GaAs, InP, GaN

MODULE II

Advanced Field Effect Devices: Heterostructure Field Effect Transistors (HFETs), Modulation Doped Field Effect Transistors (MODFETs), High Electron Mobility Transistors (HEMTs)-Structure and Principle of Operation; Resonant Tunneling Devices (RTDs)

MODULE III

Emerging semiconductor devices: Single Electron Transistors (SETs), TFT (Thin Film Transistors); Strained layer superlattices and quantum well devices; Photo Diodes, LED, Semiconductor Laser; Fin Field-effect transistor (FinFET)- Structure and Principle of Operation.

MODULE IV

Applications and Device Simulation: RF and digital applications; Noise Characteristics; HBT Modelling; Heterojunction device simulation

Reference books:

1. S.M.Sze and Kwok K.Ng, "Physics of Semiconductor Physics (3rd)", Wiley, 2007.
2. Supriyo Datta,"Quantum Transport Atomto Transistor",Cambridge University Press, 2005.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1		1			3	2	3		3	2	2
CO2		3	2	2	3		1	3	3	2	3	3	3	2	2
CO3	3		3	1	3	3		3	3	2		3	3	2	1
CO4	2	2	3	2	3	3	1	3	3		3	3	3	1	1

Paper Name: Electromagnetic Interference and Compatibility (EMI/EMC)
Paper Code: EC802B
Contacts: 3L
Credits: 3
Total: 30

Pre-requisites: Electrical and Electronic Circuits, Time varying Electromagnetic Fields, Electrostatics, Antennas and Propagation

Course Objectives:

Introduction to the concepts of undesired signalcoupling through circuit parasitic and radiation of electromagnetic waves.

Estimation of EMI level and frequencies and remedial measures.

EMC design guidance to meet International Standards.

Course Outcome (CO):

CO1: Understanding EMC problems.

CO2: Awareness of International EMC Standards for equipment design.

CO3: Analyze Conducted EMI Coupling and Designing electronic systems for EMC

CO4: Analyze Radiated EMI Coupling and Design for EMC

Module I: Introduction [6]

Concept of EMI phenomena, sources of EMI, victims of EMI; Intra-system and inter-system EMI and examples; Conducted and radiated EMI Emission and Susceptibility and examples; Transients EMI Surge, EFT and ESD phenomena and examples; Concept of EMC and examples.

Module II: EMC Standards [4]

International EMC Stadards, Civilian Standards- CISPR, FCC, IEC, EN for CE and CS, Military Standards brief, Indian Standards.

Module III: Conducted EMI Coupling and Mitigation [10]

Common mode and Differential mode EMI Couplings; Common impedance coupling; EMC by Design- Components election, Filtering, Bonding, Grounding, Isolation Transformers; PCB Design for EMC.

ModuleIV: Radiated EMI Coupling and Mitigation [10]

Cross-talk Interference; Radiated Coupling, Ground loop; EMC by Design- Shielding E field and H field, Shielding effectiveness.

Books

1. V.P.Kodali, *Engineering Electromagnetic Compatibility*", IEEE Publication, S. Chand & Co.Ltd, New Delhi, 2000.
2. C.R.Paul, Introduction to Electromagnetic Compatibility. John Wiley & Sons, Inc., 1992.
3. Henry W. Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons, Inc., 2009.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1				2		2	2	3	3	3
CO2	3	3	3	3		1			2		1	2	3	3	3
CO3	3	3	3	3		1	1		2	1		2	3	3	3
CO4	3	3	3	3				1	2			2	3	3	3

Paper Name: Mobile Communication and Network
Paper Code: EC802C
Contacts: 3L
Credits: 3
Total Contact: 36

Course Objectives:

To understand the basic principles of mobile communication systems.

To familiarize the students with concepts of the basic principles of modern mobile and wireless communication systems.

To understand the operation of mobile communications systems and their generation divisions.

Course Outcome:

CO1: Remember the evolution and history of wireless technology.

CO2: Understand the cellular concepts for mobile communication.

CO3: Understand radio signal propagation issues and different technological advancement mobile communication.

CO4: Analyze wireless and Radio channels and Compare 3G Cellular telephone data rates with those over Wireless LAN

CO5: Evaluate mobile IP allocation and function of the station roaming.

