B.E Electronics and Communication Engineering **2019-2020**

Semester-I

19BEEC101 **MATHEMATICS –I** **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with system of simultaneous linear differential equations with constant coefficients.
- To acquaint the student with system of simultaneous linear differential equations with constant coefficients.

Course Outcomes

- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.
- Gain knowledge in solving ordinary differential equations that model engineering problems.
- Discuss the change of variables in double and triple integrals.

UNIT I DIFFERENTIAL CALCULUS

Representation of functions, New functions from old functions, Limit of a function, Limits at infinity, Continuity , Derivatives, Differentiation rules, Polar coordinate system , Differentiation in polar coordinates, Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives, Homogeneous functions and Euler's theorem, Total derivative, Differentiation of implicit functions, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Errors and approximations, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS

Definite and Indefinite integrals, Substitution rule, Techniques of Integration, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions, Improper integrals.

UNIT IV MULTIPLE INTEGRALS

Double integrals, Change of order of integration, Double integrals in polar coordinates, Area enclosed by plane curves, Triple integrals , Volume of solids, Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS

Method of variation of parameters, Method of undetermined coefficients, Homogenous equation of Euler's and Legendre's type, System of simultaneous linear differential equations with constant coefficients.

Suggested Readings

1. Hemamalini. P.T, (2014&2017),Engineering Mathematics, McGraw Hill Education (India) Private, Limited, New Delhi.
2. James Stewart, (2008), Calculus with Early Transcendental Functions, Cengage Learning.
3. Narayanan S. and Manicavachagom Pillai T. K., (2007), Calculus Volume I and II, S. Viswanathan Publishers Pvt. Ltd.
4. Erwin kreyszig, (2014), Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.
5. B.S. Grewal, (2014) Higher Engineering Mathematics, 43rd Edition, Khanna Publisher.
6. Ramana B.V, (2010), Higher Engineering Mathematics, 11th Reprint,., Tata McGraw Hill New Delhi.
7. Jain R.K. and Iyengar S.R.K, (2007), Advanced Engineering Mathematics , 3rd Edition, Narosa Publications.
8. Bali N., Goyal M. and Watkins C, (2009), Advanced Engineering Mathematics, 7th Edition, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd).
9. Greenberg M.D., 5th Reprint, (2009). Advanced Engineering Mathematics, 2nd Edition,5th Reprint Pearson Education.
10. O'Neil, P.V, (2007), Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd..

B.E Electronics and Communication Engineering		2019-2020
		Semester-I
19BEEC142	Semi-Conductor Physics (Theory & Lab.)	4H-5C

Instruction Hours/week: L:3 T:1 P:3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

- To introduce students the physics of semiconductors and the inner working of semiconductor devices.
- Provide students the insight useful for understanding new semiconductor devices and technologies.
- To familiarize the students with carrier generation, recombination and transport in semiconductors.
- To divulge in basics of quantum mechanics theories
- To learn the concept of low-dimensional systems with practical examples
- To study Optical loss and gain.

Course Outcomes

- Students will be able to demonstrate a knowledge and broad understanding of Semiconductor Physics
- The students will have the knowledge on the basic theory and operation of semiconductor devices used for integrated circuit applications.
- Gain good knowledge in equilibrium carrier statistics.
- Understand the concept of low-dimensional systems with practical examples.
- Discuss the various electronic materials with its characteristics.
- Acquire the knowledge optical transitions in bulk semiconductors.

UNIT I QUANTUM MECHANICS

Introduction to quantum theory – Black body radiation - dual nature of matter and radiation – de Broglie wavelength, uncertainty principle –Schrödinger's wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, scanning electron microscope.

UNIT II ELECTRONIC MATERIALS

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

UNIT III SEMICONDUCTORS

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky).

UNIT IV LIGHT-SEMICONDUCTOR INTERACTION

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model, LED, Solar cell, photo diode.

UNIT V ENGINEERED SEMICONDUCTOR MATERIALS

Density of states in 2D, 1d and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, methods of fabrication (CVD,PVD) and characterization techniques.

Suggested Readings

1. Ganesan.S and Baskar.T(2015), Engineering Physics I, GEMS Publisher, Coimbatore-641001
2. J. Singh, (1995), Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
3. B. E. A. Saleh and M. C. Teich,(2007), Fundamentals of Photonics, John Wiley & Sons, Inc.,
4. S. M. Sze, (2008), Semiconductor Devices: Physics and Technology, Wiley.
5. Yariv and P. Yeh,(2007), Photonics: Optical Electronics in Modern Communications.
6. Oxford University Press, New York.
7. P. Bhattacharya,(1997), Semiconductor Optoelectronic Devices, Prentice Hall of India.

(ii) Laboratory

Course Objectives

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
- To study the concept of semiconductor and conductivity.
- To learn the properties of materials.
- To familiarize the students with uniform and nonuniform bending.
- To analyze and understand the viscosity of liquids by Poiseuille's flow.
- To imparts a good knowledge about numerical aperture and acceptance angle.

Course Outcome

- Familiarize the properties of material and basic concepts in physics.
- Understand the concept of uniform and nonuniform bending.
- Gain good knowledge in thermo e.m.f of a thermocouple.
- Gain good knowledge about ultrasonic interferometer.
- Clear idea about the wave length of the laser using grating.
- Understand the concept thermal conductivity of a bad conductor.

List of Experiments – Physics

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. Optical fibre -Determination of Numerical Aperture and acceptance angle
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Determination of Band gap of a semiconductor.
11. Spectrometer- Determination of wavelength using grating.
12. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

Semester-I

19BEEC103 **ENGLISH** **4H-3C**

Instruction Hours/week: L:2T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:5Hours

Course Objectives

- To enable students to attain fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
- To help students acquire their ability to speak effectively in real life situations.
- To inculcate the habit of reading and to develop their effective reading skills.
- To ensure that students use dictionary to improve their active and passive vocabulary.
- To enable students to improve their lexical, grammatical and communicative competence.
- Develop their intellectual, personal and professional abilities.

Course Outcomes

Students undergoing this course will be able to

- Use English language for communication: verbal & non –verbal.
- Enrich comprehension and acquisition of speaking & writing ability.
- Gain confidence in using English language in real life situations.
- Improve word power: lexical, grammatical and communication competence.
- Understand the descriptions of the specific **knowledge**, skills, or expertise that the learner will get from a learning activity.
- Able to compose freely and independently in speech and writing.

UNIT I BASIC WRITING SKILLS

Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents - Techniques for writing precisely

UNITII VOCABULARY BUILDING

The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance, with prefixes and suffixes from foreign languages in English to form derivatives. - Synonyms, antonyms, and standard abbreviations.

UNIT III GRAMMAR AND USAGE

Subject-verb agreement - Noun-pronoun agreement - Misplaced modifiers – Articles – Prepositions – Redundancies – Clichés

UNIT IV LISTENING AND READING SKILLS

Note taking- viewing model interviews – listening to informal conversations – improving listening / reading comprehension – reading model prose / poems – reading exercise

UNIT V WRITING PRACTICES

Comprehension - Précis Writing - Essay Writing Listening Comprehension - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods/ per each unit.

Suggested Readings

1. Sangeeta Sharma , Meenakshi Raman, (2015),Technical Communication: Principles And Practice, 2nd Edition, OUP, New Delhi.
2. Sanjay Kumar and PushpLata, (2011), Communication Skills ,Oxford University Press.
3. Liz Hamp - Lyons and Ben Heasly, (2006), Study Writing, Cambridge University Press.
4. F.T. Wood., (2007), Remedial English Grammar, Macmillan.
5. Michael Swan, (1995), Practical English Usage, OUP.

Semester-I

19BEEC144 **PROGRAMMING FOR PROBLEM SOLVING** **7H-5C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

- Identify and understand the working of key components of a computer program.
- Identify and understand the various kinds of keywords and different data types of C programming
- Understand, analyze and implement software development tools like algorithm,
- pseudo codes and programming structure
- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in "C" language
- To learn about arrays, pointers and structures to formulate algorithms and programs

Course Outcomes

The course will enable the students

- To formulate simple algorithms for arithmetic and logical problems
- To translate the algorithms to programs (in C language)
- To test and execute the programs and correct syntax and logical errors
- To implement conditional branching, iteration and recursion
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach
- To use arrays, pointers and structures to formulate algorithms and programs
  To apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

UNIT I INTRODUCTION TO PROGRAMMING

Introduction to components of a computer system disks, memory, processor, where a program is stored and executed, operating system, compilers - Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables with data types variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT II ARITHMETIC EXPRESSIONS, PRECEDENCE, CONDITIONAL BRANCHING AND LOOPS

[Arithmetic expressions and precedence – Conditional Branching- Loops-Writing and evaluation of conditionals and consequent branching-Iteration and loops.

UNIT III ARRAY AND BASIC ALGORITHMS

Arrays-Arrays1-D, 2-D,Character arrays and Strings, Searching, Basic Sorting Algorithms-Bubble Insertion and Selection sorting, Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT IV FUNCTION AND RECURSION

Functions including using built in libraries Parameter passing in functions, call by value, Passing arrays to functions :idea of call by reference, **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function. Quick sort or Merge sort.

UNIT V - STRUCTURE, POINTERS AND FILE HANDLING

Structures, Defining structures and Array of Structures,**Pointers:** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling.

Suggested Readings

1. E. Balagurusamy, (2017) Computing Fundamentals and C Programming, TMH Education, 5th Edition,
2. E. Balaguruswamy, (2017). Programmingin ANSI C, TataMcGraw-Hill, 7th Edition,
3. Byron Gottfried, Schaum's (2017) Outline of Programming with C, McGraw-Hill, 3rd Edition,
4. Brian W. Kernighan and Dennis M. Ritchie, (2015).The C Programming Language, Prentice Hall of India, 2nd Edition,

(ii) Laboratory

Course Objectives

- To provide an awareness to Computing and C Programming
- To know the correct and efficient ways of solving problems
- To learn to develop algorithm for simple problem solving.
- To divulge the basics of analysis of 2D arrays , strings and memory structure.
- To make the students familiar with numerical method problems.
- To learn about the recursive functions.

Course outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use the mind defining self- referential structures.
- To be able to create, read and write to and from simple text files.

List of Experiments

Tutorial 1: Problem solving using computers:
Lab 1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5:1DArrays: searching, sorting:
Lab 5:1DArray manipulation
Tutorial 6:2D arrays and Strings, memory structure:
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8and 9: Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls:
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Semester-I

19BEEC155 **YOGA** **1H-0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- Yoga education helps to develop the self discipline, self control, awareness, concentration and higher level of consciousness.
- Respect for life, protection of nature and the environment
- A peaceful state of mind
- Full vegetarian diet
- Pure thoughts and positive lifestyle
- Physical, mental and spiritual practices

Course Outcome

- To enable the student to have physical health and mental health.
- Demonstrate the ability to create and present various yoga activities.
- Demonstrate basic skills associated with yoga activities including strength and flexibility, balance and coordination
- Asanas enhance muscle strength, coordination, flexibility, agility and range of motion.
- Yoga improves posture, increases the intake of oxygen and enhances the functioning of all body systems like respiratory, digestive, endocrine, reproductive, excretory systems etc..
- Practicing Yoga ultimately leads towards long-term health and well-being.

UNIT I

Introduction To Yoga- Meaning Of Yoga – Concept Of Yoga- Aim And Objectives Of Yoga –History Of Yoga - Systems Of Yoga.- Stages (Or) Limbs Of Yoga

UNIT II

Asanas-Surya Namashkar- Thdasana- Veerabadhra Asana- Trikonasana- Utkatasana- Ardha Chakrasana- Ardha Kati Chakrasana- Thandasana- Gomugasana- Padmasana- Vajrasana- Paschimottasana- Matsyendrasana-Bavana Mukthasana- Supta Padhangusthasana-Sethubhandhasana- Navasana- Ardha Bavanamukthasana- Mathasyasana- Naukasana- Bujangasana- Salabasana- Makkarasana-Dhanurasana.

UNIT III

Advance Asanas- Sirasasana- Garudasana- Natrajasana- Rajakoptasana- Chakrasana- Kukutasana- Virikshasana- Sarvagasana- Halasana-.Mayurasana .

UNIT IV

Pranayama- Meaning- Types Of Pranayama- Bhastrika- Bhramari- Udgeeth- Kabalbhati- Bahya- Anulom Vilom- Pranay Pranayama- Benefits Of Pranayama. Neti - Jala Neti , Sutra Neti, Nouli-Three Types, Douthy-Three Types

UNIT V

Mudras- Uses Of Mudras- Gyan- Shoonya- Apaan- Prana- Vayu- Prithvi- Linga- Apana- Adi Mudra- - Agni Mudra- Surya Mudra- Varuna- Hakini Mudra.

Suggested Readings

1. Dr.K.Chandrasekaran(2009), Sound health through yoga,Prem Kalyan
2. B.K.S.Iyangar(2013) , Light on pranayama ,CrossRoad Centuary
3. Thirumular Thirumandhiram((2016)),SriRamakrishna Math

19BEEC201 **MATHEMATICS – II** **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- To inculate the basics of grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- To learn the use of circular contour and semicircular contour with no pole on real axis.

Course Outcomes:

The students will learn:

- To Evaluate complex integrals using the Cauchy integral formula and the residue Theorem
- To Appreciate how complex methods can be used to prove some important theoretical results.
- To Evaluate line, surface and volume integrals in simple coordinate systems
- To Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- To Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
- To understand the laplace transform theorems and its applications.

UNIT I MATRICES

Eigen values and Eigenvectors of a real matrix, Characteristic equation, Properties of eigenvalues and eigenvectors, Cayley-Hamilton theorem, Diagonalization of matrices , Reduction of a quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms. Simple Problems using Scilab.

UNIT II VECTOR CALCULUS

Gradient and directional derivative, Divergence and Curl, Irrotational and Solenoidal vector fields, Line integral over a plane curve, Surface integral, Area of a curved surface, Volume integral, Green's, Gauss divergence and Stoke's theorems, Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION

Analytic functions, Necessary and sufficient conditions for analyticity, Properties, Harmonic conjugates, Construction of analytic function, Conformal mapping, Mapping by Functions w =z+c, cz, 1/z, z^2 , Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent's series, Singularities, Residues, Residue theorem, Application of residue theorem for evaluation of real integrals, Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS

Existence conditions, Transforms of elementary functions, Transform of unit step function and unit impulse function, Basic properties, Shifting theorems, Transforms of derivatives and integrals, Initial and final value theorems, Inverse transforms, Convolution theorem , Transform of periodic functions, Application to solution of linear ordinary differential equations with constant coefficients.

Suggested Readings

1. Hemamalini. P.T, (2014&2017) Engineering Mathematics, McGraw Hill Education (India) Private Limited, New Delhi.
2. Erwin kreyszig, (2014), Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.
3. B.S. Grewal, (2014), Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
4. Ramana B.V, (2010),Higher Engineering Mathematics, Tata McGraw Hill.
5. Glyn James, (2007), Advanced Modern Engineering Mathematics, Pearson Education.
6. Jain R.K. and Iyengar S.R.K, (2007), Advanced Engineering Mathematics , 3rd Edition, Narosa Publications.
7. Bali N., Goyal M. and Watkins C, (2009), Advanced Engineering Mathematics, 7th Edition, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd).
8. O'Neil, P.V, (2007), Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd.

Semester-II

19BEEC242 **Chemistry – I** **7H-6C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Concepts in chemistry for engineering

Course Objectives

- To understand the terminologies of atomic and molecular structure
- To study the basics of Periodic properties, Intermolecular forces
- To study about spectroscopic technique
- To understand the thermodynamic functions
- To comprehend the basic organic chemistry and to synthesis simple drug.
- To divulge in fluorescence and its applications in medicine.

Course Outcomes

- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electro negativity.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalize bulk properties and processes using thermodynamic considerations.
- List major chemical reactions that are used in the synthesis of molecules.
- Understand the concept of synthesis of a commonly used drug molecule.

UNIT I ATOMIC AND MOLECULAR STRUCTURE

Schrodinger equation. Particle in a box solutions and their applications. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene and aromaticity.Introduction to Crystal field theory.

UNIT II PERIODIC PROPERTIES, INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_2F and HCN and trajectories on these surfaces.

UNIT III SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Spectroscopy (Principles and Instrumentation only).Electronic spectroscopy. Vibrational and rotational spectroscopy. Applications. Surface characterization techniques. Diffraction and scattering. Fluorescence and its applications in medicine.

UNIT IV USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT V ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Readings

1. B. H. Mahan, (2010).University chemistry, Pearson Education,
2. M. J. Sienko and R. A. Plane, Chemistry: Principles and Applications.
3. C. N. Banwell, (1994).Fundamentals of Molecular Spectroscopy, McGraw-Hill,
4. B. L. Tembe,.Kamaluddin and M. S. Krishnan(2009), Engineering Chemistry (NPTEL Webbook)
5. P. W. Atkins, Physical Chemistry, Oxford University Press,
6. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman,
7. P C Jain & Monica Jain, (2015), Engineering Chemistry, Dhanpat Rai Publishing Company,

(ii) Chemistry Laboratory

Course Objective

- To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.
- To learn synthesize a small drug molecule and analyze a salt
- To familiarize the students molecular/system properties such as surface tension, viscosity, conductance of solution.
- To divulge the basics of analysis of pH metry.
- To make the students familiar with rate constant of a reaction.
- To learn about the chloride content of a reaction.

Course Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of

solutions, redox potentials, chloride content of water, etc

- Synthesize a small drug molecule and analyze a salt .
- Gain good knowledge about thin layer chromatography.
- Clear idea about adsorption of acetic acid by charcoal.

Choice of 10 experiments from the following

1. Determination of surface tension and viscosity
2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure using volumetric titration
3. Determination of Ca / Mg using complexometric titration
4. Thin layer chromatography
5. Determination of chloride content of water
6. Determination of the rate constant of a reaction
7. Conductometry - Determination of cell constant and conductance of solutions
8. pH Metry – Determination of Acid / Base
9. Potentiometry - determination of redox potentials and emfs
10. Saponification/acid value of an oil
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

19BEEC243 **Basic Electrical Engineering 6H-5C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

- To impart the basic knowledge about the Electric circuits.
- To understand the working of Electrical Machines and Transformers.
- To understand the working of Power Converters and components of low-voltage electrical installations.
- To divulge the basics of analysis of simple circuits with dc excitation
- To make the students familiar with construction and working of various electrical machines.
- To learn the voltage and current relations in star and delta connections.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low-voltage electrical installations
- Gain good knowledge in batteries and their important characteristics.
- Clear idea about the components of LT Switchgear.
- Understand the concept Single-phase and three-phase voltage source inverters.

UNIT I DC CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II AC CIRCUITS

Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT IV TRANSFORMERS AND POWER CONVERTERS

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. Overviews of DC-DC buck and boost converters, duty ratio control. Introduction to Single-phase and three-phase voltage source inverters.

UNIT V ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings

1. D. P. Kothari and I. J. Nagrath, (2010), Basic Electrical Engineering, Tata McGraw Hill.
2. D. C. Kulshreshtha, (2009), Basic Electrical Engineering, McGraw Hill.
3. L. S. Bobrow, (2011),Fundamentals of Electrical Engineering, Oxford University Press.
4. E. Hughes, (2010), Electrical and Electronics Technology, Pearson.
5. V. D. Toro, (1989), Electrical Engineering Fundamentals, Prentice Hall India.

(ii) Laboratory

Course Objectives

- To impart the basic knowledge about the Electric circuits.
- To understand the working of Electrical Machines and Transformers.
- To understand the working of speed control of DC shunt motor
- To understand the working of single phase energy meter.

- To divulge the basics of electrical quantities.
- To learn about the Ohms law and Kirchoff's law.

Course Outcomes

At the end of this course, students will demonstrate the ability

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To understand and analyze basic Ohms law and Kirchoff's law
- To study the working principle single phase transformer.
- To introduce the fundamentals of electrical quantities.
- Gain good knowledge about single phase energy meter.

List of Experiments

1. Experimental verification of electrical circuit problems using Ohms law and Kirchoff's law.
2. Measurement of electrical quantities – voltage, current, power & power factor in R load.
3. Speed control of DC shunt motor

4. Draw the equivalent circuit of single phase Transformer by conducting OC &SC Test.
5. Measurement of energy using single phase energy meter.

Suggested Readings

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

19BEEC204 **ENVIRONMENTAL STUDIES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To create the awareness about environmental problems among people.
- To develop an attitude of concern for the environment.
- To motivate public to participate in environment protection and improvement.
- Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

Course Outcomes

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources -Deforestation: Causes and impacts

due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III BIODIVERSITY AND ITS CONSERVATION

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels).Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Case studies.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

Concept of sustainability and sustainable development. Water conservation -Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act).International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).Human population growth: Impacts on environment, human health and welfare.

Suggested Readings

1. Anonymous. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
2. AnubhaKaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Daniel, B. Botkin., and Edward, A. Keller. 1995. Environmental Science John Wiley and Sons, Inc., New York.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S.Chand& CompanyPvt. Ltd., New Delhi.
6. Odum,E.P., Odum, H.T. and Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

7. Rajagopalan, R. 2016.Environmental Studies: From Crisis to Cure, Oxford University Press**.**

8. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
9. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources.Daya Publishing House, New Delhi.
10. Tripathy. S.N.,andSunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
11. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology).S.Chand and Company Ltd, New Delhi.
12. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

Semester-II

19BEEC215 WORKSHOP / MANUFACTURING PRACTICES LABORATORY **5H-3C**

Instruction Hours/week: L:1 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To prepare the students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice
- Prepare the student for future Engineering positions.
- To divulge the basics of metal casting.
- To make the students familiar with welding and brazing.
- To learn about the CNC machining.

Course Outcomes

- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
- Students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.
- Gain good knowledge of various manufacturing methods.
- Clear idea about fitting operations and its power tools.

i) Lectures & videos: (10 PERIODS)

Detailed contents

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

ii) Workshop Practice: (60 PERIODS)

1. Machine shop (10 Periods)
2. Fitting shop (8 Periods)
3. Carpentry (6 Periods)
4. Electrical & Electronics(8 Periods)
5. Welding shop (8 hours (Arc welding 4 Periods + gas welding 4 Periods)
6. Casting (8 Periods)
7. Smithy (6 Periods)
8. Plastic moulding & Glass Cutting (3 Periods)
9. Plumbing Exercises (3 Periods)

Suggested Readings

1. Jeyachandran, K. and Balasubramanian, S, (2007), A Premier on Engineering Practices Laboratory, Anuradha Publications, Kumbakonam.
2. Jeyapoovan, T., Saravanapandian, M, (2006) Engineering Practices Lab Manual, Vikas Puplishing House Pvt. Ltd, Chennai.
3. Bawa, H.S, (2007), Workshop Practice, Tata McGraw – Hill Publishing Company Limited, New Delhi.
4. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K, (200&2010), Elements of Workshop Technology", Vol. I and Vol. II, Media promoters and publishers private limited.
5. Gowri P. Hariharan and A. Suresh Babu, (2008), Manufacturing Technology – I, Pearson Education.
6. Kalpakjian S. And Steven S. Schmid, (2002), Manufacturing Engineering and Technology, Pearson Education India Edition.
7. Roy A. Lindberg, (1998), Processes and Materials of Manufacture, Prentice Hall India.
8. Rao P.N., (2017), Manufacturing Technology, Vol. I and Vol. II, Tata McGrawHill House.

Semester-II

19BEEC216 ENGINEERING GRAPHICS AND DESIGN 5H-3C

Instruction Hours/week: L:1 T:0P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To prepare the students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions

Course Outcomes

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design and engineering graphics standards
- Exposure to solid modeling ,computer-aided geometric design , creating working drawings and engineering communication.
- Understand the conventions and the method of engineering drawing.
- Interpret engineering drawings using fundamental technical mathematics.
- To improve their visualization skills so that they can apply these skill in developing new products.

UNIT I INTRODUCTION

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Conic sections including the Ellipse, Parabola and Hyperbola (eccentricity method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales

UNIT II ORTHOGRAPHIC PROJECTIONS

Principles of Orthographic Projections- Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projections of Points and lines located in the first quadrant inclined to both planes - Determination of true lengths and true inclinations; Projection of polygonal surface and circular lamina inclined to both reference planes

UNIT IV PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V ISOMETRIC PROJECTIONS & COMPUTER GRAPHICS

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa. Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, Introduction to 3D modeling packages

Suggested Readings

1. Venugopal K and Prabhu Raja V, (2010),Engineering Graphics, New Age International Publishers.
2. C M Agrawal and Basant Agrawal, (2012), Engineering Graphics, Tata McGraw Hill, New Delhi.
3. James D. Bethune, (2015),Engineering Graphics with AutoCAD, Pearson Education.
4. Narayana, K.L. & P Kannaiah, (2008), a Text book on Engineering Drawing, Scitech Publishers.
5. Bureau of Indian Standards, (2003),Engineering Drawing Practices for Schools and Colleges SP 46, BIS, New Delhi.
6. Shah, M.B. & Rana B.C., (2008), Engineering Drawing and Computer Graphics, Pearson Education.
7. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House.

Semester-III

19BEEC301 LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.
- To divulge the basics of fourier series and their respective engineering fields

Course Outcomes

Upon successful completion of the course, students should be able to:

- Analysis of the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Illustrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their expertise by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Gain the capability to solve various types of partial differential equations.
- Ability to clarify engineering problems using Fourier series.
- Able to apply the fundamental concepts in their respective engineering fields

UNIT I VECTOR SPACES

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III INNER PRODUCT SPACES

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange‘s linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Dirichlet‘s conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

Suggested Readings

1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra‖, Prentice Hall of India, New Delhi, 2004.
3. Burden, R.L. and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
4. James, G. ―Advanced Modern Engineering Mathematics‖, Pearson Education, 2007.
5. Kolman, B. Hill, D.R., ―Introductory Linear Algebra‖, Pearson Education, New Delhi, First Reprint, 2009.
6. Kumaresan, S., ―Linear Algebra – A Geometric Approach‖, Prentice – Hall of India, New Delhi, Reprint, 2010.
7. Lay, D.C., ―Linear Algebra and its Applications‖, 5th Edition, Pearson Education, 2015.
8. O‘Neil, P.V., ―Advanced Engineering Mathematics‖, Cengage Learning, 2007.
9. Strang, G., ―Linear Algebra and its applications‖, Thomson (Brooks/Cole), New Delhi, 2005.
10. Sundarapandian, V. ―Numerical Linear Algebra‖, Prentice Hall of India, New Delhi, 2008.

Semester-III

19BEEC302 **ELECTRONIC DEVICES** **3H-3C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand the working of Semiconductor PN junction
- To familiarize the working of special purpose diodes
- To study the working principle of Bipolar Transistors (BJT)
- To impart knowledge on working of Field Effect Transistor (FET)
- To provide the knowledge about the fabrication process of monolithic Integrated Circuits (IC)
- To expose the students about the construction working and applications of basic electronic devices essential for subsequent courses on Analog electronics, Analog & digital communication and CMOS design.

Course outcomes

At the end of this course students will demonstrate the ability to

- Demonstrate the principle of semiconductor physics
- Understand and utilize the mathematical models of semiconductor
- Gain knowledge on construction and applications of Diodes
- Understand MOS transistors for circuits and systems
- Gain knowledge on Construction and working of Field effect Transistors
- List the steps involved in IC fabrication process.

UNIT I INTRODUCTION TO SEMICONDUCTOR PHYSICS

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors

UNIT II SEMICONDUCTOR DIODES

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode, LED, photodiode and solar cell

UNIT III BIPOLAR TRANSISTORS

Bipolar Junction Transistor- Construction – working, I-V characteristics, transistor configurations and input- output characteristics, Early effect (base width modulation) – Ebers-Moll Model, transistor as an amplifier –Transistor as a switch.

UNIT IV FIELD EFFECT TRANSISTORS

Field-Effect Transistors: construction, working and VI characteristics of JFET, MOSFET – enhancement MOSFET, depletion MOSFET, their working principle and VI characteristics, MOS capacitor, C-V characteristics, and small signal models of MOS transistor.

UNIT V IC FABRICATION

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Suggested Readings

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education 2003.
3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press,2010.
6. Salivahanan Electronic Devices and circuits Tata McGraw-Hill publishing company 2007

Semester-III

19BEEC303 **DIGITAL SYSTEM DESIGN** **3H-3C**

Instruction Hours/week: L: 3 T:0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To introduce basic postulates of Boolean algebra
- To simplify the Boolean expressions.
- To impart knowledge on combinational circuits.
- To design synchronous sequential circuits
- To introduce the concept of Very high speed integrated circuits Hardware Description programming Language.
- To imparts the knowledge of memory devices like FPGA

Course Outcomes

At the end of this course students will demonstrate the ability to

- Design and analyze combinational logic circuits
- Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
- Design & analyze synchronous sequential logic circuits
- Differentiate different logical families
- Gain knowledge about various memory devices and implement using PLDs
- Use HDL & appropriate EDA tools for digital logic design and simulation

UNIT I BOOLEAN ALGEBRA

Number system, Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De-Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT II COMBINATIONAL CIRCUITS

Logic gates, AND & NOR implementation, MSI devices - Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

UNIT III SEQUENTIAL LOGIC DESIGN

D,S-R, JK FF and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudorandom Binary Sequence generator, Clock generation

UNIT IV LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

UNIT V INTRODUCTION TO VHDL

VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation
VHDL constructs and codes for combinational and sequential circuits.

Suggested Readings

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition ,2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 2004
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

Semester-III

19BEEC304 **C++ & DATA STRUCTURES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To develop programming skill and to solve engineering related problems using C++
- Object Oriented Programming (OOP) and Data Structure Concept.
- Ability to work with arrays and structures.
- To introduce the concepts of Abstract data Type, data structure, performance measurement, time and space complexities of algorithms.
- To discuss the implementation linear data structures such as stacks, queues and lists and their applications.
- To discuss the implementation of different non linear data structures such as trees and graphs.

Course Outcomes

- Gain confidence to use a simple Java programming environment, compile programs and interpret compiler errors.
- Capable to understand and use the fundamental data types.
- Design classes and organize them into packages.
- Perceptive of the basic data structures.
- Understand the basic search and sort algorithms.
- Cultivate the knowledge to use a particular data structure and algorithm to solve a problem

UNIT I OBJECTS ORIENTED PROGRAMMING

Objects and classes – methods, messages, encapsulation, abstraction, inheritance, polymorphism, dynamic building. Traditional approach Versus object orientation; benefits of object orientation – flexibility in software development – reusability – extensibility – maintainability.

UNIT II OBJECTS AND CLASSES

Specifying classes – using – C++ objects and data types – constructors and destructors – object as function arguments – structures and classes. Array fundamentals – array as class member data – array of objects. Structures – simple structure – accessing structure member – structure within structure – structure and classes – Function overloading – Inline function – Virtual function and polymorphism.

UNIT III OPERATOR OVERLOADING

Overloading unary operator – overloading binary operator – data conversion. Inheritance – derived class and base class – derived class constructors – public and private inheritance – level of inheritance. C++ graphics – text – mode graphics functions – graphics – mode graphics functions – colors – rectangles

and lines – polygons and inheritance – text in graphics mode – Addresses and pointers, Simple file operations: streams – string I/O – character I/O.

UNIT IV INTRODUCTION TO DATA STRUCTURES

Abstract data types – Arrays – Static, Dynamic and Generic arrays. Strings – Fixed and variable size – static and dynamic strings.

UNIT V LINKED LISTS

Dynamic storage management – singly and doubly linked list – Stack – Application of stack – Fixed, variable and Generic stack – queues – queue based on Dynamic linked list – Trees – Binary Trees – Graphs – Warshall's Algorithms – Shortest paths.

Suggested Readings

1. Herbert Schildt "Java: The Complete Reference", 9th Edition, Mcgraw-Hill, 2014.
2. D.T. Editorial Services ,"Java 8 Programming: Black Book",Dreamtech Press, 2015.
3. Mark Allen Weiss, " Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition,2011.
4. Aho Hopcroft and Ullman, " Data Structures and Algorithms, Pearson Education, 4th Edition,2009
5. Gay S. Horstmann and Gary Cornel, "Core Java: Volume I – Fundamentals", 8th Edition, Sun Microsystems Press, 2011
6. Timothy Budd "Understanding Object-oriented programming with Java" Pearson Education,2nd edition, 2006
7. Herbert Schildt, "Java The Complete Reference", Oracle Press, 8th edition, 2011
8. Richard.F., Gilberg A, Behrouz A., Forouzan, "Data Structures- A Pseudocode Approach with C", Thomson Brooks, 2nd Edition,2008

2019-2020

B.E Electronics and Communication Engineering

Semester-III

19BEEC305 SIGNALS AND SYSTEMS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To understand Linear Shift-Invariant Systems and its properties
- To understand signal types, properties and analysis
- To learn the concepts of Fourier Transform in signal analysis.
- To study Laplace Transform
- To familiarize with Z Transform and its application on signals
- To get familiarize of sampling of signals

Course Outcomes

At the end of this course students will demonstrate the ability to

- Analyze different types of signals
- Represent continuous and discrete systems in time and frequency domain using different transforms
- Apply Fourier series and Transforms on signals
- Investigate whether the system is stable
- Sample and reconstruct a signal
- Apply Laplace and Z Transforms on signals

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

UNIT II LTI SYSTEMS AND ANALYSIS

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations and difference equations.

UNIT III FOURIER SERIES AND FOURIER TRANSFORM

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation tothe impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases,

UNIT IV LAPLACE TRANSFORM ANALYSIS

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

UNIT V Z TRANFORM AND SAMPLING

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis. State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

Suggested Readings

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

Semester-III

19BEEC306 **NETWORK THEORY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce various laws for DC circuit analysis
- To understand various network theorems for DC circuits
- To be familiar with Tallegen's theorem for AC circuits
- To study the transient behavior of RL,RC and RLC circuits using initial and final conditions
- To make them aware of various network parameters in two port networkTo make the students capable of analyzing any given electrical network.
- To make the students to learn synthesis of an electrical network for a given impedance/ admittance function

Course Outcomes

At the end of this course students will demonstrate the ability to

- Understand basics electrical circuits with nodal and mesh analysis.
- Describe electrical network theorems.
- Apply Fourier series on networks
- Interpret Laplace Transform for steady state and transient analysis.
- Resolve different network functions.
- Understand the frequency domain techniques.

UNIT I DC CIRCUIT ANALYSIS

Basic components and electric circuits – Charge – Current – Voltage and Power– Voltage and Current Sources – Ohms Law – Voltage and Current laws – Kirchoff's Current Law – Kirchoff's voltage law – The single Node – Pair Circuit – Series and Parallel Connected Independent Sources – Resistors in Series and Parallel – Voltage and Current division. Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances.

UNIT II NETWORK THEOREM AND DUALITY

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. Circuits, source transformation and duality.

UNIT III FOURIER SERIES AND STEADY STATE RESPONSE

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT IV LAPLACE TRANSFORMS AND RLC ANALYSIS

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT V TRANSIENT RESPONSE AND RESONANCE CIRCUITS

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Suggested Readings

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000.
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 2002.
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education 2018.

Semester-III

19BEEC311 C++ & DATA STRUCTURES LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Write programs that implement linear data structures such as stacks, queues and lists and their applications.
- Write programs that implement of different non linear data structures such as trees and graphs.
- Write programs to implement algorithms for searching using hash tables and binary search trees.
- Write programs to implement sorting algorithms such as selection, shell, merge, quick and heap sorts
- Analyze the given algorithms.
- Enable the motto write algorithms for solving problems with the help of fundamental data structures

Course Outcomes

- Understand the principles of OOP;
- Ability to demonstrate good object-oriented programming skills in Java
- Understand the capabilities and limitations of Java
- Distinguish the importance of structure and abstract data type, and their basic usability in different applications through different programming languages.
- Capability to analyze and differentiate different algorithms based on their time complexity.
- Demonstrate the linked implementation, and its uses both in linear and non-linear data structure.

List of Experiments

1. Implementation of List using Arrays
2. Implementation of Singly Linked List
3. Implementation of Linked Stack
4. Implementation of Linked Queue
5. Implementation of Insertion Sort
6. Implementation of Insertion operation in Binary Search Tree
7. Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.
8. Write a JAVA program to implement constructor.
9. Write a JAVA program to implement constructor overloading.
10. Write a JAVA program implement method overloading.
11. Write a JAVA program to implement Single Inheritance
12. Write a JAVA program to implement multi level Inheritance

Semester-III

19BEEC312 ELECTRONIC DEVICES LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn the characteristics of various basic electronic devices
- To understand the characteristics of various configuration of BJT
- To learn the simulation process using pSPICE and Multisim.
- To understand the characteristic of LED.
- To learn how to use software's for simulating characteristics of various circuits.
- To divulge the basics of rectifier circuits.

Course Outcomes

At the end of this course students will have the ability to

- Design various electronic circuits for various configurations and applications
- Design and simulate diverse circuits using simulation software
- Clear idea about the design of rectifiers.
- To divulge the basics of LED with three different wavelengths.
- To make the students familiar with construction series voltage regulator.
- To learn the photo-diode and phototransistor.

List of Experiments

1. Characteristics of PN junction and Zener diode.
2. Input, Output and Transfer characteristics of CE Configuration.
3. Input, Output and Transfer characteristics of CC Configuration.
4. Characteristics of LDR, Photo-diode and Phototransistor.
5. Transfer characteristics of JFET.
6. Transfer characteristics of MOSFET. (with depletion and enhancement mode)
7. Characteristics of LED with three different wavelengths.
8. Half wave rectifier, Full wave rectifier and Full wave Bridge rectifier with and without Capacitive filter.
9. Series voltage Regulator.
10. Simulation experiments1, 2,3,5,6 using PSPICE or Multisim.

Semester-III

19BEEC313 DIGITAL SYSTEM DESIGN LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To study various logic gates and flip-flops
- To study different combinational circuits
- To implement combinational function using multiplier
- To do simulation of simple combinational and sequential circuits
- To design synchronous sequential circuits.
- To simulate simple combinational and sequential circuits
- To learn about Encoders and Decoders design.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Design various combinational circuits for different application
- Implementation of combinational functions using LSI devices
- Construct counter circuits for different application
- Simulate a design using VHD/Verilog HDL
- Design a two bit magnitude comparator .
- Design and simulate encoder and decoder circuits.

List of Experiments

1. Study of Gates & Flip-flops.
2. Design and implementation of arbitrary functions and Code Converters using logic gates
3. Design and implementation of four bit adder/subtractor
4. Implementation of combinational logic function using multiplexers
5. Design and Implementation of Shift Registers.
6. Design and implementation Synchronous Counters.
7. Design and implementation Ripple Counter.
8. Simulation of combinational circuits using VHDL/Verilog
9. Simulation of sequential circuits using VHDL/Verilog
10. Design and implementation of Magnitude Comparator (2-Bit).
11. Design and implementation Encoders and Decoders.

Semester-III

19BEEC351 **PCB DESIGNING** **1H-0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn software used for PCB design
- To learn about the tools used in PCB.
- To create a net list for a design.
- To divulge the basics of OR-CAD PCB software.
- To make the students familiar with design verification.
- To learn the automatic routing and manual routing.

Course Outcome

- At the end of this course students will demonstrate the ability to simulate any circuit design using simulation software.
- Able to carry out any PCB design necessary for their graduation projects
- The course is intended to give the students the necessary knowledge and of PCB design steps, starting from a simple schematics, through creating new components, and all the way to down a final PCB layout ready for population.
- Gain good knowledge about PCB design .
- Clear idea about automatic routing and manual routing.
- Understand the basics tools used in PCB.

List of Experiments

1. Introduction to OR-CAD PCB
2. Installation and Setup
3. PCB Basics(Tools)
4. PCB Design Session
5. Automatic Routing
6. Manual Routing
7. Design Verification
8. Creation of Net list

Semester-IV

19BEEC401 **MATERIAL SCIENCES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- To impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- To divulge the basics of crystals, their structures and different crystal growth techniques.
- To make the students familiar in the fundamentals of ceramics, composites and nonmaterial's.
- To learn about crystal growth techniques and vapour growth techniques

Course Outcomes

Upon the successful completion of this course

- Students accumulate the knowledge on the basics of magnetic materials and its applications.
- Gain knowledge on the concepts of superconductivity, devices and their applications.
- Clarity on the concepts of dielectric properties of materials and their applications in engineering field
- Understand the basics of crystals, their structures and different crystal growth techniques.
- Clear idea of ceramics, composites and nanomaterials.
- Ability to apply the knowledge gained to solve problems in solid state physics using appropriate mathematical formulae.

UNIT I MAGNETIC MATERIALS

Origin of magnetic moment; Bohr magneton; comparison of Dia, Para and Ferro magnetism; Langevin theory of diamagnetism and paramagnetism; Quantum theory of paramagnetism; Curie-Weiss law; Temperature dependence of saturation magnetization; Domain theory; Hysteresis; soft and hard magnetic materials; antiferromagnetic materials; Ferrites and its applications; Magnetic storage devices principle; construction and working.

UNIT II SUPERCONDUCTING MATERIALS

Superconductivity, properties; Meissner effect; Type I and Type II superconductors; London equation; BCS theory of superconductivity(Qualitative), Flux quantization; High Tc superconductors; Josephson superconductor tunnelling, DC and AC Josephson effect; Applications of superconductors, SQUID, cryotron, magnetic levitation.