Module I: INTRODUCTION

Evolution of mobile radio communications, mobile radio systems around the world, trends in cellular radio and personal communication, first generation (1G), second generation (2G), third generation (3G) mobile cellular networks. [2L]

Module II: CELLULAR CONCEPT

Limitations of conventional mobile system, Introduction to mobile cellular communication, concept of frequency reuse,cluster size,cellular system architecture,channel assignment strategies, call handoff strategies - hard handoff and soft handoff, prioritizing handoff; interference and system capacity, improving capacity in cellular systems – cell splitting, sectoring, microcell zone concept, Co-channel interference, Propagation Effects-scattering, ground reflection, fading. [10L]

Module III: DIFFERENT MOBILE COMMUNICATION SYSTEMS

GSM services and features, system architecture, GSM radio subsystem, GSM channel types, location updating and call setup, WAP, SCSD, GPRS, EDGE, 3G W-CDMA; CDMA digital cellular standard, comparison between GSM and CDMA, 3g CDMA 2000, IMT-2000 [8L]

Module IV: WIRELESS NETWORKS

Advantages and applications of Wireless LAN, WLAN technology – RF and IR wireless LAN, diffuse, quasi-diffuse and point-to point IR wireless LAN, IEEE 802.11, IEEE 802.11 architecture, Introduction to WI-FI, HIPERLAN2, Bluetooth– Bluetooth architecture. [8L]

Module V: MOBILE NETWORK

Introduction to Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunneling And Encapsulation,Optimization, Reverse Tunneling; Mobile ad-hoc networks – Routing, Destination sequence distance vector, Dynamic source routing and Alternative metrics, Future of mobile communication – 3G to 4G. 4G Introduction and vision, Multi antenna Technologies: MIMO; software defined radio, adaptive multiple antenna techniques, radio resource management, QOS requirements.

[8L]

Text & Reference Books:

1. Theodore S. Rappaport, Wireless communications: principles and practice, PHI/ Pearson education.
2. J.Schiller, Mobilecommunications, Addison-Wesley.
3. William C. Y. Lee, Mobile cellular telecommunication– analog and digital systems, McGraw Hill, 2nd ed.
4. Wang, Wireless communication System, Pearson Education
5. Talukdar, Mobile Computing,TMH
6. J.W. Mark, W.Zhuang, Wireless Communication and Networking, PHI.
7. A. Santamaria et al, Wireless LAN systems, Artech House.
8. Stallings, Wireless Communication & Networks, Pearson Education.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3						1		2	3	2	
CO2	3	2	2		1	1	1			1			2	2	
CO3	2	2	3	3		1						2	2	2	
CO4	2	2		3		1	1					2	3	2	1
CO5	2	2	3		1	1						2	3	1	1

Paper Name: Software Engineering
Paper Code: EC803A
Contact Hours: 3L+ 1T
Credits: 4

Course outcome:

On completion of the course students will be able to

CO.1: Understand the structure and behavioral software system the UML class diagrams and state diagrams.

CO.2: Understand common life cycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches.

CO.3: Apply software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level.

CO.4: Work collaboratively in a small team environment to develop a moderate-sized software system from conceptualization to completion, including requirements elicitation, system modeling, system design, implementation, unit and system testing, integration, source code Management configuration management, and release management

CO.5: 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).

CO.6: Design a solution to a given problem using one or more design patterns and implement the design in a programming language.

Module I

Introduction:

Definition of SE, Software crisis, Evolution of technology-Hypecurve, Exploratory style of Software development vs SE, Human cognition mechanism, SE principle-abstraction and decomposition. 3L

Module II

Software life-cycle models:

Waterfall model, V Model, Prototyping Model, Spiral Model, RAD Agile Model 4L

Module III

Software Project Management:

Responsibility of a project manager, Project planning, Metrics for project sizeestimation, 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. 10L

Module IV

Requirement analysis and specification:

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

Module V

Software Design: 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 floworiented Design, Program Design and the requirements. 7L

Module VI

Coding andTesting: 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. 10L

Module VII

Software Reliability and Quality Management: Reliability, Hazard, MTTF, Repair and Availability, Software quality, SEICMM and ISO-9001.Software reliability and fault-tolerance, Six sigma 5L

Module VIII

Computer-aided software engineering (CASE)- environment and benefit, Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 900. 4L

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-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	3	3		1	1						3	3	2	2
CO.2	3	3		3			2		L	2	2	3	3	2	2
CO.3	3	3	2	3	3	2				3	3	3	3	2	1
CO.4	3	3	1	2					2		2	3	3	1	1
CO.5	3	3		1	2		1			1	3	3	2	2	2
CO..6	3	3	3		2	2						3	2	2	2

Paper Name: Physical Design, Verification &Testing
Paper Code: EC803B
Contact Hours: 3L+1T
Credits: 4
Total: 30

Course Outcome (CO):

CO1: Able to Design, Verification and Test a VLSI circuit pertaining to these three phases.