UNIT III DIELECTRIC MATERIALS

Electrical susceptibility, dielectric constant; electronic, ionic, orientational and space charge polarization; frequency and temperature dependence of polarisation; internal field;Clausius -Mossotti relation (derivation); dielectric loss; dielectric breakdown, uses of dielectric materials (capacitor and transformer); ferroelectricity and applications.

UNIT IV CRYSTAL PHYSICS

Lattice, Unit cell, Bravais lattice; Lattice planes; Miller indices; d spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number, Packing factor for SC, BCC, FCC and HCP structures; Diamond and graphite structures (qualitative treatment); Crystal imperfections; Crystal growth techniques; solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative).

UNIT V NEW MATERIALS

Ceramics; types and applications; composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics; metallic glasses: types , glass forming ability of alloys, melt spinning process, applications; shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications;nanomaterials: preparation (bottom up and top down approaches), properties and applications; carbon nanotubes: types.

Suggested Readings

1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. A. J. Dekker, Solid State Physics, Published by Macmillan India, 2000
3. William D CallisterJr, "Materials Science and Engineering – An Introduction", John Wiley and Sons Inc.,7th edition, New York, 2006
4. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
5. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
6. M. Arumugam, Materials Science. Anuradha publishers, 2010.

Semester-IV

19BEEC402 **ANALOG CIRCUITS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn various biasing arrangements for BJT and FET
- To know about various high frequency models for BJT
- To learn various feedback configurations
- To study Op-amp configurations with its applications
- Design simple circuits using OPAMPs
- Gain knowledge on Data converters

Course Outcomes

At the end of this course students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyze high frequency models
- Design sinusoidal and non-sinusoidal oscillators
- Understand the functioning of OP-AMP and design OP-AMP based circuits.
- Design ADC and DAC
- Gain good knowledge in various classes of operation of amplifiers.

UNIT I BIASING CIRCUITS AND SMALL SIGNAL MODELS

Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT II HIGH FREQUENCY MODELS

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

UNIT III FEEDBACK AND OSCILLATOR CIRCUITS

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Current

mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.

UNIT IV OP-AMP AND ITS APPLICATIONS

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OPAMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation. review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

UNIT V DATA CONVERTORS

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc. Analog-todigital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Suggested Readings

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press,1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11 Publishing, Edition IV
5. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

Semester-IV

19BEEC403 ANALOG AND DIGITAL COMMUNICATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand various noise and its characteristics.
- To study different analog modulation techniques
- To expose various digital modulation techniques
- To understand Pulse Code Modulation (PCM) techniques
- To provide knowledge on inter symbol interference and nyquist criterion.
- To learn about pass band digital modulation

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Analyze and tabulate different analog modulation schemes in terms of efficiency and bandwidth.
- Analyze the behavior of a communication system in the presence of noise.
- Analyze different digital modulation schemes and compute the bit error performance
- Investigate pulsed modulation system and analyze the system performance.
- Gain knowledge on base band pulse transmission concepts
- Understand the pass band modulation concepts

UNIT I ANALOG MODUL ATION SYSTEMS

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT II NOISE CHARACTERIZATION

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De emphasis, Threshold effect in angle modulation.

UNIT III DIGITAL MODUL ATION SYSTEMS

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

UNIT IV BASE BAND PULSE TRANSMISSION

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion.

UNIT V PASS BAND DIGITAL MODULATION

Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Suggested Readings

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley,1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

Semester-IV

19BEEC404 **MICROCONTROLLER** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study processor architecture and its programming
- To study advanced processor architecture
- To expose them to programming concepts
- To learn the concepts of Interfacing with Peripherals
- To understand the concepts of Reduced Instruction Set Computer (RISC) architecture
- To provide knowledge on Advanced RISC Machine (ARM) architecture

Course Outcomes

At the end of this course students will demonstrate the ability to

- Design ALP for different applications for 8085
- Write ALP for different applications for 8086
- Gain knowledge on advanced processors and controllers
- Interface memory and I/O device with controllers
- Gain knowledge about architectures of RISC and ARM processors
- Distinguish between advanced processors

UNIT I MICROPROCESSOR- 8085/8086

Introduction to 8085- Introduction to 8086 -Register Organization -Architecture-Signals- Memory Organization- Bus Operation-I/O Addressing-Minimum Mode-Maximum Mode-Timing Diagram- Interrupts - Service Routines – I/O and Memory Interfacing concepts.

UNIT II PROGRAMMING OF 8086

Instruction Format - Instruction set - Addressing Modes- -Assembly language programs in 8086, Strings, Procedures, Macros, Assembler Directives- Interrupts and Interrupt Applications.

UNIT III ADVANCED PROCESSOR AND MICROCONTROLLER

Advanced coprocessor Architectures- 286, 486, Pentium architecture -Architecture of 8051 microcontroller, Register Set - I/O and memory addressing- Interrupts- Instruction set- Addressing modes.

UNIT IV INTERFACING WITH PERIPHERALS

Timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design, Concepts of virtual memory, Cache memory

UNIT V INTRODUCTION TO RISC AND ARM

Introduction to RISC processors; RISC architecture – Review of ARMv7 core and its architecture, introduction to ARM Programming - register configuration and instruction set – sample program. ARM microcontrollers interface designs.

Suggested Readings

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 2002.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers 2018
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 2005.
4. Kenneth J. Ayala, The 8051 Microcontroller, Clifton Park, NY : Thomson Delmar Learning, 2005.
5. Jonathan W Valvano Introduction to Arm(r) Cortex-M Microcontrollers Createspace Independent Publisher 2012

Semester-IV

19BEEC405 ECONOMICS FOR ENGINEERS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

Course Objectives

- To enable students to understand the fundamental economic concepts applicable to engineering
- To learn the techniques of incorporating inflation factor in economic decision making
- To imparts good knowledge in various depreciation methods.
- To study material selection and design selection for a product
- To learn the replacement and maintenance analysis
- To familiarize the students with methods of comparison of alternatives.

Course Outcome

Upon successful completion of this course, students will acquire the skills

- To apply the basics of economics
- Gain knowledge on Value Engineering
- To do cost analysis to engineering
- To do replacement and Maintenance analysis
- Gain knowledge on Depreciation methods
- To take economically sound decisions.

UNIT I INTRODUCTION TO ECONOMICS

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

Suggested Readings

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
2. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
3. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
4. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
5. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

Semester-IV

19BEEC411 MICROCONTROLLER LABORATORY 2H-1C

Instruction Hours/week: L: 0 T: 0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce students to basic ALP in 8086
- To introduce practical training on interfacing peripheral devices with 8086 microprocessor
- To study basic programming on advanced controller
- To inculcate basic programming for ADC and DAC
- To enhance their practical knowledge on microcontroller programming.
- To imparts a good knowledge of Traffic Control Using MSP 430 controller/8051.

Course Outcomes

At the end of this course students will have the ability to

- Design applications like speed control using advanced controller.
- Write program on subroutine.
- Interface data converters with microcontrollers.
- Program advanced processors.
- Write program for design of simple system.
- Gain a good knowledge about interfacing with 8259 programmable interrupt controller.

List of Experiments

1. Programs for 8/16 bit Arithmetic operations (Using 8085 and 8086).
2. Programs for Sorting and Searching (Using 8086).
3. Programs for String manipulation operations (Using 8086).
4. Programs on Subroutines (Using 8051).
5. Interfacing ADC and DAC (Using MSP 430 Controllers/8051).
6. Interfacing with 8255.
7. Transfer data serially between two kits (8253/8251).
8. Interfacing with 8279.
9. Traffic Control Using MSP 430 controller/8051.
10. Interfacing with 8259 Programmable Interrupt Controller.
11. Interfacing and Programming of Stepper Motor and (8051).
12. Programming using Arithmetic, Logical & Bit Manipulation instructions of 8051 microcontroller.

Semester-IV

19BEEC412 **ANALOG CIRCUITS LABORATORY** **2H-1C**

Instruction Hours/week: L: 0 T: 0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study various feedback configurations
- To study various application of transistors
- To learn different RC and LC oscillators
- To study various application of Op-amps.
- To imparts a good knowledge about astable, monostable multivibrators and schmitt Trigger using op-amp.
- To familiarize with basics of instrumentation amplifier.

Course Outcomes

At the end of this course students will have the ability to

- Design various analogue circuits for various applications
- Design and simulate various circuits using simulation software
- Analyze the various linear application of op-amp
- Design filters to a given frequency
- Analyze multivibrator circuits using op-amp
- Construct an Instrumentation amplifier for a given gain

List of Experiments

1. Series and Shunt feedback amplifiers
2. Design of Wein bridge oscillator
3. Design of transistor RC phase shift oscillator
4. Design of LC–Hartley and Colpitt oscillator
5. Inverting, Non-inverting and differential amplifiers.
6. Integrator and Differentiator.
7. Astable, Monostable multivibrators and Schmitt Trigger using op-amp.
8. Instrumentation amplifier.
9. Active lowpass, highpass and Bandpass filter.
10. Design of ADC and DAC using discrete components
11. Simulation of Experiments1,2,3,4,5 using PSpice / MultiSim

Semester-IV

19BEEC413 ANALOG AND DIGITAL COMMUNICATION LABORATORY **2H-1C**

Instruction Hours/week: L: 0 T: 0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To design and verify the working of analog and digital communication circuits.
- To familiarize the students with pulse modulation and demodulation
- To design and verify analog and digital modulation using simulation sofwares.
- To study basics of Line Coding & Decoding
- To imparts a good knowledge multiplexing and demultiplexing.
- To familiarize with basics about ASK FSK PSK and design .

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Understand the working of analog modulation techniques.
- Knowledge on Multiplexing mechanisms
- Construct Pulse modulation and demodulation circuits
- Simulate analog and digital modulation using simulation softwares.
- Gain knowledge about line coding & decoding.
- Understand the delta modulation and demodulation.

List of Experiments

1. Signal Sampling and its reconstruction.
2. Time division multiplexing and Demultiplexing.
3. Pulse modulation and demodulation-PAM/PWM/PPM
4. Pulse code modulation & demodulation.
5. Line Coding & Decoding
6. Digital modulation & demodulation–ASK,PSK,FSK
7. Delta modulation and demodulation.
8. Software simulation of Signal Sampling and its reconstruction
9. Software simulation of AM,FM,PM
10. Software simulation of ASK,PSK,FSK

Semester-III

19BEEC451 CONSTITUTION OF INDIA 1H-0C

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.
- To inculate the students
- To imparts a good knowledge in judicial system in states
- To familiarize the student with constitutional Amendments and Functionaries.

Course Outcomes

Upon completion of the course, students will be able to

- Clarify on functions of the Central government.
- Define functions of the State government
- Explain the functions of Constitution
- Understand and abide the rules of the Indian constitution.
- Identify and appreciate different culture among the people.
- Gain knowledge on Indian Society

UNIT I INTRODUCTION

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Suggested Readings

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India, New Delhi
2. R.C.Agarwal, (1997).Indian Political System ,S.Chand and Company, New Delhi,
3. Maciver and Page, Society: An Introduction Analysis, Mac Milan India Ltd, New Delhi
4. K.L.Sharma(1997)., Social Stratification in India: Issues and Themes , Jawaharlal Nehru University, New Delhi,
5. Sharma, Brij Kishore,(2011)., Introduction to the Constitution of India, Prentice Hall of India, New Delhi,
6. U.R.Gahai, (1998).Indian Political System, New Academic Publishing House, New Delhi,.
7. R.N. Sharma, (1987).Indian Social Problems, Media Promoters and Publishers Pvt. Ltd, New Delhi,

Semester-V

19BEEC501 PROBABILITY AND RANDOM PROCESSES 4H-4C

Instruction Hours/week: L:3 T: 1 P:0 **Marks:** Internal**:40** External**: 60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.
- To inculate the basics of various random process.

Course Outcomes:

Upon successful completion of the course, students should be able to:

- Understand the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Expertise in basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Ability to apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
- Analyze the response of random inputs to linear time invariant systems.

UNIT I PROBABILITY AND RANDOM VARIABLES

Probability – Axioms of probability – Conditional probability – Baye‘s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES

Classification – Stationary process – Markov process - Markov chain - Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Suggested Readings

1. Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
4. Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
5. Miller. S.L. and Childers. D.G., ―Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.
6. Stark. H. and Woods. J.W., ―Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3rd Edition, 2002.
7. Yates. R.D. and Goodman. D.J., ―Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

Semester-V

19BEEC502 **COMPUTER ARCHITECTURE** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic structure and operation of digital computing systems
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To expose the students with different ways of I/O devices and standard
- To imparts a good knowledge in memory organization and memory management.
- To divulge the basic structure of microprogrammed computers.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Gain mastery about working principles of computers
- Analyze the performance of computers
- Design ALU
- Gain knowledge on Processing ,memory and other units of a computer.
- Know how computers are designed and built
- Understand issues affecting modern processors (caches, pipelines etc.)

UNIT I ARCHITECTURE OF COMPUTING SYSTEMS

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines. Processor organization, Information representation, number formats.

UNIT II ARITHMETIC UNIT

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation

UNIT III PROCESSING UNIT

Hard wired control-Design methods and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit

UNIT IV MEMORY SYSTEM

Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

UNIT V I/O ORGANIZATION

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces ,Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.

Suggested Readings

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J., Prentice Hall.
4. M.M.Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition

Semester-V

19BEEC503 **DIGITAL SIGNAL PROCESSING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce discrete Fourier transform and its applications.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To introduce signal processing concepts in systems having more than one sampling frequency.
- To study DSP architecture
- Understand fundamentals of Digital Signal Processing.
- Analyze & compare different signal processing strategies.
- Become aware of some applications of DSP

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete time and frequency domain
- Record the response of an LSI system to different signals
- Design FIR Filter
- Design IIR Filter
- Understand the effects of word length while designing filters
- Gain knowledge on architecture of DSP processors

UNIT I DISCRETE FOURIER TRANSFORM

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

UNIT II FIR FILTER DESIGN

Design of FIR Digital filters: Window method, Park-McClellan's method.

UNIT III IIR FILTER DESIGN

Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, High pass, Bandpass and Bandstop filters.

UNIT IV FINITE WORDLENGTH EFFECTS

Effect of finite register length in FIR filter design .Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP.

UNIT V DIGITAL SIGNAL PROCESSORS

Introduction to DSP architecture - Dedicated MAC unit - Multiple ALUs, Advanced addressing modes, Pipelining, Overview of instruction set of TMS320C5X and C54X.

Suggested Readings

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall,1992
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Semester-V

19BEEC504 **ELECTROMAGNETIC WAVES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic transmission line theory
- To introduce the concept of impedance matching
- To introduce wave propagation mechanism and polarization
- To study basics of waveguides and antennas
- To imparts a good knowledge in radiation parameters of antenna
- To familiarize with basic laws of Electromagnetics

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Understand characteristics and wave propagation on high frequency transmission lines
- Carryout impedance transformation on TL
- Utilization of transmission line sections for realizing circuit elements
- Characterize uniform plane wave
- Calculate reflection and transmission of waves at media interface
- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

UNIT I TRANSMISSION LINE THEORY

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss less and Low loss Transmission line, Power transfer on TX line,

UNIT II IMPEDANCE MATCHING IN HIGH FREQUENCY LINES

Impedance Matching, use transmission line sections as circuit, Smith Chart, Admittance Smith Chart, Applications of transmission lines elements.

UNIT III MAXWELL'S EQUATIONS

Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell'sEquations, Boundary conditions at Media Interface. Uniform Plane Wave- Uniform plane wave,

UNIT IV WAVE PROPAGATION AND ANTENNAS

Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

UNIT V WAVE GUIDES AND ANTENNAS

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

Suggested Readings

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Semester-V

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Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-V

19BEEC5E** **PROFESSIONAL ELECTIVE -I** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-V

19BEEC511 DIGITAL SIGNAL PROCESSING LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To implement the processing techniques using TMS320C5X
- To implement the IIR and FIR filter using MATLAB
- To familiarize with DSP system simulations.
- To study the knowledge about various addressing modes of DSP.
- To imparts a good knowledge sampling and effect of aliasing.
- To familiarize with fast fourier transform and its simulation using MATLAB.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Execute the simulation of DSP systems.
- Demonstrate the applications of FFT to DSP.
- Implement adaptive filters for various applications of DSP.
- Acquire good knowledge about IIR and FIR filters.
- Understand the Sampling and effect of aliasing
- Clear idea about various addressing modes of DSP.

List of Experiments Using Tms320c5x

1. Study of various addressing modes of DSP using simple programming examples
2. Sampling of input signal and display.
3. Implementation of FIR filters.
4. Calculation of FFT.

Simulation Using Matlab/ Equivalent Software Package

5. Generation of Signals
6. Linear and circular convolution of two sequences
7. Sampling and effect of aliasing
8. Design of FIR filters
9. Design of IIR filters
10. Calculation of FFT of a signal

19BEEC512 **ANTENNA LABORATORY** **2H-1C**

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To Understand the radiation patterns and applications of all types of antennas
- Understand the design of rectangular microstrip patch antenna.
- Design Monopole Antenna and half-wave dipole Antenna using Matlab.
- To inculate the basic knowledge about special purpose antennas.
- To imparts good knowledge about various types of antennas.
- To divulge the basics of antenna parameters and antenna arrays.

Course Outcomes

At the end of the course the students will be able to

- Design antenna for any application
- Select proper type of antenna based on applications
- Distinguish between various antennas based on their radiation patterns.
- Gain knowledge about Monopole antenna and half-wave dipole antenna.
- Acquire knowledge about antenna arrays.
- Understand the fundamentals about special purpose antennas.

List of Experiments:

1. Study of Antenna Parameters and antenna arrays.
2. Study of special purpose antennas.
3. Measurement of Radiation pattern of
    a. Monopole Antenna.
    b. Halfwave dipole Antenna
    c. Yagi Antenna
    d. Loop Antenna
    e. Parabolic reflector
    f. Log-periodic antenna
4. Analysis and design of rectangular microstrip patch antenna.
5. Software simulation of Monopole Antenna and half-wave dipole Antenna using Matlab

19BEEC551 **IN PLANT TRAINING** **0H-0C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:-** Total**:100**

Course Objective

- To bridge the gap between academia and industry in providing a industry exposure for satisfying local industrial needs .
- To provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
- To enhance students' knowledge in one particular technology.
- To Increase self-confidence of students and helps in finding their own proficiency
- To cultivate student's leadership ability and responsibility to perform or execute the given task.
- To provide learners hands on practice within a real job situation.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Gain knowledge on various tools used in industry
- Recent technological advancement happening in current scenario
- Capability to acquire and apply fundamental principles of engineering.
- Become master in one's specialized technology
- Become updated with all the latest changes in technological world
- Knack to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.
- Ability to identify, formulate and model problems and find engineering solution based on a systems approach.
- Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

19BEEC601 TOTAL QUALITY MANAGEMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.
- To familiarize the students with statistical fundamentals.
- To imparts a good knowledge in stages of FMEA.
- To learn about the New seven Management tools.

Course Outcome

Students would be able to

- Apply the tools and techniques of quality managements to manufacturing and servicing process
- Understand the Principles behind TQM
- List tools of quality
- Gain knowledge on Benchmarking process
- Understand the ISO Quality standards
- Gain knowledge on ISO auditing

UNIT I INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality Costs-Analysis Techniques For Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership–Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

Customer satisfaction– Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement– Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement–Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership– Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures– Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL(SPC)

The seven tools of quality, Statistical Fundamentals–Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS

Bench marking–Reasons to Benchmark, Bench marking Process, Quality Function Deployment(QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM)–Concept, Improvement Needs, FMEA–Stages of FMEA.

UNIT V QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System–Elements, Implementation of Quality System, Documentation, Quality Auditing, QS9000, ISO 14000–Concept, Requirements and Benefits.

Suggested Readings

1. Dale H. Besterfiled Total Quality Management Pearson Education 2003
2. James R.Evans& William M.Lidsay The Management and Control of Quality South-Western (Thomson Learning) 2002
3. L. Suganthi, Anand A. Samuel Total Quality Management PHI Learning 2011
4. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.
5. B. Janakiraman, R. K. Gopal Total Quality Management: Text And Cases PHI Learning Pvt 2006.

Semester-VI

19BEEC602 **CONTROL SYSTEMS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators.
- To introduce state variable representation of physical systems
- To familiarize the students the concepts of stability.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Characterize a system and find its study state behavior
- Investigate stability of a system using different tests
- Analyze frequency response for any given system
- Analyze Time response for any given system
- Design various controllers
- Solve liner, non-liner and optimal control problems

UNIT I INTRODUCTION TO CONTROL PROBLEM

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT II TIME RESPONSE ANALYSIS

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT III FREQUENCY-RESPONSE ANALYSIS

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT IV INTRODUCTION TO CONTROLLER DESIGN

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems.Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs.Analog and Digital implementation of controllers.

UNIT V STATE VARIABLE ANALYSIS AND NON LINEAR CONTROL

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis.

Suggested Readings

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Semester-VI

19BEEC603 **COMPUTER NETWORKS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the concept of networking
- To introduce various types of switching in networks
- To study about various routing algorithm
- To familiarize the students with layering concepts.
- To imparts a good knowledge in transport layer protocol
- To learn about congestion avoidance mechanisms and quality of service

Course Outcomes

At the end of this course students will demonstrate the ability to

- List out different OSI Layers
- Understand the concepts of networking thoroughly.
- Gain knowledge on Switching techniques for networks
- Understand the details of Transport layer protocols
- Gain knowledge to allocate appropriate resources
- Analyze the performance of the network.

UNIT I INTRODUCTION TO COMPUTER NETWORKS AND THE INTERNET

Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

UNIT II SWITCHING IN NETWORKS

Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call.

UNIT III TRANSPORT LAYER

Connectionless transport - User Datagram Protocol, Connection-oriented transport –Transmission Control Protocol, Remote Procedure Call.

UNIT IV CONGESTION CONTROL AND RESOURCE ALLOCATION

Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service. Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

UNIT V LINK LAYER

ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Suggested Readings

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
2. L. Peterson and B. Davie, "Computer Networks –A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education
5. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, "Computer networks", Prentice Hall
7. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall
8. William Stallings, "Data and computer communications", Prentice Hall

Semester-VI

19BEEC6E**	**PROFESSIONAL ELECTIVE -II**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VI

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Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VI

19BEEC611 COMPUTER NETWORKS LABORATORY 0H-2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Learn to communicate between two desktop computers.
- Learn to implement the different protocols
- Be familiar with socket programming.
- Be familiar with the various routing algorithms
- Be familiar with simulation tools.
- To imparts good knowledge about go-back-N and selective repeat protocols.

Course outcomes

At the end of the course, the student should be able to

- Communicate between two desktop computers.
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use simulation tool NS simulator.
- Acquire a good knowledge about network topology.

List of experiments

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Go-back-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Study of Socket Programming and Client – Server model
6. Write a socket Program for Echo/Ping/Talk commands.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology – Star, Bus, Ring
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Encryption and decryption.

Semester-VI

19BEEC612 ELECTRONIC MEASUREMENT LABORATORY 0H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To study design of various bridges used for measurements
- To understand statistical data analysis
- To familiarize the students with error compensation study using Numerical analysis using MATLAB.
- To imparts a good knowledge about signal conditioning circuit for pressure measurement and temperature measurement.
- To learn about the characteristics of ADC and DAC.
- To study the design of various bridge circuit for resistance and capacitance measurement.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Design and validate DC and AC bridges
- Analyze the dynamic response and the calibration of few instruments
- Learn about various measurement devices, their characteristics, their operation and their limitations
- Capability to explain statistical data analysis
- Understand computerized data acquisition.
- Understand the error compensation using MATLAB

List of Experiments

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for Torque Measurement
6. Designing signal Conditioning circuit for Strain Measurement
7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)

Semester-VI

19BEEC613 **MINI PROJECT** **0H-2C**

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To make students to understand a problem statement
- To make students to design an electronic circuit
- To follow correct grounding and shielding practices
- To do effective trouble-shooting of the project.
- To develop effective communication skill by delivering a seminar based on project.
- To understand the real time software development environment.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on mini project work.
- Demonstrate a through and systematic understanding of project contents.
- Understand methodologies and professional way of documentation and communication.
- Know the key stages in development of the project.

Semester-VI

19BEEC651 **SOFT SKILLS** **1H-0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To elevate the students into productivity powerhouses who can employ life skills to better their performances.
- To help the students understand interpersonal skills.
- To support them in building interpersonal skills.
- To better the ability to work with others.
- To imparts good knowledge in stress management.
- To understand the leadership teamwork, creativity, efficiency & productivity

Course Outcomes

- Ability to communicate smartly and effectively with co-workers, relationship enhancement
- Improvement of time management and organizational skill.
- Development of leadership teamwork, creativity, efficiency & productivity
- Development of presentation skills
- Recognize stress symptom & develop stress deflecting strategies
- Brain storming & problem solving strategies to increase creativity and collaborative outcomes

UNIT I

Overview to communication, self-Introduction, Presentation on their own topic, Extempore, Group Activity

UNIT II

Group Discussion, Do's and Don’ts of Group Discussion, Body language, Grooming and Resume, Resume correction

UNIT III

Introduction to HRM – Questions - Do's and Don’ts - Interview - Mock GD – Stress Management

UNIT IV

Personality Development - Presentation skills, Interpersonal skills, Critical thinking, Confidence building and Stress management.

Suggested Reading

1. Barun K Mitra Personality Development and SoftSkills Oxford University Press-New Delhi 2012
2. Rajiv K. Mishra Personality Development Rupa & Co. 2012

Semester-VII

19BEEC701 **PROFESSIONAL ETHICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.
- To familiarize the student with professional rights and employee rights
- To imparts a good knowledge in weapons development.

Course Outcome

Upon completion of the course, the student should be able to

- Gain knowledge on human values
- Apply ethics in society,
- Discuss the ethical issues related to engineering
- Realize the responsibilities and rights in the society
- Understand about Computer Ethics
- Gain knowledge on Corporate Social Responsibility

UNIT I HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES

Multinational Corporations – Professional Rights – Employee Rights – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

Suggested Readings

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
   Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
5. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
6. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
7. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

web sources

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

Semester-VII

19BEEC7E**	**PROFESSIONAL ELECTIVE -III**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VII

19BEEC7E**	**PROFESSIONAL ELECTIVE -IV**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VII

19BEEC7E**	**PROFESSIONAL ELECTIVE -V**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VII

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19BECSOE/**		
19BEEEOE/**		
19BTBTOE/**		
19BEMEOE/**	**OPEN ELECTIVE-III**	**3H-3C**
19BEAEOE/**		
19BECEOE/**		
19BTCEOE/**		
19BTFTOE/**		
19BEBMEOE**		

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Electronics and Communication Engineering **2019-2020**

Semester-VII

19BEEC791 **PROJECT WORK PHASE-I** **10H-5C**

Instruction Hours/week: L:0 T:0 P:10 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To make students to understand a problem statement
- To make students to design an electronic circuit useful to the society
- To be able to apply some of the techniques/principles you have been taught
- To follow correct grounding and shielding practices
- To do effective trouble-shooting of the project.
- To develop effective communication skill by delivering a seminar based on project

Course Outcomes

At the end of this course students will demonstrate the ability to

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on project work.
- Demonstrate a through and systematic understanding of project contents.
- Understand methodologies and professional way of documentation and communication.
- Know the key stages in development of the project.

B.E Electronics and Communication Engineering **2019-2020**

Semester-VII

19BEEC751 **VLSI DESIGN USING CADENCE TOOL** **2H-0C**

Instruction Hours/week: L:1 T:0 P:1 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand the basics of VLSI, CMOS techniques.
- To know about the various CAD tools.
- To understand design styles & programming using verilogHDL language
- To learn simulation, synthesis and implementation using Cadence tools.
- To familiarize the students with the design of adders using VHDL.
- To indulge the fundamentals of Cadence IES.

Course Outcomes

- Familiar with VLSI basics.
- Ability to write verilog programmes for digital circuits.
- Gain mastery to work on cadence tools
- Acquire the knowledge of procedural assignments conditional statements in VHDL.
- Understand the concept of mixed language programming

UNIT I INTRODUCTION TO VLSI & VERILOG HDL

Introduction to VLSI -An overview of Silicon semiconductor technology- Moor's law - Basic CMOS technology-CAD tools -VLSI design flow using cadence tools.

Verilog HDL: Design hierarchies, Gate Delays, Operators, timing controls, Procedural assignments conditional statements. Switch Level modeling, Structural Gate Level modeling, Data flow modeling and Behavioral modeling (RTL). Design Examples: half adder, Full adder, Ripple Carry adder, D-latch, D-ff and Registers.

UNIT II SIMULATION, SYNTHESIS & IMPLEMENTATION USING CADENCE TOOLS

Overview of Cadence IES & Simulation using IES. Synthesis using Cadence RTL Compiler (rc), Implementation using Cadence Encounter/Velocity *(hands on training)*

Semester-VIII

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19BEMEOE/**	**OPEN ELECTIVE-IV**	**3H-3C**
19BEAEOE/**		
19BECEOE/**		
19BTCEOE/**		
19BTFTOE/**		
19BEBMEOE**		

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VIII

19BESHOE/**		
19BECSOE/**		
19BEEEOE/**		
19BTBTOE/**		
19BEMEOE/**	**OPEN ELECTIVE-V**	**3H-3C**
19BEAEOE/**		
19BECEOE/**		
19BTCEOE/**		
19BTFTOE/**		
19BEBMEOE**		

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VIII

19BEEC8E**	**PROFESSIONAL ELECTIVE -VI**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VIII

19BEEC8E**	**PROFESSIONAL ELECTIVE -VII**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

Semester-VII

19BEEC891 **PROJECT WORK PHASE-II** **18H-9C**

Instruction Hours/week: L:0 T:0 P:18 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To make students to understand a problem statement
- To make students to design an electronic circuit useful to the society
- To be able to apply some of the techniques/principles you have been taught
- To carry out budget and time planning for the project.
- To do effective trouble-shooting of the project
- To develop effective communication skill by delivering a seminar based on project.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on project work.
- Demonstrate a sound technical knowledge of their selected project topic.
- Design engineering solutions to complex problems utilising a systems approach.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Electives

B.E Electronics and Communication Engineering **2019-2020**

Semester-V

19BEEC5E01 **BIOMEDICAL ELECTRONICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study the methods of recording various biopotentials
- To study how to measure biochemical and various physiological information
- To understand the working of units which will help to restore normal functioning
- To understand the use of radiation for diagnostic and therapy
- To understand the need and technique of electrical safety in Hospitals.
- To imparts good knowledge in diagnostic x-ray equipments.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Gain knowledge on Biomedical transducers
- Understand the application of the measuring devices in biological applications.
- Understand the need of assist devices and the need of electrical safety in Hospitals
- Demonstrate the practical limitations on the electronic components while handling bio-substances.
- Understand and analyze the biological processes like other electronic processes.
- Gain knowledge on recent medical instruments

UNIT I TRANSDUCERS AND ELECTRODES

Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

UNIT II MEASURING DEVICES

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, Xray and nuclear imaging.

UNIT III ASSSIT DEVICES

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects and Bio-telemetry

UNIT-IV RADIOLOGICAL EQUIPMENTS

Ionizing radiation, Diagnostic x-ray equipments, use of Radio Isotope in diagnosis, Radiation Therapy.

UNIT-V RECENT TRENDS IN MEDICAL INSTRUMENTATION

Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment.

Suggested Readings

1. Leislie Cromwell, Biomedical instrumentation and measurement, Prentice Hall of
2. India, New Delhi.2002
3. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
4. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
5. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Semester-V

19BEEC5E02 ANTENNAS AND WAVE PROPAGATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To give insight of the radiation phenomena and antennas
- To introduce various antenna arrays and its radiation characteristics
- To imparts the knowledge in various methods of synthesis of antenna arrays
- To familiarize the students with the concept of adaptive beam forming.
- To inculate the structure of ionosphere and its propagation mechanism.
- To divulge the concept and benefits of smart antennas

Course Outcomes

At the end of the course the students will be able to

- Understand the properties and various types of antennas.
- Analyze the properties of different types of antennas and their design.
- Gain knowledge on special purpose antennas
- Understand the applications of smart antennas
- Gain knowledge on Radio wave propagation
- Design antenna of required specifications using software tools .

UNIT I FUNDAMENTAL CONCEPTS

Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions, Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication

UNIT II ANTENNA ARRAYS

Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, and synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

UNIT III SPECIAL PURPOSE ANTENNA

Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

UNIT IV SMART ANTENNAS

Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

UNIT V RADIO WAVE PROPAGATION

Basics of propagation-Ground wave propagation – Space wave propa gation- Considerations in space wave propagation – Super refraction – Ionospheric wave propagation – Structure of ionosphere – Mechanism of ionospheric propagation – Effect of earth's Magnetic field on Radio wave propagation– Virtual height – MUF – Skip distance – OWF – Ionosphere abnormalities.

Suggested Readings

1. D. Kraus, Antennas, McGraw Hill, 2008.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 2007
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw hill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Semester-V

19BEEC5E03 **INFORMATION THEORY AND CODING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To analyze the process of coding for analog and discrete sources and the mathematical model for information sources.
- To solve problems on error detection and error correction for various types of codes.
- To understand the principles of Huffman codes and to solve problems therein.
- To study the properties of Entropy and the principles of Shannon-Fano coding.
- To learn the concepts of mutual information, channel capacity, and Shannon's Main Theorem
- To imparts knowledge in entropy and its mathematical properties.

Course Outcomes

At the end of the course the students will be able to

- Understand the concept of information and entropy
- Choose error detecting and correcting codes based on the application
- Gain knowledge about Huffman codes.
- Understand Shannon's theorem for coding
- Calculation of channel capacity
- Apply coding techniques

UNIT I SOURCE CODING

Model of signaling system - Mathematical models for information sources – Encoding a source alphabet – ASCII code – Radix r code – Miscellaneous codes - A Logarithmic measure of information – Coding for Discrete sources – Coding for analog sources (Optimum quantization) – Coding techniques for analog sources.

UNIT II ERROR DETECTING AND ERROR CORRECTING CODES

Simple parity checks – CRC codes – Hamming weight – Hamming distance – Minimum distance decoding – Single / Double parity checks – Hamming codes – Linear block codes – Cyclic codes – Syndrome calculation – Block encoders and Decoders.

UNIT III VARIABLE-LENGTH CODES – HUFFMAN CODES

Unique decoding – Instantaneous codes and its construction – The Kraft's inequality – Shortened block codes – The McMillan's Inequality – Huffman codes and its special cases – Extensions of a code – Huffman codes Radix r – Noise in Huffman coding probabilities – Use of Huffman codes – Hamming Huffman coding

UNIT IV ENTROPY AND SHANNON'S FIRST THEOREM

Entropy and its Mathematical properties – Entropy and coding – Shannon-Fano coding – Entropy of a Markov process – The Adjoint system – Robustness of Entropy.

UNIT V MUTUAL INFORMATION, CHANNEL CAPACITY & SHANNON'S MAIN THEOREM

Information channel – Capacity of a Binary symmetric channel – System entropies – Mutual information – Definition of channel capacity – Uniform channel – Conditional mutual information – Random encoding - Average random code – Fano bound – Converse of Shannon's theorem.

Suggested Readings

1. Hamming, Richard W, "Coding and Information Theory", Prentice Hall Inc., NJ, 1986.
2. Proakis J. G., "Digital Communications", McGraw Hill Inc., 4th Edition, NY, 2001.

Semester-V

19BEEC5E04 SENSORS AND TRANSDUCERS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study basic concepts of various sensors and transducers.
- To develop knowledge in selection of suitable sensor based on requirement
- To familiarize the concepts of inductive and capacitive sensors and its comparison
- To imparts the knowledge in analysis of error.
- To learn the fundamentals of various thermal and radiation sensors.
- To study about applications of sensors in various field.

Course Outcomes

At the end of the course the students will be able to

- Characterize and classify errors
- Understand basic concepts of mechanical sensors.
- Gain knowledge about thermal sensors
- Explain the principle behind magnetic sensors
- Gain knowledge about electro analytical sensors
- Gain thorough knowledge in selection of suitable sensor based on requirement and application.

UNIT I INTRODUCTION

Definition, classification, static and dynamic parameters, Characterization–Electrical, mechanical, thermal, optical, biological and chemical, Classification of errors–Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors.

UNIT II MECHANICAL AND ELECTRO MECHANICAL SENSORS

Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors.

UNIT III THERMAL AND RADIATION SENSOR

Thermal Sensors: Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change-type thermometric sensors, thermos emf sensors, junction semiconductor types, Thermal radiation sensors, spectroscopic thermometry

Radiation Sensors: Photo detectors, photovoltaic and photo junction cells, photo sensitive cell, photo FET sand other devices.

UNIT IV MAGNETIC AND ELECTRO ANALYTICAL SENSOR

Magnetic Sensors: Force and displacement measurement, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flowmeter, squid sensor.

Electro analytical Sensors: Electro chemical cell, cell potential, sensor electrodes, electro ceramics in gas media, chem FET.

UNIT V SENSORS AND THEIR APPLICATIONS

Auto mobile sensor, Home appliance sensor, Aero space sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.

Suggested Readings

1. Patranabis D Sensor and Actuators Prentice Hall of India (Pvt) Ltd 2006
2. Ian Sinclair Sensor and Transducers 3rd Edition Elsevier India Pvt Ltd, 2011
3. A.K. Sawhney, Puneethsawhney A Course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai Publications 2012
4. Ernest O. Doeblin Measurement System, Application and Design 5th Edition Tata McGraw Hill Publishing Company Ltd. 2008

Semester-VI

19BEEC6E01 **POWER ELECTRONICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn various power devices for different application
- To study different type of rectifiers and choppers
- To study switching power supplies and single phase inverters
- To imparts good knowledge in semi and full bridge converters for R, RL, RLE and level loads.
- To familiarize the concept of fast recovery and schottky diodes as freewheeling &feedback diode.
- To divulge the basics of single phase inverters and compare its performance.

Course Outcomes

At the end of the course the students will demonstrate the ability to

- Build and test circuits using power devices such as SCR
- Gain knowledge about controlled rectifiers
- Understand the working and application of choppers
- Learn to analyze these inverters and some basic applications
- Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters
- Design SMPS.

UNIT I SEMICONDUCTOR POWER DEVICES

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling &feedback diode.

UNIT II CONTROLLED RECTIFIERS

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

UNIT III CHOPPERS

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

UNIT IV SINGLE-PHASE INVERTERS

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

UNIT V SWITCHING POWER SUPPLIES

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter – series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Suggested Readings

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India 2009.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons 2006.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co 2005.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press 2005.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla, Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

19BEEC6E02 **INTRODUCTION TO MEMS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study materials used for MEMS and its working
- To study the fabrication process used for MEMS
- To study the packaging process used for MEMS
- To familiarize the students with various micro actuators and micro sensors.
- To learn the survey of materials central to micro engineering.
- To imparts good knowledge in micro system packaging materials

Course Outcomes

At the end of the course the students will be able to

- Appreciate the underlying working principles of MEMS devices.
- Understand the working of Micro sensors and actuators
- Explain the IC fabrication processes
- Gain knowledge on bulk manufacturing
- Understand the Design of Micro systems.
- Design and model MEMS devices.

UNIT I INTRODUCTION TO MICROSYSTEMS

Overview of microelectronics manufacture and Microsystems technology. Definition - MEMS materials. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT II MICRO SENSORS AND ACTUATORS

Working principle of Microsystems - micro actuation techniques - micro sensors – types – Microactuators – types – micropump – micromotors – micro – valves – microgrippers – microaccelerometers.

UNIT III FABRICATION PROCESS

Substrates - single crystal silicon wafer formation – Photolithography – Ion implantation – Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition epitaxy - etching process.

UNIT IV MICRO SYSTEM MANUFACTURING

Bulk Micro manufacturing - surface micro machining – LIGA – SLIGA - Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation – surface bonding - wire bonding - sealing.

UNIT V MICROSYSTEMS DESIGN AND PACKAGING

Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

Suggested Readings

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. Mems & Microsystems Design & Manufacture by Tai-Ran Hsu. Tata McGraw-Hill Publishing Company Ltd 2002.
4. Foundation of MEMS" by Chang Liu. Pearson Education. 2012
5. Mohamed Gad – el – Hak, "MEMS Handbook", CRC Press, 2002.
6. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
7. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
8. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd Edition, 2002.

19BEEC6E03 **CMOS DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn the MOS process technology.
- To learn the basic MOS Circuits.
- To learn concept of various logic styles.
- To learn the concepts of VLSI implementation strategies.
- To familiarize the concept of Dynamic and Domino CMOS logic.
- To imparts the knowledge in various delay models

Course Outcomes

At the end of the course the students will be able to

- Explain the basic CMOS circuits and the CMOS process technology.
- Design different CMOS circuits using various logic families along with their circuit layout.
- Gain knowledge on complex gates
- Model the digital system using Hardware Description Language.
- Gain exposure on various delay models
- Implement simple circuits using HDL Programming

UNIT I MOS TECHNOLOGY

Chip Design Hierarchy – IC Layers – Photolithography and Pattern Transfers – Basic MOS Transistors – CMOS Fabrication: n-well – p-well – twin tub – Latch up and prevention- Layout design rules, physical design- basic concepts, CAD tool sets, physical design of logic gates- Inverter, NAND, NOR.