CO2: Aims to cover the important problems /algorithms /tools so that students get a comprehensive idea of the whole digital VLSI design flow.

CO3: able to understand High level Synthesis, Verilog RTL Design, Combinational and Sequential Synthesis Logic Synthesis (for large circuits) through VLSI Design.

CO4: Able to analyze Hardware Verification and methodologies, Binary Decision Diagrams (BDDs) and algorithms over BDDs through Verification Techniques.

CO5: Able to check Combinational equivalence checking, Temporal Logics, Modelling sequential systems and model checking, Symbolic model checking through Verification Techniques.

CO6: Able to locate Faultmodels, Fault Simulation, Test generation for combinational circuits, Test generation algorithms for sequential circuits and Built in Self test through VLSI Testing.

Pre-requisites: Digital Design, Algorithm

Course Objective: This course covers introduction to the concepts and techniques of VLSI (Very Large Scale Integration) design verification and testing. Details of test economy, faul tmodeling and simulation, defects, AutomaticTest Pattern Generation (ATPG), design for testability, and built-inself-test (BIST) also covered.

Module I: ASIC & FPGA

Introduction toApplication specific Integrated circuits (ASICs) &Classification of ASIC, Classification of ASIC in details (Full & Semi Custom ASIC), Classification of PLD in details & design of logic circuits using PLDs (PAL, PLA, PROM), Circuit realization using FPGA, Programming method of FPGA.

Module II: Physical Design Automation

Partitioning (K-L Algorithm). Floor Planning (Technology File, Circuit Description, Design, Constraints, Design Planning, Pad Placement, Power Planning, Macro Placement, Clock Planning).

Placement - Global & Detailed Placement (Min Cut Algorithm & Simulated Annealing). Routing-Special, Global & Detailed Routing (Wire length estimation algorithms).

Module III: Fault Modelling & simulation

Different types of Fault sin ASIC Design, Classification of Fault Models, Faults detection and Redundancy of Combinational & Sequential Circuits (Single and multiple Stuck at Fault model, Rauth's Algorithm or D-Algorithm), Fault Simulation: Serial, Parallel, Deductive & Concurrent Fault Simulation.

Module IV: Testing

Test Generation: Boundary Scan Test (BST), Built-In-Self-Test (BIST) technique, Automatic Test Pattern Generation (ATPG), Designfor Testability (DFT).

ASIC- Smith. Logic Synthesis and Verification Algorithm- Hachtel & Somenzi.

Physical Design Essentials Golshan

Test pattern generation for combinational circuits: Boolean difference, D-algorithm, Podem, etc, exhaustive, random, weighted test pattern generation, aliasing and its effects on fault coverage. [2]

Test pattern generation for sequential circuits: ad-hoc and structures techniques scan path and LSSD, boundary scan. [2]

Built-in self test techniques: Introduction to BIST architecture BIST Test Pattern Generation, Response Compaction and Response Analysis, Memory BIST MarchTest, BIST with MISR, Neighborhood Pattern Sensitive Fault Test, Transparent Memory BIST [3]

Books:

1. D. D. Gajski, N. D. Dutt, A.C.- H. Wu and S.Y.- L.Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition, 1992.
2. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.
3. G. De Micheli. Synthesis and optimization of digital circuits, 1st edition, 4. 1994.
4. M.Huth and M.Ryan, Logic in Computer Science modeling and reasoning about systems,Cambridge University Press, 2nd Edition, 2004.
5. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	3	3	3				2	2		2	2	3	2	2
CO.2	3	3	3	3			2		2	2	2	2	3	2	2
CO.3	3	3	3	3	1	2			2	3	3	2	3	2	1
CO.4	3	3	3	3			1		2		2	2	3	1	1
CO.5	3	3	3	3	2		1	2	2	1	3	2	2	2	2
CO..6	3	3	3	3	2	2			2			2	2	2	2

Paper Name: Soft Computing
Paper Code: EC803C
Contact Hours: 3L+1T
Credits: 4
Total Lecture: 38

Course Outcome:

CO1: Learn about soft computing techniques and their applications

CO2: Analyze various neural network architectures

CO3: Define the fuzzy systems

CO4: Understand the genetic algorithm concepts

CO5: Identifty asuitable soft computing technique to solve a problem

Module I:

Introduction to soft computing, neural network, Genetic Algorithm, fuzzy logic [2L]

Module II: Introduction to Neural Networks [14L]

Biological Neurons and Artificial neural network; model of neuron- activation function

Learning methods: Supervised, Unsupervised, Reinforcement learning, - Error Correction learning, Hebbian learning, Competitive learning networks, gradient descent learning, Regression, Active and Passive machine learning

Neural Network models: Mc Culloch-Pittsmodel, Feed forward & Feed back network, Perceptron, Adaline and Madaline networks; single layer network, multilayer networks. Back-propagation Network, Radial Basis function networks Logical AND, OR. Nonlinear separability: XOR problem, solving XOR.