UNIT II MOS TRANSISTOR PRINCIPLE

Introduction to MOSFET: Symbols, Enhancement Mode-Depletion mode transistor operation – Threshold voltage derivation – Drain current derivation – Non-ideal behavior of the MOS Transistor. NMOS and CMOS inverter – Determination of pull up to pull down ratio –Delay Models- RC Delay model, linear delay model.

UNIT III CMOS LOGIC GATES & OTHER COMPLEX GATES

Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic –Pass Transistor Logic – Dynamic CMOS Logic – Domino CMOS Logic, NORA CMOS Logic, True Single-Dual rail logic.

UNIT IV VERILOG HDL

Hierarchical modeling concepts – Basic concepts: Lexical conventions – Data types – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling – Functions – UDP concepts.

UNIT V VLSI IMPLEMENTATION STRATEGIES

Introduction – Design of Adders: carry look ahead-carry select-carry save. Design of multipliers: Array – Braun array – Baugh-Wooley Array. Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

Suggested Readings

1. Douglas A. Pucknell Basic VLSI Systems and Circuits 3rd Edition reprint Prentice Hall of India 2008
2. John P. Uyemura, Introduction to VLSI Circuits and Systems John Wiley&Sons, Reprint 2009
3. Smith.M.J. S Application Specific integrated circuits Pearson Education, New York 2008
4. Weste & Eshraghian, Principles of CMOS VLSI Design 2nd Edition AddisonWesley, 2011
5. John P Uyemura Chip Design for Submicron VLSI: CMOS layout and simulation Thomson India Edition 2010
6. Samir Palnitkar, VerilogHDL– Guide to Digital Design and Synthesis-3rd Edition Pearson Education 2003

Semester-VI

19BEEC6E04 **NANO ELECTRONICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To Understand the basics of Quantum mechanics concepts and process involved in preparation of nano particle.
- To imparts a good knowledge in nanosensors and nanobiosensors
- To familiarize the students with the benefits of the nano-materials and appropriate use in solving practical problems.
- To inculate the nanoscale MOSFET.
- To divulge the applications of nanosenors in various fields.
- To make the student acquire the knowledge of carbon nanotubes and its application in various fields

Course outcomes:

At the end of this course students will demonstrate the ability to

- Understand the basics of Quantum Mechanics
- Gain knowledge on shrink down approaches
- Characterize SET and tunnel diodes
- Understand various aspects of carbon nano structures
- Advantages of the carbon nano sensors
- Knowledge on benefits of the nano-materials and appropriate use in solving practical problems.

UNIT I BASICS OF QUANTUM MECHANICS:

Introduction to nanotechnology, meso structures, Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. KronigPenny Model. Brillouin Zones.

UNIT II SHRINK-DOWN APPROACHES:

Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

UNIT III CHARACTERIZATION

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors ,Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

UNIT IV CARBON NANOSTRUCTURES

Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes.

UNIT V CARBON NANOSTRUCTURES NANOSENSORS

Introduction, What is Sensor and Nanosensors?, What makes themPossible?, Order From Chaos, Characterization, Perception, Nanosensors Based OnQuantum Size Effects, Electrochemical Sensors, Sensors Based On PhysicalProperties, Nanobiosensors, Smartdust-Sensor for the future. Applications: Injection lasers, quantum cascade lasers, single-photon sources,biological tagging, optical memories, coulomb blockade devices, photonic structures,QWIP's, NEMS, MEMS

Suggested Readings

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Semester-VII

19BEEC7E01 SATELLITE COMMUNICATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To prepare students to excel in basic knowledge of satellite communication principles
- To provide students with solid foundation in orbital mechanics for the satellite communication
- To train the students with a basic knowledge of link budget design of satellite with a design examples.
- To provide better understanding of modulation and multiple access technology.
- To imparts a good knowledge in concepts of solar day and sidereal day.
- To familiarize the students with the drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Course Outcomes

At the end of the course the students will be able to

- Visualize the architecture of satellite systems as a means of high speed, high range communication system.
- Understand the principle behind Orbital mechanics
- List out satellite sub systems
- State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
- Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
- Gain knowledge on Multiple access schemes on Modulation

UNIT I INTRODUCTION TO SATELLITE COMMUNICATION

Principles and architecture of satellite Communication ,Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

UNIT II ORBITAL MECHANICS

Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit,evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

UNIT III SATELLITE SUB-SYSTEMS

Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

UNIT IV TYPICAL PHENOMENA IN SATELLITE COMMUNICATION

Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget, Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT V MODULATION AND MULTIPLE ACCESS SCHEMES

Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Suggested Readings

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Semester-VII

19BEEC7E02 **EMBEDDED SYSTEMS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To provide knowledge on real time application using embedded controllers.
- To understand the Synchronous , Iso-synchronous and asynchronous communications devices.
- To imparts a good knowledge in Ports- Timer and Counting Devices and
- To familiarize the students with the concepts of EMBEDDED PROGRAMMING in C++.
- To inculate the knowledge of inter process communications using signals.
- To learn interfacing of real world input and output devices

Course Outcomes

At the end of the course the students will be able to

- Understand the classification of Units in embedded systems
- Gain knowledge on buses and devices for network
- Suggest design approach using advanced controllers to real-life situations.
- Program using Embedded C,C++
- Design interfacing of the systems with other data handling / processing systems.
- Understand inter process communication in RTOS.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT II DEVICES AND BUSES FOR DEVICES NETWORK

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '13C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C+

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues

Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

UNIT IV REAL TIME OPERATING SYSTEMS – PART - 1

Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organization and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks

UNIT V REAL TIME OPERATING SYSTEMS – PART - 2

INTER PROCESS COMMUNICATION AND SYNCHRONISATION – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs).Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions

Suggested Readings

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

Semester-VII

19BEEC7E03 MICROWAVE THEORY AND TECHNIQUES 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To deal with the issues in the design of microwave amplifier
- To instill knowledge on the properties of various microwave components.
- To deal with the microwave generation and microwave measurement techniques.
- To imparts a good knowledge in network analyzer and spectrum analyzer.
- To familiarize the students with the analysis of RF and microwave transmission lines.
- To acquaint the student with concepts microwave semiconductor devices and microwave tubes.

Course Outcomes

At the end of the course the students will be able to

- Gain knowledge on Microwave Frequency bands, and applications
- Understand various microwave system components their properties.
- Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
- Understand concepts of Microwave measurements
- Understand the principle behind working of RADAR
- Design microwave systems for different practical application.

UNIT I INTRODUCTION TO MICROWAVES

History of Microwaves, Microwave Frequency bands, Applications of Microwaves, Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line, - Scattering Parameters

UNIT II PASSIVE AND ACTIVE MICROWAVE DEVICES

Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, Magnetron oscillator, Traveling wave tube amplifier

UNIT III MICROWAVE DESIGN PRINCIPLES

Impedance transformation, Impedance Matching, Microwave Filter Design, RF & Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave

Mixer Design, Microwave Oscillator Design. Microwave Antennas -Antenna parameters, Antenna for ground based systems, Antennas for airborne & satellite borne systems
Planar Antennas. Measurement of Microwave antenna parameters.

UNIT IV MICROWAVE MEASUREMENTS

Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency & measurement of noise figure.

UNIT V MICROWAVE SYSTEMS

Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID,GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Suggested Readings

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house
3. David, M. Pozar, Microwave Engineering, Wiley India, (2012).
4. Ramo, S., Whinnery, J.R., and Duzer, T.V., Fields and Waves in Communication Electronics, Wiley India
5. Collin, R.E., Foundations for Microwave Engineering, IEEE Press

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Semester-VII

19BEEC7E04 **VLSI TECHNOLOGY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn the processing steps in fabrication of VLSI devices.
- To learn the concepts of assembling and packaging for VLSI devices.
- To imparts a good knowledge in reactive plasma etching techniques and equipment.
- To familiarize the students with the NMOS and CMOS IC technology.
- To make the student acquire reactive Plasma Etching techniques and Equipment.
- To acquaint the student with the VLSI assembly technology and package fabrication technology

Course outcomes

After completing this course, the students will be able to

- List out various fabrication techniques
- Understand the etching principle in IC fabrication
- Gain knowledge on deposition and diffusion methods
- Understand the process simulation and integration.
- Assembling and packing techniques
- various technologies used for fabricating VLSI devices

UNIT I CRYSTAL GROWTH, WAFER PREPARATION, EPITAXY AND OXIDATION

Electronic Grade Silicon, Czochralski crystal growing, Silicon Shaping, processing considerations, Vapor phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation, Growth Mechanism and kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxide properties, Redistribution of Dopants at interface, Oxidation of Poly Silicon, Oxidation inducted Defects.

UNIT II LITHOGRAPHY AND RELATIVE PLASMA ETCHING

Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography, Plasma properties, Feature Size control and Anisotropic Etch mechanism, reactive Plasma Etching techniques and Equipment.

UNIT III DEPOSITION, DIFFUSION, ION IMPLEMENTATION AND METALLIZATION

Deposition process, Poly silicon, plasma assisted Deposition, Models of Diffusion in Solids, Fick's one dimensional Diffusion Equations – Atomic Diffusion Mechanism – Measurement techniques - Range theory- Implant equipment. Annealing Shallow junctions – High energy implantation – Physical vapor deposition – Patterning.

UNIT IV PROCESS SIMULATION AND VLSI PROCESS INTEGRATION

Ion implantation – Diffusion and oxidation – Epitaxy – Lithography – Etching and Deposition- NMOS IC Technology – CMOS IC Technology – MOS Memory IC technology - Bipolar IC Technology – IC Fabrication.

UNIT V ANALYTICAL, ASSEMBLY TECHNIQUES AND PACKAGING OF VLSI DEVICES

Analytical Beams – Beam Specimen interactions - Chemical methods – Package types – packaging design considerations – VLSI assembly technology – Package fabrication technology.

Suggested Readings

1. S.M.Sze, "VLSI Technology", McGraw Hill Second Edition. 1998.
2. James D Plummer, Michael D. Deal, Peter B. Griffin, "Silicon VLSI Technology: Fundamentals Practice and Modeling", Prentice Hall India.2000.
3. Wai Kai Chen, "VLSI Technology" CRC Press, 2003.

Semester-VII

19BEEC7E05 **MIXED SIGNAL DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To Understand the Switched capacitors Circuits and Operation and Analysis.
- To study Data Converter Fundamentals, Nyquist Rate and A/D Converters.
- To study and to analyze the Oversampling Converters and Continuous-Time Filters.
- To study the concepts of Continuous-Time Filters, CMOS Transconductors Using Triode and Active Transistors and MOSFET-C Filters.
- To imparts a good knowledge in Basic PLL topology.
- To familiarize the students with the delta sigma modulators with multi-bit quantizers

Course Outcomes

At the end of the course the students will be able to

- Understand the concepts of Switched Capacitor circuits.
- Understand the dynamics of PLL
- Design simple applications using PLL
- Design Data converters
- Gain knowledge on Oversampling converters
- Learn about continuous time filters

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UNIT I SWITCHED CAPACITOR CIRCUITS

Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

UNIT II PHASED LOCK LOOP (PLL)

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non- idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT III DATA CONVERTERS

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT IV OVERSAMPLING CONVERTERS

Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multi-bit quantizers, Delta sigma D/A.

UNIT V CONTINUOUS-TIME FILTERS

Introduction to Gm-C Filters, Bipolar Transconductors, CMOS transconductors Using Triode and Active Transistors, BiCMOS Tran conductors, MOSFET-C Filters.

Suggested Readings

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002.
2. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2013.
3. CMOS Mixed-Signal Circuit Design – R. Jacob Baker, Wiley Interscience, 2009.
4. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Semester-VII

19BEEC7E06 **INTERNET OF THINGS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand the basics of Internet of Things.
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things.
- To understand the concepts of Web of Things.
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- To understand the IOT protocols

Course Outcomes

At the end of the course the students will be able to

- Identify and design the new models for market strategic interaction Design business intelligence and information security for Web.
- Analyze various protocols for IoT Design a middleware for IoT.
- Learn about Web of things
- Gain knowledge on Integrated billing solutions in IoT
- Design for IoT applications
- Analyze and design different models for network dynamics.

UNIT I INTRODUCTION

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT II IOT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT III WEB OF THINGS

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud

Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture

UNIT IV INTEGRATED IoT

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT V APPLICATIONS

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

Suggested Readings

1. Honbo Zhou The Internet of Things in the Cloud: A Middleware Perspective CRC Press 2012
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of things pringer 2011
3. David Easley and Jon Kleinberg Networks, Crowds, and Markets: Reasoning About a Highly Connected World Cambridge University Press 2010
4. Olivier Hersent, Omar Elloumi and David Boswarthick The Internet of Things: Applications to the Smart Grid and Building Automation Wiley 2012.
5. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012

Semester-VII

19BEEC7E07 ARTIFICIAL NEURAL NETWORKS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn the various architectures of building an ANN and its applications.
- Advanced methods of representing information in ANN like elf organizing.
- Networks, associative and competitive learning.
- To learn architecture of Neocognitron.
- To imparts a good knowledge in self-organizing map-learning algorithm.
- To familiarize the students with the Data processing and performance of architecture of spacio - temporal networks for speech recognition.

Course Outcomes

At the end of the course the students will be able to

- Gain adequate knowledge about the various architectures of building an ANN and its applications.
- Sufficient knowledge regarding BPN and BAM.
- Understand the process of Annealing
- Gain knowledge about self organizing networks, associative and competitive learning.
- Understand the architecture of ART
- Aply neural networks for classification of various applications.

UNIT I INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS

Neuro-Physiology-General Processing Element-ADALINE-LMS learning rule-MADALINE- MR2 training algorithm.

UNIT II BPN AND BAM

Back Propagation Network-updating of output and hidden layer weights-application of BPN–associative memory- Bi-directional Associative Memory-Hopfield memory-traveling sales man problem.

UNIT III SIMULATED ANNEALING AND CPN

Annealing, Boltzmannmachine-learning-application-CounterPropagationnetwork-architecture-Training-Applications.

UNIT IV SOM AND ART

Self-organizing map-learning algorithm-feature map classifier-applications -architecture of Adaptive Resonance Theory-pattern matching in ART network.

UNIT V NEOCOGNITRON

Architecture of Neocognitron -Data processing and performance of architecture of spacio -temporal networks for speech recognition.

Suggested Readings

1. J. A. Freeman and B.M. Skapura Neural Networks, Algorithms Applications and Programming Techniques Wiley & Sons Chichester,2003
2. Laurene Fausett Fundamentals of Neural Networks: Architecture, Algorithms and Applications Prentice Hall 1994
3. S.N. Sivanandham Paul raj.M. P Introduction to artificial neural networks Vikas Publishers 2003

Semester-VII

19BEEC7E08 **ADVANCED MICROPROCESSORS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the concepts in internal programming model of Intel family of microprocessors.
- To introduce the programming techniques using MASM, DOS and BIOS function calls.
- To introduce the basic architecture of Pentium family of processors.
- To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introduce the concepts and architecture of RISC processor and ARM.
- To imparts a good knowledge in modular programming using assembly languages with C/C++.

Course outcomes

At the end of the course the students will be able to

- Understand the concept in internal programming model of Intel family of microprocessors.
- Knowing the programming techniques using MASM, DOS and BIOS Function calls.
- Acquire knowledge in basic architecture of Pentium family of processors.
- Gain knowledge about the architecture programming and interfacing of 16 bit microcontrollers.
- Know about the concepts and architecture of RISC processor and ARM.
- Program using advanced processors

UNIT I ADVANCED MICROPROCESSOR ARCHITECTURE

Internal Microprocessor Architecture-Real mode memory addressing– Protected Mode Memory addressing–Memory Paging-Data addressing modes–Program memory addressing modes–Stack memory addressing modes–Data movement instructions–Program control Instructions-Arithmetic and Logic Instructions.

UNIT II MODULAR PROGRAMMING AND ITS CONCEPTS

Modular programming–UsingkeyboardandVideodisplay–DataConversions-Diskfiles-Interrupt hooks-using assembly languages with C/C++

UNIT III PENTIUM PROCESSORS

Introduction to Pentium Microprocessor–Special Pentium Registers-Pentium memory management–New Pentium Instructions–Pentium Processor–Special Pentium pro features–Pentium4 processor.

UNIT IV 16-BIT MICRO CONTROLLER

8096/8097 Architecture-CPU registers–RALU-Internal Program and Data Memory Timers-High-speed Input and Output–Serial Interface-I/O ports–Interrupts–A/D Converter-Watch dog timer–Power down feature–Instruction Set-External Memory Interfacing–External I/O interfacing.

UNIT V RISC PROCESSORS ANDARM

The RISC revolution–Characteristics of RISC Architecture–The Berkeley RISC–Register Windows – Windows and parameter passing–Window overflow–RISC architecture and pipelining–Pipeline bubbles–Accessing external memory in RISC systems–Reducing the branch penalties–Branch Prediction–The ARM processors–ARM registers–ARM instructions–The ARM built-in shift Mechanism–ARM branch instructions–sequence control–Data movement and memory reference instructions.

Suggested Readings

1. Barry B. Brey The Intel Microprocessors 8086/8088,80186,80286,80386,80486, Pentium, Pentium Pro Processor, Pentium II,Pentium III, Pentium4, Architecture, Programming and interfacing Prentice Hall of India Private Limited, New Delhi. 2003
2. Raj Kamal The concepts and feature of microntrollers 68HC11,8051 and 8096 S Chand Publishers, New Delhi.2000
3. Alan ClementsThe principles of computer Hardware Oxford University Press, Oxford.2003

Semester-VII

19BEEC7E09 DIGITAL LOGIC DESIGN WITH PLDS AND VHDL 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To describe the features of s ystem-level design options
- To describe basic structures and features of cell -based ASICs, gate arra y ASICs , programmable logic devices (PLDs), field-programmable gate arrays (FPGAs), Complex PLD (CPLDs)
- To understand how to model combinational circuits and sequential circuits using PLDs, Complex PLDs
- To understand how to model combinational circuits and sequential circuits using VHDL.
- To imparts a good knowledge in Field Programmable Gate Arrays.
- To familiarize the students with the Mealy and Moore machines.

Course Outcomes

At the end of the course the students will be able to

- Gain knowledge about Shannon theorem and its applications
- Design simple sequential circuits.
- Design combinational circuits and sequential circuits using PLDs
- Understand the VHDL programming aspects
- Program using HDL.
- Design digital circuits using VHDL

UNIT I ADVANCED TOPICS IN BOOLEAN ALGEBRA

Shannon's Expansion theorem and its application, Consensus theorem, Reed Muller Expansion technique, Multiplexer logic as function generators, Implementation of Multiple output logic functions, Static and Dynamic hazards, Design of static hazard-free and dynamic hazard-free logic circuits.

UNIT II SEQUENTIAL CIRCUIT DESIGN

Mealy and Moore machines, clocked synchronous sequential circuit design procedure-state diagrams-state table-state reduction-state assignment, Incompletely Specified Sequential Machines.

UNIT III DESIGN WITH PROGRAMMABLE LOGIC DEVICES

Basic concepts, PROM as PLD, Programmable Array Logic (PAL),Programmable Logic Array (PLA), Design of combinational and sequential circuits using PLD's, Complex PLD (CPLD), Introduction to Field Programmable Gate Arrays (FPGA), Xilinx FPGAs-Xilinx 3000 series and 4000 series FPGA.

UNIT IV INTRODUCTION TO VHDL

VHDL Description of combination circuits, VHDL Modules- entity and architecture description, Sequential statements and VHDL processes, VHDL Data types and Operators, Concurrent and Sequential Assignment Statements(All t ypes), Different types of Modeling in VHD L – Behavioral, dataflow and structural modeling, Variables, Signals and Constants in VHDL, Package in VHDL.

UNIT V DIGITAL DESIGN WITH VHDL

Combinational Circuit Design using Structural, behavioral and data flow modeling (Circuits like Arithmetic circuits, decoders, encoders, multiplexers, demultiplexers, code converters, 4-bit binar y adders, BCD adder, comparator, ALU etc.,), Design of Sequential Elements, Registers, Counters and Synchronous Sequential Circuits using VHDL.

Suggested Readings

1. Charles. H. Roth, Jr Digital S ystems Design using VHDL CENGAGE Learning, Third Indian Reprint 2010
2. Zwolinski Digital S ystem Design With VHDL Pearson Education India 2004
3. Ian Grout Digital S ystems Design with FPGAs and CP LDs Newness 2011

Semester-VII

19BEEC7E10 **SPEECH AND AUDIO PROCESSING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the concept of speech coding
- To learn speech prediction and quantization
- To learn various speech coding standards.
- To imparts a good knowledge in long term and short-term linear prediction models.
- To familiarize the students with the basics of ITU-T G.726, G.728 and G.729standards.
- To inculate the basic knowledge of CELP based on adaptive codebook.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Mathematically model the speech signal
- Analyze the quality and properties of speech signal.
- Gain knowledge on speech quantization techniques.
- Understand about speech coding standards.
- Analysis and synthesis of CELP speech production model
- Modify and enhance the speech and audio signals.

UNIT I INTRODUCTION

Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid,Requirements of speech codecs –quality, coding delays, robustness.Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT II LINEAR PREDICTION OF SPEECH

Basic concepts of linear prediction; Linear Prediction Analysis of non stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

UNIT III SPEECH QUANTIZATION

Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

UNIT IV LINEAR PREDICTION CODING & SPEECH CODING STANDARDS

LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model. -An overview of ITU-T G.726, G.728 and G.729standards

UNIT V CODE EXCITED LINEAR PREDICTION

CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Suggested Readings

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

Semester-VII

19BEEC7E11 MOBILE COMMUNICATION AND NETWORKS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce some fundamentals of cellular system
- To introduce concept of fading and its type
- To introduce various antennas and diversity techniques.
- To understand the different modulation schemes used.
- To imparts a good knowledge in large scale signal propagation and lognormal shadowing.
- To familiarize the students with the multicarrier modulation schemes.

Course Outcomes

At the end of f the course, students will demonstrate the ability to:

- Understand the working principles of the mobile communication systems.
- Gain knowledge on Fading techniques
- Gain knowledge on antennas and modulation techniques.
- Understand the working principle of Receivers
- Understand the relation between the user features and underlying technology.
- Analyze mobile communication systems for improved performance

UNIT I CELLULAR CONCEPTS AND PROPAGTION

Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards. Signal propagation- Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing.

UNIT II FADING

Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Capacity of flat and frequency selective channels.

UNIT III ANTENNAS AND MODULATION SCHEME

Antennas- Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays. Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

UNIT IV RECEIVERS

Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff

UNIT IV PERFORMANCE MEASURES AND SYSTEM EXAMPLES

Outage, average snr, average symbol/bit error rate - GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Suggested Readings

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.
2. T. S. Rappaport, Wireless digital communications: Principles and practice, 2nd Ed.,Prentice Hall India, 2007.
3. W. C. Y. Lee, Wireless and cellular telecommunications, 3rd Ed., MGH, 2006.
4. G. L. Stuber, Principles of mobile communications, 2nd Ed., Springer, 2007.
5. Simon Haykin and Michael Moher, Modern Wireless Communication, Pearson education, 2005.
6. A. Paulraj, R. Nabar and D. Gore, Introduction to Space-Time Wireless Communication, Cambridge University Press, 2003.
7. M. K. h Simon and M. Alouini, Digital Communication over Fading Channels, 2nd Ed. John Wiley and Sons, 2005.

Semester-VII

19BEEC7E12 DIGITAL IMAGE AND VIDEO PROCESSING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To provide the fundamentals of image and video processing.
- To study smoothing and sharpening of images
- To learn basics of video coding
- To imparts a good knowledge in various video coding standards like MPEG and H.26X.
- To familiarize the students with the the images for enhancement of certain properties or for optimized use of the resources.
- To inculate colour transformations.

Course Outcomes

At the end of the course the students will demonstrate the ability to

- Mathematically represent the various types of images and analyze them.
- Understand the segmentation process.
- Gain knowledge on Multi resolution analysis.
- Process the images for enhancement of certain properties or for optimized use of the resources.
- Understand about video coding and compression techniques.
- Develop algorithms for image compression and coding

UNIT I IMAGE FUNDAMENTALS AND FILTERING

Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency,connectivity, distance measures. Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

UNIT II PROCESSING AND SEGMENTATION

Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

UNIT III MULTI RESOLUTION IMAGE PROCESSING

Uncertainty principles of Fourier Transform, Time frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets. Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform;

Still image compression standards–JPEG and JPEG-2000.

UNIT IV FUNDAMENTALS OF VIDEO CODING

Inter-frame redundancy, motion estimation techniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy–Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

UNIT V VIDEO SEGMENTATION

Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation–motion-based; Video object detection and tracking.

Suggested Readings

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015

Semester-VIII

19BEEC8E01 **FPGA DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To Provide an understanding of FPGA lifecycle
- To understand the concept of selecting a FPGA based on project specifications
- To enable the student to understand the floor planning, place and route optimization techniques.
- To introduce the lower power reduction techniques to analyze and design FPGA.
- To imparts a good knowledge in logical replications-I/O registers.
- To familiarize the students with the power consumption reduction techniques

Course Outcomes

At the end of the course the students will be able to

- Understand FPGA lifecycle
- Gain knowledge on FPGA Architecture
- Learn Implementation issues.
- To select a FPGA based on project specifications
- Understand the floor planning, place and route optimization techniques.
- Knowledge on lower power reduction techniques to analyze and design FPGA.

UNIT I INTRODUCTION TO GATE ARRAY AND CMOS LOGIC

Types of gate array–Design flow-CMOS Logic-Combinational–Sequential–Data path–Transistor as resistor–Capacitance-Hardware description language.

UNIT II FIELD PROGRAMMABLE GATE ARRAY

FPGA Architecture- Altera FPGA technologies- Xilinx FPGA technologies – Lattice FPGA technologies- Actel FPGA technologies.

UNIT III FPGA IMPLEMENTATION ISSUES

Lookuptables–Memory availability-Fixed coefficient design technique–Distributed arithmetic.

UNIT IV FLOOR PLANNING, PLACE AND ROUTE OPTIMIZATION

Design Partitioning-Optimal floor planning–Relationship between placement and routing–Logical Replications-I/O registers–Register Ordering-Placement seed.

UNIT V LOW POWER FPGA IMPLEMENTATION

Sources of power Consumption-Power consumption reduction Techniques-Voltage scaling FPGA's– Data reordering- Pipeline.

Suggested Readings

1. Steve Kilts Advanced FPGA Design Wiley Inter- Science,2003
2. Roger Woods, John McAllister, Ying Yi, Gaye Lightbody FPGA-based Implementation of Signal Processing Systems Wiley 2008.
3. M.J. S. Smith Application Specific Integrated Circuits Pearson 2003.

Semester-VIII

19BEEC8E02 **FIBER OPTIC COMMUNICATION** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To Provide a knowledge on principles of fibre optic communication and design of optical networks.
- To imparts a good knowledge in introduction to optical receiver operation.
- To familiarize the students with the intra model dispersion, inter model dispersion.
- To inculate the basics of point–to–point links.
- To acquaint the student with basics of optical amplifiers and networks.
- To make the student acquire knowledge of fiber alignment and joint loss.

Course Outcomes

At the end of the course the students will be able to

- Ability to understand the principles fiber-optic communication, the components and the bandwidth advantages.
- Know about Optical sources and detectors
- Learned the properties of the optical fibers and Connectors.
- Understand operation of lasers, LEDs, and detectors
- Understand the application of analog and digital links in optical communication systems
- Gain knowledge on optical amplifiers and networks.

UNIT I OVERVIEW OF OPTICAL FIBER COMMUNICATION

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers. Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT II OPTICAL SOURCES DETECTORS AND RECEIVERS

Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors .Introduction to Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers.

UNIT III FIBER COUPLERS AND CONNECTORS

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT IV ANALOG AND DIGITAL LINKS

Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT V OPTICAL AMPLIFIERS AND NETWORKS

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

Suggested Readings

1. St 1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press,1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Semester-VIII

19BEEC8E03 **WAVELETS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To expose the students to the basics of wavelet theory
- To expose the students to CWT
- To illustrate the application of wavelet.
- To imparts a good knowledge in construction and computation of the discrete wavelet transform.
- To familiarize the students with the wavelet based signal de-noising and energy compaction.
- To inculate the continuous wavelets and inverse continuous wavelet transform.

Course Outcomes

At the end of the course the students will be able to

- Understand time-frequency nature of the signals.
- Apply Continuous wavelet transform on signals and Images.
- Design Filter banks
- Understand the concept of Multi resolution analysis
- Apply the concept of wavelets to practical problems
- Mathematically analyze the systems or process the signals using appropriate wavelet functions.

UNIT I INTRODUCTION

Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Timefrequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

UNIT II CONTINUOUS WAVELET TRANSFORM

Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain.

UNIT III DISCRETE WAVELET TRANSFORM AND FILTERBANKS

Orthogonal and biorthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

UNIT IV MULTI RESOLUTION ANALYSIS

Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packets

UNIT V APPLICATIONS

Signal and Image compression, Detection of signal changes, analysis and classification of audio signals using CWT, Wavelet based signal de-noising and energy compaction, Wavelets in adaptive filtering, Adaptive wavelet techniques in signal acquisition, coding and lossy transmission, Digital Communication and Multicarrier Modulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

Suggested Readings

1. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J.C. Goswami and A.K.
2. Chan, 2nd ed., Wiley, 2011.
3. Wavelets and their Applications, Michel Misiti, Yves Misiti, Georges Oppenheim, JeanMichel
4. Poggi, John Wiley & Sons, 2010 .
5. A premier on Wavelets and their scientific applications, J S Walker, CRC press, 2002.
6. Wavelets and signal processing: An application based introduction, Stark, Springer, 2005.
7. A friendly guide to Wavelets, Gerald keiser, Springer, 2011.
8. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Pearson Education, 2004.
9. Wavelets : from math too practice, Desanka.P.Radunovik, springer, 2009.
10. Insight into wavelets from theory to practice, K P Soman and KL Ramachandran, PHI, 2008.

Semester-VIII

19BEEC8E04 HIGH SPEED NETWORKS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To Provide knowledge about high speed networks, congestion control and traffic management mechanism and also about protocols for QoS support.
- To imparts a good knowledge in wireless LANs and high speed LANs
- To familiarize the students with the ATM protocol architecture.
- To inculcate the congestion control in packet switching networks.
- To divulge the basics of RSVP.
- To make the student acquire Integrated Services Architecture.

Course Outcomes

At the end of the course the students will be able to

- Understand significance and the areas of application of high-speed networks.
- Gain knowledge on ATM Protocols.
- Understand the congestion control mechanisms
- Design of traffic free network
- Kknowledge about ISDN architecture and its services
- Gain exposure on various protocols for QoS support.

UNIT I HIGH SPEED NETWORKS

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture,ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT II CONGESTION AND TRAFFIC MANAGEMENT

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion –Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III TCP AND ATM CONGESTION CONTROL

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNIT V PROTOCOLS FOR QOS SUPPORT

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

Suggested Readings

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.
2. Warland, Pravin Varaiya, "High performance communication networks", Second Edition , Jean Harcourt Asia Pvt. Ltd., , 2001.
3. Irvan Pepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
4. Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", CRC Press, New York, 2004.

Semester-VIII

19BEEC8E05	**Error correcting codes**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To gain exposure on classical and modern correcting codes
- To imparts a good knowledge in finite fields and finite rings.
- To familiarize the students with the Berlekamp's decoding algorithm
- To inculate with massey's minimum shift register synthesis technique.
- To acquaint the student with the basics of idempotents and Mattson-Solomon polynomials.
- To make the student acquire wozencraft's sequential decoding algorithm.

Course Outcomes

At the end of the course the students will be able to

- Understand various linear codes.
- Gain knowledge about perfect codes
- Learn about Cyclic codes and method of decoding.
- Know about cyclic codes and its properties
- Apply properties of Cyclic codes
- Gain knowledge about convolution codes

UNIT I LINEAR CODES:

Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels;

UNIT II PERFECT CODES:

Hamming codes; Weight enumerators and the McWilliams identities; Introduction to finite fields and finite rings; factorization of (X^n-1) over a finite field;

UNIT III CYCLIC CODES:

Cyclic Codes.BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes;

UNIT IV PROPERTIES OF CYCLIC CODES

Spectral properties of cyclic codes.; Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp – Massey algorithm.

UNIT V CONVOLUTION CODES

Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

Suggested Readings

1. P. V. Kumar, M. Win, H-F. Lu, C. Georghiades, "Error-Control Coding Techniques and Applications", Chapter 17 in Optical Fiber Telecommunications IV-B: Systems and Impairments, Editors: Ivan P. Kaminow and Tingye Li, Elsevier Science Press, 2002.
2. F.J. MacWilliams and N. J. A. Sloane, The Theory of Error-Correcting Codes, North-Holland, 1977.
3. Tom Richardson and Ruediger Urbanke, Modern Coding Theory, Cambridge University Press, 2008.
4. W. C. Huffman and V. Pless, Fundamentals of Error-Correcting Codes, Cambridge University Press, 2003.
5. Shu Lin and D. J. Costello, ErrorControl Coding, Second Edition, Pearson Press, 2004

19BEEC8E06 **ADAPTIVE SIGNAL PROCESSING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To Provide a knowledge ion filters and various algorithms used for adaptive signal processing
- To imparts a good knowledge in Correlation structures and its properties.
- To familiarize the students with the variants of the LMS algorithm.
- To make the student to acquire the knowledge in recursive least squares (RLS).
- To acquaint the student with concepts of orthogonal projection and decomposition of vector spaces.
- To inculate the concepts of QR decomposition and systolic array.

Course Outcomes

At the end of the course the students will be able to

- Understand the non-linear control, the need and significance of changing the control parameters with respect to. real-time situation.
- Design FIR filter
- Mathematically represent the 'adaptability requirement'.
- Design using lattice filters
- Design using RLS filters
- Understand the mathematical treatment for the modeling and design of the signal processing systems.

UNIT I INTRODUCTION

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

UNIT II OPTIMAL FILTER

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment. Variants of the LMS algorithm: the sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

UNIT III VECTOR SPACES:

Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of

vector spaces. Vector space of random variables, correlation as inner product, forward andbackward projections,

UNIT IV LATTICE FILTERS

Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

UNIT V INTRODUCTION TO RLS FILTERS

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Suggested Readings

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 2009.

19BEEC8E07 **WIRELESS SENSOR NETWORKS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study about Wireless networks architecture and standards.
- To study about localization techniques
- To study about network and routing protocols
- To imparts a good knowledge in single-hop and multihop localization.
- To familiarize the students with the design principles and service interfaces of WSNs.
- To acquaint the student with MAC protocols and routing protocols.

Course Outcomes

At the end of the course the students will be able to

- Design wireless sensor networks for a given application
- Gain knowledge on network architecture
- Deploy and configure any network
- Understand emerging research areas in the field of sensor networks
- Understand MAC protocols used for different communication standards used in WSN
- Explore new protocols for WSN

UNIT I INTRODUCTION

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks

UNIT II NETWORK ARCHITECTURE

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

UNIT III DEPLOYMENT AND CONFIGURATION

Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management.

UNIT IV NETWORK AND ROUTING PROTOCOLS

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

UNIT V DATA STORAGE AND MANIPULATION

Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.

Suggested Readings

1. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Ed. 2004 (ISBN: 13-978- 1-55860-914-3)
4. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
5. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press.
6. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag.

Semester-VIII

19BEEC8E08 **ASIC DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To give basic knowledge of ASIC internals.
- To impart knowledge on ASIC types.
- To give basic understanding of tools used.
- To make the students acquire the design of ASIC library.
- To make the student acquire the knowledge of automatic test pattern generation algorithm.
- To acquaint the student with the introduction of SOC

Course Outcomes

At the end of the course the students will be able to

- Understand basic knowledge of ASIC.
- Know about the types of ASIC.
- Do Programming with ASIC
- Simulate and synhezise any circuit
- Perform testing of ASIC
- Gain knowledge about the tools used in ASIC design.

UNIT I INTRODUCTION TO ASICS

Introduction to ASICs: Full-custom and Semi-custom ASIC–CMOS logic –ASIC library design.

UNIT II PROGRAMMABLE ASICS

Programmable ASICs–Anti fuse–static RAM–EPROM and technology–Actel ACT–Xilinx LCA –Altera flex–Altera MAX Logic cells– I/O cells–Interconnects– Low level design entry: Schematic entry.

UNIT III SIMULATION AND SYNTHESIS

Logic synthesis: A comparator MUX, inside a logic synthesizer, VHDL and logic synthesis, FSM synthesis, memory synthesis–Simulation: Types of simulation–logic systems–how logic simulation works.

UNIT IV ASIC TESTING

Boundary scantest– Faults–Fault simulation–Automatic test pattern generation algorithm: D-algorithm, PODEM –Built in self-test.

UNIT V ASIC CONSTURCTION

System partitioning–power dissipation–partitioning methods–floor planning and placement: – Routing: Global routing, detailed routing, special routing–Introduction to SOC.

Suggested Readings

1. M.J. S. Smith Application Specific Integrated Circuits Pearson Education Reprint 2006
2. Wolf Wayne FPGA based system design Pearson Education 2005
3. M. Sarafzadeh and C.K. Wong An Introduction to VLSI Physical Design McGraw Hill 1996
4. JanM.Rabaey Anantha Chandra kasan, Borivoje Nikolic Digital Integrated Circuits Prentice-Hall Publication 2002

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B.E Electronics and Communication Engineering **2019-2020**

19BESHOE01	**SOLID WASTE MANAGEMENT**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

- To make the students conversant with basics of Solid wastesand its classification.
- To make the student acquire sound knowledge of different treatments of solid wastes.
- To acquaint the student with concepts of waste disposals.
- To develop an understanding of the basic concepts of Hazardous waste managements.
- To acquaint the students with the basics of energy generation from waste materials.
- To divulge the sanitary land fill method of solid waste disposal.

Course Outcome:

- Outline the basic principles of Solid waste and separation of wastes
- Identify the concepts of treatment of solid wastes
- Identify the methods of wastes disposals.
- Examine the level of Hazardousness and its management.
- Examine the possible of the energy production using waste materials.
- Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I SOLID WASTE

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III WASTE DISPOSAL

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV HAZARDOUS WASTE MANAGEMENT

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous

Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V ENERGY GENERATION FROM WASTE

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, Energy recovery systems. Biological & Chemical conversion technologies – Aerobic composting, low solids.Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

Suggested Readings:

1. Dara.S.S,Mishra.D.D, A Text book of Environmental Chemistry and Pollution Control, S.Chand and Company Ltd., New Delhi.2011.
2. Naomi B. Klinghoffer and Marco J. Castaldi,Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy),Woodhead Publishing Ltd., Cambridge, UK,2013.
3. Frank Kreith, George Tchobanoglous,Hand Book of Solid Waste Management- 2nd edition, McGraw Hill Publishing Ltd., Newyork,2002.
4. Shah, L Kanti, Basics of Solid & Hazardous Waste Management Technology, Prentice Hall (P) Ltd.,New Delhi.1999.
5. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
6. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
7. www.alternative-energy-news.info/technology/garbage-energy/
8. nzic.org.nz/ChemProcesses/environment/

19BESHOE02 **GREEN CHEMISTRY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To make the students conversant about the green chemistry
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- To imparts a good knowledge in green fuels, e-green propellants and bio catalysts.

Course Outcomes

- Outline the basic principles of green chemistry
- Examine the different atom efficient process and synthesis elaborately
- Apply the concepts combustion of green technology
- Identify and apply the concepts of renewable energy
- Apply the concepts of green catalysts in the synthesis
- Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air.Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

Suggested Readings:

1. Sanjay K. Sharma, AckmezMudhoo,Green Chemistry for Environmental Sustainability,CRC Press , London,2010
2. Ahluwalia V. K. and M.Kidwai,New Trends in Green Chemistry 2nd edition,Anamaya publishers., New Delhi,2007.
3. Dr. SunitaRatan,A Textbook of Engineering Chemistry,S.K. Kataria and Sons., New Delhi.,2012.
4. MukeshDoble. Ken Rollins, Anil Kumar,Green Chemistry and Engineering, 1st edition, Academic Press, Elesevier., New Delhi.2007.
5. Desai K. R.,GreenChemistry, Himalaya Publishing House, Mumbai.,2005.
6. Matlack A. S.,Introduction to Green Chemistry.,Marcel Dekker: New York,2001.
7. http://www.organic-chemistry.org/topics/green-chemistry.shtm
8. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
9. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
10. http://www.epa.gov/research/greenchemistry/
11. http://www.amazon.in/Green-Chemistry-Catalysis

19BESHOE03 APPLIED ELECTROCHEMISTRY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Objectives

- To make the students conversant with the information on electrochemical material.
- To make the student acquire sound knowledge of conducting polymers.
- To acquaint the student with concepts of Energy storage devices.
- To develop energy storage devices.
- To inculate the basics of amorphous silicon solar cells and photo electrochemical cells.
- To imparts a good knowledge in primary and secondary batteries.

Course Outcomes

1. Outline the basic principles of chemistry in electrochemical material (K)
2. Examine the properties of conducting polymers(S)
3. Apply the concepts of electrochemistry in storage devices.(S)
4. Identify the concepts of storage devices and its applications. (S)
5. Apply the suitable materials for the manufacturing of storage devices. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I METAL FINISHING

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning.