Applications of Neural Networks: Pattern Recognition and classification

Module III: Fuzzy Logic [10L]

Fuzzy member ship functions, Operations on Fuzzy sets, Fuzzy relations, Fuzzy proposition, Fuzzy implications, Fuzzy Rule based Systems, Fuzzyinference system, Defuzzyfication Techniques

Applications of Fuzzy Logic:Application of Fuzzy logic in Home Appliances, General Fuzzy Logic controllers

Module IV: Genetic Algorithms: [10L]

Biological background, Encoding: Binary, Simple GA, Roulette wheel and Tournament selection, elitism, crossover and mutation

Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition

Module V: Other Soft Computing Techniques: [2L]

Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

Text Books:

1. S.N.Sivanandam, S.N.Deepa: Principles of Soft Computing, Wiley India
2. Simon Heykin: Neural Networks –A Comprehensive Foundation (2nd Edition), PHI
3. GeneticAlgorithmsinsearch,Optimization&MachineLearningbyDavidE.Goldberg,Pearson/PHI
4. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
5. ReferenceBooks:
6. Samir Roy, Udit Chakraborty: Soft Computing(Pearson)
7. S. Rajsekaran, G.A. Vijaylakshmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithm
8. Amit Konar: Artificial Intelligence and Soft Computing (CRC Press, Indian Edition Available)
9. J.S.Jang, C.T.Sun, E.Mizutani: Neuro-Fuzzy and Soft Computing (PHI)
10. Satish Kumar: Neural Networks–A Classroom Approach (McGraw Hill Ed.)
11. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J.Klir and BoYuan, Prentice Hall.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2							3	3	2	2
CO2	3	3	2	3	2	2					2	3	3	2	2
CO3	3	2	3	2	2							3	1	3	2
CO4	2	3	3	3	2			2				3	3	2	1
CO5	2	3	2	2	2							3	3	1	1

Paper Name: Advanced Communication Lab
Paper Code: EC891
Contact hour: 3P

Prerequisites: knowledge of fundamentals of Wireless and Mobile communication system

Course Objective:

To provide the basic skills required tounderstand, develop, and design various engineering applications involving a wireless communication system. To provide basic laboratory and software based development exposure to satellite communication principles, Mobile Communication systems and applications.

List of Experiments:

1. Studies on GSM: Understanding of GSM Technology Signal like its network, network commands: Modem Commands, Sim card hardware commands, Network registration commands, Phone book commands, Message handling commands.
2. Satellite Communication: To setup passive satellite communication link, and use different combinations of Uplink and Downlink frequencies to check the communication link
3. To setup passive satellite communication link to transmit and receive various wave forms from a function generator through a satellite link
4. Setup an experiment to generate a digitally modulated QPSK signal and measure the performance in a channel with AWGN noise.
5. Write a MATLAB code to study the QPSK performance subjected to Rayleigh fading and AWGN. Plot the SNR vs. BER graph.
6. Write a MATLAB code or SIMULINK model to generate a digitally modulated 16 QAM signal and measure its performance in a channel with AWGN noise
7. Setting up a fiber optic Data link and study of TDM.
8. Study of different routing protocols.
9. Write a MATLAB code to perform simulation of large scale path loss.
10. Write a MATLAB code to perform Simulation of small scale fading and multi-path (Any one
    model)
11. Simulation of DS spread spectrum transmitter and receiver
12. Simulation of channel equalizer for mobile channel

Course Outcome:

On completion of the course students will be able to

CO.1: Analyze the concept of Mobile, wireless and satellite communication techniques and their applications.

CO.2: Demonstrate practically the use of satellite communication, links etup and the frequencies used.

CO.3: Evaluate practically the modulation and demodulation techniques applied in communication signals.

CO.4: Analyze the performance of a communication system under the effect of noise and fading.

CO.5: Evaluate the various routing algorithms applied in the adhoc networks

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		1	3						1	3	2	3
CO2	3	3	3	1	1	3					3	3	3	2	3
CO3	3	3	2	1	1	3					3	1	3	2	3
CO4	3	3	3	1	3	3						3	3	2	3
CO5	3	3	2	2	1	3					2	3	3	1	3