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS

lectropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers- poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III BATTERIES AND POWER SOURCES-I

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV BATTERIES AND POWER SOURCES-II

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIAL SCIENCE

Solar cells- Preparation of CdS/Cu_2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics

Suggested Readings:

1. Cynthia G. Zoski,Hand Book of Electrochemistry,Academic Press, Elesevier., UK,2007.
2. D.Pletcher and F.C.Walsh,Industrial Electrochemistry,Chapman and Hall, London,1990.
3. M. Barak,Electrochemical Power Sources,I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.1997.
4. Bruno Scrosati,Applications of Electroactive Polymers,Chapman & Hall, London,1993.
5. K.L. Chopra and I. Kaur,Thin Film Devices and their Application,Plenum Press, New York.1983.
6. M.M.Baizer,Organic Electrochemistry,Dekker Inc. New York,1983.
7. http://www.anoplate.com/finishes/
8. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
9. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

19BESHOE04	**INDUSTRIAL CHEMISTRY**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

- To make the students conversant with cement and lime and its uses.
- To make the student acquire sound knowledge of abrasives and refractories.
- To acquaint the student with concepts of inorganic chemicals.
- To develop an understanding of the basic concepts explosives.
- To acquaint the students with the basics of agriculture chemicals.
- To imparts a good knowledge about classification refractories.

Course Outcomes:

- Outline the basic chemistry of cement and lime (K)
- Examine the uses of abrasives and refractories (S)
- Identify the usage of the inorganic chemicals. (S)
- Diagnose the concepts of explosives and smoke screens(S)
- Identify the usage of the agriculture chemicals(S)
- Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I CEMENT AND LIME

Manufacture of Portland cement – settling of hardening of portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

UNIT II ABRASIVES AND REFRACTORIES

Abrasives – hard abrasives – siliceous abrasives – soft abrasives – artificial abrasives – uses. Refractories – definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

UNIT III INORGANIC CHEMICALS

Common salt and soda ash – manufacture – different grades – products – alkalis – Na_2CO_3, caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture – absorption – uses, sulphur and sulphuric acid – extraction of sulphur – manufacture of H_2SO_4 – chamber – contact processes – industrial uses.

UNIT IV EXPLOSIVES

Explosives – uses – properties and tests – explosives for war – nitrocellulose – picric acid and T.N.T. – industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gas mask.

UNIT V AGRICULTURE CHEMICALS

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

Suggested Readings:

1. Harikrishan, ndustrial Chemistry, Goel Publishing House, Meerut.,2014.
2. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.,2000.
3. B.N.Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing CO. New Delhi.1998.
4. James A. Kent, Hand Book of Industrial Chemistry, 9th edition, Van Nostrand Reinhold, New York.1992.
5. R.N. Sherve, Chemical Process Industries, McGraw-Hill, Kugakuisha Ltd., Tokyo.1984.
6. S.D. Shukla and G.N. Pandy, A Text book of Chemical Technology, Vikas Publishing
7. House (P) Ltd, New Delhi.1979.
8. http://en.wikipedia.org/wiki/Cement
9. http://www.hon.ch/HONselect/Selection/D01.html
10. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
11. http://toxics.usgs.gov/topics/agchemicals.html

19BESHOE05 **TECHNICAL WRITING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

- Develop abilities to write technically and expressively,
- Recognize writing as a constructive, meaningful process.
- Practice using reading strategies for effective writing.
- Design effective technical documents for both print and digital media
- Identify the qualities of good technical writing.
- To imparts a good knowledge about organizing the structure of thesis and articles.

Course outcomes

Students undergoing this course are able to

- Construct simple sentences, correct common grammatical errors in written English.
- Build confidence in English language by imbibing lexical and syntax rules.
- Enrich their reading ability for effective writing.
- Minimize word, sentence, and paragraph length without sacrificing clarity or substance
- Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
- Understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

UNIT I BASICS OF WRITING

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer's block – Prioritizing for effective writing– Avoiding plagiarism.

UNIT II PARAGRAPHS AND ESSAYS

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

UNIT III LETTERS, MEMOS AND EMAIL

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

UNITIV THE ART OF CONDENSATION AND TECHNICAL PROPOSALS

Steps to Effective précis writing – Guidelines – Technical Proposals – Types of Proposals – Characteristics – Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /Film Review – Travelogue – Dialogue Writing.

UNIT V REPORTS AND RESEARCH ARTICLES

Discussion of newspaper articles -Objectives of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

Suggested Readings

1. V.N. Arora & Lakshmi Chandra, Improve Your Writing: Revised First Edition, OUP, New Delhi. 2014.
2. David Morley, The Cambridge Intro. to Creative Writing, CUP, New Delhi.2010.
3. Graham King, Collins Improve Your Writing Collins; First edition, UK 2009
4. Crème, P. and M. Lea.Writing at University: A guide for students.OUP, New Delhi.2003
5. http://www.stevepavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/http://www.nyu.edu/classes/keefer/brain/net2.html
6. https://www.udemy.com/technical-writing-and-editing/
7. http://techwhirl.com/what-is-technical-writing/

19BESHOE06 **GEOPHYSICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To inculcate the basics of brief history of Earth sciences (K)
- To divulge knowledge on the basics of structure of earth and earth's gravitational field.(S)
- To disseminate the fundamentals of magnetic field and thermal distribution of earth(K)
- To introduce the concepts of seismology and seismic waves (S) .
- To impart the basic knowledge of oceans (K)
- To divulge knowledge on the basics of continental drift and plate tectonics.

Course Outcomes

- Gain knowledge on the basics of history of Earth sciences.
- Acquire knowledge on concepts of structure of earth and earth's gravitational field.
- Knowledge on the concepts of magnetic field and thermal distribution of earth
- Familiarity on the basics of seismic waves.
- Understand the basics of oceans and properties of sea water.
- Application of gained knowledge from this course to solve the relevant propblems in engineering stream.

UNIT I ORIGIN OF EARTH

A brief history of the development of Earth Sciences . An overview of Geophysical methods and their essential features, Problems of inversion and non-uniqueness in Geophysics, Origin & evolution of Solar system, Earth and Moon structure,.Kepler's law of planetary motion, A review of the Earth's structure and composition

UNIT II STRUCTURE OF EARTH

Chemical composition of Earth, Rheological behavior of crust and upper mantle, viscoelasticity and rock failure criteria, Geochronology: Radiometric dating and their advantages, meaning of radiometric ages, Major features of the Earth's gravitational field and relationship with tectonic processes in the crust and upper mantle, concept of isostasy, mathematical concept of Airy and Pratt hypotheses of isostasy

UNIT III MAGNETIC FIELD AND THERMAL DISTRUBUTION OF EARTH

Origin of geomagnetic field, polar wandering, secular variations and westward drift, reversals of geomagnetic field, sun spot, solar flares, geomagnetic storms, sea-floor spreading, Paleomagnetism and its uses, Thermal history of the Earth, sources of heat generation and temperature distribution inside the earth, convection in the mantle

UNIT IV SEISMOLOGY

Earthquake seismology, Earthquakes and its classifications, Global seismicity and tectonics, Earth's internal structure derived from seismology, Earthquake mechanism and Anderson's theory of faulting,

Continental drift and plate tectonics: its essential features, present day plate motions, Triple junctions, oceanic ridges, Benioff zones, arcs, hot spots, Mantle Plume, Mountain building, origin of Himalaya, Geodynamics of Indian subcontinent.

UNIT V OCEANS

Physical properties of seawater and methods of determination, distribution of salinity in the oceans, factors affecting salinity, water masses and water type, TS Diagram, Circulation of currents in major ocean waves. Tides: Dynamical and equilibrium theory of tides. Marine pollution, steps to control marine pollution, Laws of seas, Coastal zone management

Suggested Readings

1. B.F. Howell,Introduction to Geophysics, McGraw-Hill,2007.
2. W. Lowrie,Fundamentals of Geophysics, Cambridge University Press,2007.
3. J.A. Jacobs, R.D. Russel,Physics and Geology, McGraw-Hill.2002.
4. www. ocw.mit.edu
5. www.physicsclassroom.com
6. www.nptel.ac.in
7. www.physics.org

19BESHOE07 **ENGINEERING ACOUSTICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To disseminate the fundamentals of acoustic waves. (K)
- To inculcate the characteristics of radiation and reception of acoustic waves. (K)
- To divulge knowledge on the basics of pipe resonators and filters.(S)
- To introduce the features of architectural acoustics.**(S)**
- To impart the basic knowledge of transducers and receivers.(K)
- To familiarize the students with the fundamental properties of hearing.

Course Outcome

- Develop the idea of the fundamentals of acoustic waves.
- Apply the concepts of radiation and reception of acoustic waves.
- Explain the basic ideas of pipe resonators and filters.
- Illustrate the basics of architectural acoustics.
- Illustrate the transducers and receivers and its applications in various electronic devices.
- Apply the knowledge inputs of the course for engineering applications.

UNIT I INTRODUCTION

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves - Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales.Reflection and Transmission:Transmission from one fluid to another normal and oblique incidence –method ofimages.

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line sourceradiation impedance - Fundamental properties of transducers.Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III PIPES RESONATORS AND FILTERS

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters – low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

UNIT IV ARCHITECTURAL ACOUSTICS

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design.
Environmental Acoustics: Highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

UNIT V TRANSDUCTION

Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker– horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

Suggested Readings

1. LawerenceE.Kinsler, Austin R.Frey, Fundamentals of Acoustics, John Wiley & Sons, 4th edition 2000.
2. F. AltonEverest & Ken Pohlmann, Master Handbook of Acoustics, McGraw Hill Professional, 6th edition 2014.
3. www.acousticalsociety.org
4. www.acoustics-engineering.com
5. www.nptel.ac.in
6. www. ocw.mit.edu

19BESHOE08 INDUSTRIAL MATHEMATICS – I 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To develop analytical skills for solving engineering problems
- To teach the students the basic concepts of LPP,
- To learn the techniques to solve transportation and Assignment problems
- To make the students to study about the Integer Programming and Network Analysis
- Analyse the results and propose recommendations to the decision-making processes in Management Engineering.
- To divulge knowledge on the basics of networks and graphs.

Course outcomes

- Defining and formulate linear programming problems and appreciate their limitations.
- Solving linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
- Ability to build and solve Transportation Models, Assignment Models,
- Construct linear integer programming models and discuss the solution techniques.
- Formulate and solve problems as networks and graphs.
- Capability to solve problems in different environments and develop critical thinking

UNIT I LINEAR PROGRAMMING PROBLEM

Formulation of LPP - Graphical Method - Simplex Method - Artificial variable technique and two phase simplex method. Duality - Dual and simplex method - Dual Simplex Method .

UNIT II TRANSPORTATION PROBLEM

Transportation Model, finding initial basic feasible solutions, moving towards optimality, Degeneracy.

UNIT III ASSIGNMENT PROBLEM

Solution of an Assignment problem, Multiple Solution, Hungarian Algorithm, Maximization in Assignment Model, Impossible Assignment.

UNIT IV INTEGER PROGRAMMING

Integer Programming Problem – Gromory's fractional cut Method – Branch Bound Method

UNIT V NETWORK ANALYSIS

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis.

Suggested Readings

1. HamdyTaha. A., Operations Research, Prentice – Hall of India Private Limited, New Delhi.2013.
2. KantiSwarup, Manmohan, Gupta, Operations Research, Sultan Chand & Sons, New Delhi.2010.

3. Natarajan A.M., Balasubramani P., Thamilarasi A, Operations Research, Pearson Education, New Delhi.2005.
4. Srinivasan G, Operations Research: Principles and Applications, PHI Private Limited, New Delhi.2007.
5. Winston, Operations Research, Applications and Algorithms, Cengage Learning India Pvt. Ltd, New Delhi,2004.
6. www.mathworld.
7. Wolfram.com
8. www.mit.edu
9. **www.nptel.com**

19BESHOE09 INDUSTRIAL MATHEMATICS – II 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To kindle analytical skills for solving engineering problems
- To impact the knowledge about inventory models
- To learn replacement models and simulation models
- To provide techniques for effective methods to solve nonlinear programming and decision making.
- To analyze the results and propose recommendations to the decision-making processes in management Engineering.
- To divulge knowledge on the basics of tree analysis.

Course Outcome

The students will

- Able to solve simple models in Inventory problems and Replacement problems.
- Understand different queuing situations and find the optimal solutions using models for different situations.
- Simulate different real life probabilistic situations using Monte Carlo simulation technique.
- Able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
- Convert and solve the practical situations into replacement models.
- Understand how to model and solve problems using non integer programming.

UNIT – I INVENTORY MODELS

Economic order quantity models-techniques in inventory management-ABC analysis.

UNIT – II NON LINEAR PROGRAMMING

Khun-tucker conditions with non-negative constraints- Quadratic programming- Wolf's modified simplex method.

UNIT – III SIMULATION MODELS

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1): (∞\FIFO) , (M\M\c): (∞\FIFO) Models.

UNIT -IV DECISION MODELS

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

UNIT -V REPLACEMENT MODELS

Models based on models that gradually detoriate with time-whose maintenance cost increase with time-Replacement of items that fail suddenly and completely.

Suggested Readings

1. HamdyTaha. A., Operations Research, Prentice – Hall of India Private Limited, New Delhi.2013.
2. KantiSwarup, Manmohan, Gupta, Operations Research, Sultan Chand & Sons, New Delhi.2010.
3. Natarajan A.M., Balasubramani P., Thamilarasi A, Operations Research, Pearson Education, New Delhi.2005.
4. Srinivasan G, Operations Research: Principles and Applications, PHI Private Limited, New Delhi.2007.
5. Winston, Operations Research, Applications and Algorithms, Cengage Learning India Pvt. Ltd, New Delhi,2004.
6. www.mathworld.
7. Wolfram.com
8. www.mit.edu
9. **www.nptel.com**

19BESHOE10 **FUZZY MATHEMATICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Be able to understand basic knowledge of fuzzy sets and fuzzy logic
- Be able to apply basic knowledge of fuzzy operations.
- To know the basic definitions of fuzzy relations
- Be able to apply basic fuzzy inference and approximate reasoning
- To know the applications of fuzzy Technology.
- To divulge knowledge on the basics of Fuzzy functional equations.

Course Outcome

- Gain the idea of main subject of fuzzy sets.
- Understand the concept of fuzziness involved in various systems and fuzzy set theory.
- Knowledge about the methods of fuzzy logic.
- Ability to comprehend the concepts of fuzzy relations.
- Analyze the application of fuzzy logic control to real time systems.
- The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I FUZZY SETS

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II OPERATIONS ON FUZZY SETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V FUZZY INFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Suggested Readings

1. George J Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic : Theory and Applications, Prentice Hall of India, New Delhi,2003.
2. Zimmermann H.J. Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.2001.
3. Michal Baczynski and BalasubramaniamJayaram, Fuzzy Implications, Springer-Verlag publishers, Heidelberg,2008
4. Kevin M Passino and Stephen Yurkovich, Fuzzy Control, Addison Wesley Longman publishers, USA,1998.

19BESHOE11 MATHEMATICAL PHYSICS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

- To know the fundamentals of Tensors.
- To know the series solutions to differential equations.
- To introduce the concepts of special functions.
- To study about Calculus of variations and integral equations
- Be familiar with the main mathematical methods used in physics.
- To divulge knowledge about integral equations of the convolution type.

Course Outcomes

- Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
- Learn about special type of matrices that are relevant in physics and then learn about tensors.
- Get introduced to Special functions like Bessel, Legendre , Hermite and Laguerre functions and their recurrence relations
- Learn different ways of solving second order differential equations and familiarized with singular points and Frobenius method.
- Students will master in calculus of variations and linear integral equations.
- The students will have the knowledge on Mathematical Physics and that knowledge will be used by them in different engineering and technology applications.

UNIT I TENSORS

Definition of tensor - rank, symmetric tensors, contraction, quotient rule - tensors with zero components, tensor equations, metric tensors and their determinants - pseudo tensors

UNIT II DIFFERENTIAL EQUATIONS-SERIES SOLUTIONS

Series Solution : Classification of singularities of an ordinary differential equation - Series solution- Method of Frobenius - indicial equation - examples

UNIT III SPECIAL FUNCTIONS

Basic properties (Recurrence and Orthogonality relations, series expansion) of Bessel, Legendre ,Hermite and Laguerre functions – Generating Function

UNIT IV CALCULUS OF VARIATIONS

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric Problems – Direct methods – Ritz and Kantorovich methods.

UNIT V LINEAR INTEGRAL EQUATIONS

Introduction – conversion of a linear differential equation to an integral equations and vice versa – conversion of boundary value problem to integral equations using Green's function – solution of aintegral equation – integral equations of the convolution type – Abel's integral equations –integro– differential equations – integral equations with separable kernels – solution of Fredholm equations with separable kernels.

Suggested Readings:

1. Dr. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.2013.
2. Murray R Spiegel, Seymour Lipschutz, Dennis Spellman, Vector Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010
3. Stephenson, G, Radmore, P.M, Advanced Mathematical Methods for Engineering and Science students, Cambridge University Press India Pvt. Ltd., New Delhi,1990.
4. Andrews, Larry C. Special Functions of Mathematics for Engineers, Oxford Science publishers, New Delhi,1997.
5. www.mathcentre.ac.uk
6. www.mathworld.
7. wolfram.com
8. www.nptel.ac.in

19BESHOE12 **LINEAR ALGEBRA** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic concepts of vector space
- To know the fundamentals of linear Algebra
- To solve system of linear equations
- To study about the linear transformations
- To introduce the concepts of inner product spaces.
- To imparts a good knowledge about various methods to calculate system linear equations.

Course Outcomes

The student will be able to

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Apply the fundamental concepts in their respective engineering fields
- Visualize linear transformations as matrix form
- Recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
- Articulate the importance of Linear Algebra and its applications in branches of Mathematics.
- Acquire knowledge about the Dot Product on R^n and inner product spaces .

UNIT I VECTOR SPACES

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space,

UNIT II EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS

Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss-Jacobi method, Gauss–Seidel method, convergence criteria.

UNIT IV LINEAR TRANSFORMATIONS

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES

The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

Suggested Readings

1. Kreyszig,E, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.,2014.
2. Anton and Rorres, Elementary Linear Algebra, Applications version, Wiley India Edition, New Delhi,2012.
3. Jim Defranza, Daniel Gagliardi, Introduction to Linear Algebra with Application, Tata McGraw-Hill, New Delhi.2008.
4. wolfram.com
5. www.sosmath.com
6. www.nptel.ac.in
7. www.mathworld.

OPEN ELECTIVE
Computer Science and Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BECSOE01	**INTERNET PROGRAMMING**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the Java programming language and explore its current strengths and Weaknesses
- To study the way that object-oriented concepts are implemented in the Java programming language
- To write working Java code to demonstrate the use of applets for client side programming .
- To acquaint the student with IP subnetting and addressing.
- To imparts a good knowledge in network security techniques.
- To familiarize the students with the basics of CGI scripts.

Course Outcomes

After Completing the course the students,

- Understand the basic and advanced concepts& techniques of Java.
- Can generate an application based upon the concepts of java & advance java.
- Can Understand the way that exceptions are detected and handled in the Java programming language
- Can develop Java code that demonstrates multiple treads of execution .
- Gain the knowledge about working of Java code to demonstrate the use of applets for client side programming.
- Acquire the fundamentals of Java Applets.

UNIT I INTRODUCTION

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing, Subnetting

UNIT II HTML

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

UNIT III PERL

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular

Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets- Container Class, Components, Applet Life Cycle, Update method, Applications.

UNIT IV CLIENT-SERVER PROGRAMMING

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V INTERNET TELEPHONY

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Suggested Readings

1. Paul Deitel, Harvey Deitel and Abby Deitel, "Internet and World Wide Web-How to Program", 5th Edition, 2011.
2. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
3. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2011.
4. Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, 2016

19BECSOE02 **MULTIMEDIA AND ANIMATION** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study the graphics techniques and algorithms
- To study the multimedia concepts and various I/O technologies.
- To understand and gain the knowledge about theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.
- To acquaint the student with special effects of animation techniques.
- To imparts a good knowledge in 3D animation and its applications
- To familiarize the students with the basics of creation of 3D animation movies.

Course Outcomes

After Completing the course the students,

- Understand the fundamental concepts of Computer Animation and Multimedia.
- Can understand about various latest interactive multimedia devices, the basic concepts about images and image formats.
- Understand about data compression techniques, image compression techniques like JPEG, video compression techniques like MPEG.
- Understand the basic concepts about animation.
- Can develop an interactive multimedia presentation by using multimedia devices.
- Identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

UNIT I INTRODUCTION

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation – Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation.

UNIT II CREATING ANIMATION IN FLASH

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

UNIT III 3D ANIMATION & ITS CONCEPTS

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

UNIT IV MOTION CAPTION

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage

– Different Language of Script Animation Among the Software.

UNIT V CONCEPT DEVELOPMENT

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

Suggested Readings

1. Computer Graphics, Multimedia and Animation-Malay K. Pakhira,PHI Learning PVT Ltd,2010
2. Principles of Multimedia – Ranjan Parekh, 2007, TMH. (Unit I, Unit V)
3. Multimedia Technologies – Ashok Banerji, Ananda Mohan Ghosh – McGraw Hill Publication.
4. Encyclopedia of Multimedia and Animations-Pankaj Dhaka, Anmol Publications-2011

19BECSOE03 PC HARDWARE AND TROUBLE SHOOTING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To assemble/setup and upgrade personal computer systems
- To perform installation, configuration, and upgrading of microcomputer hardware and software.
- To install/connect associated peripherals.
- To acquaint the student with basics about caching, multi-threading, dual-core technology.
- To imparts a good knowledge about PC memories such as RAM and ROM devices.
- To familiarize the students with the disk technologies and the IDE systems.

Course Outcomes

After Completing the course the students,

- Can identify the main components for the PC.
- Can Understand about power supplies and the skills to trouble-shoot various power-related problems.
- Have an idea about the processor generations used in PCs starting from the first Intel generations to current CPU families. Also, students will familiarize themselves with terms that are directly related to processors such as: caching, multi-threading, Dual-core technology, multi-processing, and pipelining. Computer faults that are related to CPU problems will also be familiar to students.
- Familiarize themselves with PC memories such as RAM and ROM devices. This includes RAM types, RAM upgrading, ROM BIOS, and the CMOS chip.
- Know about motherboards and the various technologies connected to main boards such as Chipsets, Buses, and various BIOS types. Terms such as PCI, ISA, AGP, MCA, POST, Bootstrap loader, IDE controllers, Regulators, Heat sinks, and others will be familiar to the students.
- Learn how to prepare a HDD for storing data, installing Windows OS and various programs. This will be combined with the knowledge about disk technologies and the IDE systems. Students will learn skills such as installing IDE HDDs, high-level Formatting, and HDD partitioning using a variety of tools.

UNIT I INTRODUCTION

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques– Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC Hardware Overview

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V TROUBLESHOOTING

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

Suggested Readings

1. B. Govindarajalu, "IBM PC Clones Hardware, Troubleshooting and Maintenance", 2/E, TMH, 2002.
2. Peter Abel, Niyaz Nizamuddin, "IMB PC Assembly Language and Programming", Pearson Education, 2007
3. Scott Mueller, "Repairing PC's", PHI, 1992

19BECSOE04 **JAVA PROGRAMMING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To understand the basics of event handling.
- To gain the knowledge about graphics programming for I/O streams.
- To understand and gain the knowledge about various oobjects and classes in Java.
- To acquaint the student with multi-threaded programming.

Course Outcomes

After Completing the course the students,

- Can identify classes, objects, members of a class and relationships among them needed for a specific problem
- Demonstrate the concepts of polymorphism and inheritance
- Be aware of the important topics and principles of software development.
- Have the ability to write a computer program to solve specified problems.
- Be able to use the Java SDK environment to create, debug and run simple Java programs.
- Gain knowledge about multi-threaded programming.

UNIT I INTRODUCTION TO JAVA

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members –constructors – finalize method

UNIT II PACKAGES

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNIT III I/O STREAMS

The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes.

UNIT IV EXCEPTION HANDLING

Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT

event hierarchy – introduction to Swing – Model-View-Controller design pattern –buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions.

UNIT V MOTIVATION FOR GENERIC PROGRAMMING

Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics - Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – Executors – synchronizers.

Suggested Readings

1. Cay S. Horstmann and Gary Cornell Core Java: Volume I – Fundamentals Sun Microsystems Press 2008
2. K. Arnold and J. Gosling The JAVA programming language Third edition, Pearson Education, 2009
3. Timothy Budd Understanding Object-oriented programming with Java Updated Edition, Pearson Education 2002
4. C. Thomas Wu An introduction to Object-oriented programming with Java Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2008

Websites

1. http://elvis.rowan.edu/~kay/cpp/vc6_tutorial/
2. http://www.winprog.org/tutorial/msvc.html
3. http://www.tutorialized.com/tutorials/Visual-C/1
4. http://www.freeprogrammingresources.com/visualcpp.html

19BECSOE05 **MACHINE LEARNING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic concepts and techniques of Machine Learning.
- To have a complete understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To learn Dimensionality Reduction Techniques.
- To understand Evolutionary Models and Graphical models of machine learning algorithms.
- To familiarize the students with the basics of decision trees.

Course Outcomes

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

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the appropriate machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Design systems that uses the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification accuracy / efficiency.
- Understand the basics of decision trees

UNIT I INTRODUCTION

Foundations: Linear Algebra-Probability-Vectorization

Learning – Types of Machine Learning – Supervised Learning – Preliminaries-Testing Machine Learning Algorithms-Data into Probabilities – Basic Statistics-The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression-Logistic Regression

UNIT II LINEAR MODELS AND TREE

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Networks – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines-Introduction to Deep Learning.

UNIT III - PROBABILISTIC MODELS

Decision Trees – Constructing Decision Trees – Classification and Regression Trees –Feature Selection-Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning –Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K-Means and K-Medoids Algorithms – Vector Quantization – Self Organizing Feature Map-

Case Study 1 : Analysis of Feature Selection Algorithms for Real World Problems

Case Study 2 : Evaluation of Neural Network Model, Decision Trees and Support Vector Machines for Real World Problems

Case Study 3 : Evaluation of Clustering Algorithms such as K-Means and K-Medoids for Real World Problems

Case Study 4: Modify Supervised & Unsupervised Learning algorithms to improve the learning performance.

UNIT IV -DIMENSIONALITY REDUCTION, EVOLUTIONARY MODELS

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V - GRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Case Study 5 : Working with Dimensionality Reduction Algorithms for Real World Problems

Case Study 6 : Demonstrating the use of Evolutionary Algorithms to improve the efficiency of the algorithm / to optimization problem for Real World scenarios

Case Study 7 : Working with Markov Models and Bayesian Networks to forecast future for Real World scenarios

Suggested Readings

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014

3. Michael Bowles, Machine Learning in Python-Essential Techniques for Predictive Analysis, Wiley Publication, 2015.
4. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014
5. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
6. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013

Websites

1. 1) http://nptel.ac.in/courses/106106139/
2. 2)https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. 3) https://www.kdnuggets.com/2015/11/seven-steps-machine-learning-python.html
4. 4) https://www.dataquest.io/blog/machine-learning-python/
5. 5)https://www.analyticsvidhya.com/blog/2016/10/16-new-must-watch-tutorials-courses-on-machine-learning/

OPEN ELECTIVE
Electrical and Electronics Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BEEEOE01	**ELECTRIC HYBRID VEHICLE**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

Course Objectives

- To understand the basic concepts of electric hybrid vehicle.
- To gain the knowledge about electric propulsion unit.
- To understand and gain the knowledge about various energy storage devices.
- To acquaint the student with configuration and control of induction motor drives and permanent magnet motor drives.
- To imparts a good knowledge in fuel cell based energy storage and its analysis.
- To familiarize the students with the implementation issues of energy management strategies.

Course Outcomes:

- Summarize the basic concepts in bioprocess Engineering.
- Explain the concept of Hybrid Electric Vehicles.
- Understand the concept of Hybrid Electric Drive-Trains.
- Identify the different Energy Management Strategies.
- Understand the concept of different Energy Storage devices.
- Analyze the different motor drives used in Hybrid Electric Vehicles.

UNIT I INTRODUCTION

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Suggested Readings

1. Iqbal Hussein Electric and Hybrid Vehicles: Design Fundamentals CRC Press – 2nd edition 2010.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design Standardsmedia – 2nd edition 2009.
3. James Larminie, John Lowry Electric Vehicle Technology Wiley – 2nd edition 2012

19BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

Course Objectives:

- To gain the knowledge about energy management.
- To understand the basic concepts in economic analysis in energy management.
- To understand the basic principles of energy audit.
- To acquaint the student with application of PLCs in various fields.
- To imparts a good knowledge in economic analysis and replacement analysis.
- To familiarize the students with the construction details and characteristics of energy efficient motors

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concept of Energy Management.
- Analyze the different methods for economic analysis
- Knowledge about the basic concept of Energy Audit and types.
- Evaluate the different energy efficient motors
- Understand the concept of Energy conservation.
- Investigate the different methods to improve power factor.

UNIT I ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II ECONOMIC ASPECTS AND ANALYSIS

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV ENERGY EFFICIENT MOTORS

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air conditioning system- energy efficient transformers.

UNIT V POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice-lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

Suggested Readings

1. Murphy W.R. and G.Mckay Butter worth Energy Management Heinemann Publications 2007.
2. John.C. Andreas Energy Efficient Electric Motors Marcel Dekker Inc Ltd – 3rd edition 2005.
3. W.C.Turner Steve Doty Energy Management Handbook Lulu Enterprises, Inc. - 8th Edition Volume II 2013.

19BEEEOE03 PROGRAMMABLE LOGIC CONTROLLER 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

Course Objectives

- To understand the basic principles of PLC systems.
- To gain the knowledge about data handling functions.
- To understand the principles of PID.
- To acquaint the student with concepts of PLC registers and PLC functions.
- To imparts a good knowledge in construction of PLC ladder diagrams.
- To familiarize the students with PID principles position indicator with PID control.

Course Outcome

At the end of the course the student will be able to

- Understand the registers and functions in PLC and they are able to do the program.
- Analyze digital logic gates programming in the boolean algebra system
- Gain a good knowledge in ladder diagram construction and flow chart for spray process system.
- Understand the controlling of two axes and three axis Robots with PLC.
- Understand the concept of PID modules and tuning.
- Knowledge about the basics of PLC registers and PLC functions.

UNIT I INTRODUCTION

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II PLC PROGRAMMING

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

Suggested Readings

1. JR Hackworth and F.D Hackworth – Jr Programmable Logic Controllers – Programming Method and Applications Pearson 2006
2. John Webb and Ronald A Reiss Programmable Logic Controllers – Principle and Applications Fifth edition, PHI 2004
3. W.Bolton Programmable Logic controller Elsevier Newnes Publications, 5th Edition 2009

B.E Electronics and Communication Engineering

19BEEEOE04	RENEWABLE ENERGY RESOURCES	3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

Course Objectives

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
- To imparts a good knowledge in solar thermal conversion devices and its storage.
- To familiarize the students with various wind machines and its electric generation process.
- To understand the basic principles fuel cell, Geo thermal power plants.
- To gain the knowledge about hydro energy.

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Analyze the Energy Scenario in india
- Understand the concept of Solar Energy
- Understand the concept of Wind Energy
- Understand the concept of Hydro Energy
- Analyze the different energy sources.
- Gain a good knowledge in various applications of energy resources in domestic and industrial areas.

UNIT I INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT IV HYDRO ENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Suggested Readings

1. Rai.G.D Non-conventional sources of energy Khanna publishers 2011
2. Khan.B.H Non-Conventional Energy Resources The McGraw Hills, Second edition 2009
3. Rao.S. & Parulekar Energy Technology Khanna publishers, Eleventh Reprint 2013
4. Godfrey Boyl Renewable Energy: Power sustainable future Oxford University Press, Third edition 2012.
5. John W Twidell and Anthony D Weir Renewable Energy Resources Taylor and Francis – 3rd edition 2015.

OPEN ELECTIVE

B.Tech Biotechnology

B.E Electronics and Communication Engineering **2019-2020**

19BTBTOE01	**BIOREACTOR DESIGN**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart basic knowledge in bioprocess Engineering
- To design the bioreactors for various operations.
- To understand the principle and working of heat transfer equipments.
- To extend the knowledge in principle of heat transfer inside a bioreactor
- To construct the equipments used in mass transfer operations.
- To learn the equipments used in separation process.

Course Outcomes

- Summarize the basic concepts in bioprocess Engineering.
- Design the bioreactors for various operations.
- Develop the heat transfer equipments for Bioprocess Engineering.
- Construct the equipments used in mass transfer operations.
- Categorize the equipments used in separation process.
- Gain good knowledge to design of Bollmann extractor.

UNIT I INRODUCTION TO BIOPROCESS ENGINEERING

Introduction – Biotechnology and Bioprocess Engineering- Biologists and Engineers Differ in their approach to research-How Biologists and Engineers work Together- Bioprocesses: Regulatory constraints.

UNIT II REACTOR DESIGN

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III HEAT TRANSFER EQUIPMENTS

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

UNIT V SEPARATION EQUIPMENTS

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotary drum drier and Swenson –walker crystallizer.

Suggested Readings

1. James Edwin Bailey, David F. Ollis (2015) Biochemical Engineering Fundamentals, Second Edition. McGraw-Hill Education (India) private limited.
2. Don W. Green, Robert H.Perry (2008). Chemical Engineer Hand book. The McGraw-Hill Companies, Inc.
3. Pauline. M. Doran (2015). Bioprocess Engineering Principles Second Edition . Academic Press.

19BTBTOE02 FOOD PROCESSING AND PRESERVATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn the scope and importance of food processing.
- To impart basic knowledge in different food processing methods carried out in the food tech companies.
- To extend the brief knowledge in food conservation operations.
- To study the methods of food preservation by cooling.
- To familiarize the students on the concepts of preservation methods for fruits.
- To create deeper understanding on preservation methods for vegetables.

Course Outcomes

- Describe the scope and importance of food processing.
- Outline the various processing methods for foods.
- Extend the knowledge in food conservation operations.
- Describe the methods of food preservation by cooling.
- Summarize the preservation methods for fruits.
- Demonstrate the preservation methods for vegetables.

UNIT I SCOPE AND IMPORTANCE OF FOOD PROCESSING

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNIT II PROCESSING METHODS

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning-additives- fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing-Concepts and equipment used.

UNIT III FOOD CONVERSION OPERATIONS

Size reduction – Fibrous foods, dry foods and liquid theory and foods – equipments - membrane separation- filtration- equipment and application.

UNIT IV FOOD PRESERVATION BY COOLING

Refrigeration, Freezing-Theory, freezing time calculation, methods freezing of freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V PRESERVATION METHODS FOR FRUITS AND VEGETABLES

Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation– Food irradiation- Combined preservation techniques.

Suggested Readings

1. R. Paul Singh, Dennis R.Heldman (2014).Introduction to food engineering. Academic press.
2. P.Fellows.(2017). Food processing technology principles and practice, Fourth Edition. Wood head publishing Ltd.
3. Mircea Enachescu Dauthy. (1995). Food and vegetable processing.FAO agricultural services bulletin.
4. M.A. Rao, Syed S.H.Rizvi, Ashim K. Datta. (2014). Engineering properties of foods. CRC press.
5. B. Sivasankar. (2002). Food processing and preservation.PHI learning Pvt.Ltd.

19BTBTOE03 **BASIC BIOINFORMATICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand the available tools and databases for performing research in bioinformatics.
- To expose students to sequence alignment tool in bioinformatics.
- To construct the phylogenetic trees for evolution.
- To get familiar with the 3D structure of protein and classification.
- To acquire basic knowledge in protein secondary structure prediction.
- To extend the brief knowledge in Micro array data analysis.

Course Outcomes

- Summarize the basic concepts and importance of Bioinformatics in various sectors.
- Demonstrate the sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Analyze the three dimensional protein structure and classification using various tools.
- Illustrate the protein secondary structure prediction by comparative modeling.
- Extend the knowledge in micro array technology and applications of bioinformatics in various sectors.

UNIT I OVERVIEW OF BIOINFORMATICS

The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II RETRIEVAL OF BIOLOGICAL DATA

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III PHYLOGENETICS

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV STRUCTURAL BIOINFORMATICS

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNIT V MICROARRAY DATA ANALYSIS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

Suggested Readings

1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. Pearson Education.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.
4. Jonathan Pevsner.(2015). Bioinformatics and functional genomics. wiley-Liss.
5. Michael J Koernberg. (2016).Microarray Data Analysis: Methods and applications. Humana Press

19BTBTOE04 FUNDAMENTALS OF NANOBIOTECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart the skills in the field of nano biotechnology and its applications.
- To acquire knowledge in the nano particles and its significance in various fields.
- To extend the knowledge in types and application of nano particles in sensors.
- To define the concepts of biomaterials through molecular self assembly.
- To equip students with clinical applications of nano devices.
- To describe deeper understanding of the socio-economic issues in nanobiotechnology.

Course Outcomes

- Develop skills in the field of nano biotechnology and its applications.
- Summarize the nanoparticles and its significance in various fields.
- Extend the knowledge in types and application of nano particles in sensors.
- Define the concepts of biomaterials through molecular self assembly.
- Outline the clinical applications of nano devices.
- Describe the socio-economic issues in nanobiotechnology.

UNIT I INTRODUCTION

Introduction, Scope and Overview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

UNIT II NANO PARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

UNIT III MEDICAL NANOTECHNOLOGY

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine.

UNIT IV NANOBIOTECHNOLOGY

Clinical applications of nanodevices. Artificial neurons. Real-time nanosensors- Applications in cancer biology. Nanomedicine.Synthetic retinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nano carbontubules.Nanosurgical devices.

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

Suggested Readings

1. Niemeyer, C.M. and Mirkin, C.A (2005). Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH.
2. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
3. Shoseyov, O.and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materials of the Future. Humana Press.
4. Bhushan, B.(2017). Springer Handbook of Nanotechnology. Springer-Verlag Berlin Heidelberg.
5. FreitasJr R.A (2006) Nanomedicine. Landes Biosciences.
6. Kohler, M. and Fritzsche, W. (2008). Nanotechnology – An Introduction to Nanostructuring Techniques. Wiley-VCH.

OPEN ELECTIVE
Mechanical Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BEMEOE01 COMPUTER AIDED DESIGN 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To provide an overview of how computers are being used in mechanical component design
- To study about the various computer graphics concepts
- To get basic knowledge on geometric modeling
- to study about the basics of parametric design and object representation
- To get basic knowledge in product design and development.
- To imparts a good knowledge in display transformation in two- and three dimensional graphics concepts.

Course Outcomes

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

- Give the overview of the cad systems and its importance
- Explain the ideas and principles behind the computer graphics
- Explain the process involved in graphic transformations
- Understand the operations involved in the geometric modeling.
- Describe the concepts of parametric design
- Understand the basics of the product design and development.

UNIT I OVERVIEW OF CAD SYSTEMS

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNIT II INTERACTIVE COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive

solids, sweeping solids, Boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

UNIT IV PARAMETRIC DESIGN AND OBJECT REPRESENTATION

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids - manipulations.

UNIT V PRODUCT DESIGN AND DEVELOPMENT

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

Suggested Readings

1. Vera B Anand, Computer Graphics and Geometric Modeling for Engineers,1st edition, John Wiley & Sons, New York, 2000
2. Radhakrishnan P and Subramanyan S, CAD/CAM/CIM, 2nd edition, New Age International Pvt. Ltd, 2008
3. Ibrahim Zeid, CAD/CAM Theory and Practice,2nd edition, McGraw Hill Inc., New York, 2009
4. Barry Hawhes, The CAD/CAM Process,1st edition, Pitman Publishing, London, 2007(digital)
5. William M Newman and Robert Sproul, Principles of Interactive Computer Graphics,1st edition, McGraw Hill Inc., New York, 2001
6. Sadhu Singh, Computer-Aided Design and Manufacturing,1st edition, Khanna Publishers, New Delhi, 1998

19BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To provide in-depth knowledge on various techniques of non-destructive testing.
- To make the student acquire the concept of evolution of modern safety.
- To acquaint the student with concepts of safety education and training methods.
- To imparts a good knowledge in reactive and proactive monitoring techniques for safety.
- To familiarize the students with the accident investigation process
- To inculate role of government agencies and private consulting agencies in safety training

Course Outcome

At the end of the course, student will be able to

- Understand the need and awareness of the safety concepts
- Understand the various safety techniques involved in industrial sector
- Record and investigate the accident zone and prepare reports related to it.
- Conduct basic safety inspections using strategies that they have developed
- Identify and demonstrate working of safety monitoring
- Train about the education and training based on safety

UNIT I CONCEPTS

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

UNIT II TECHNIQUES

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING

Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

UNIT IV SAFETY PERFORMANCE MONITORING

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.

UNIT V SAFETY EDUCATION AND TRAINING

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

Suggested Readings

1. Accident Prevention Manual for Industrial Operations, 3rd edition, N.S.C. Chicago, 2010(digital).
2. Heinrich H.W. "Industrial Accident Prevention", 2nd edition, Tata McGraw-Hill Company, New York, 1941.
3. Krishnan N.V, Safety Management in Industry, 1st edition, Jaico Publishing House, Bombay, 1997.
4. John R Ridley, Safety at Work,3rd edition, Elsevier,2014
5. Roland P. Blake ,Industrial Safety, 2nd edition,Prentice Hall, Inc., New Jersey, 1973
6. L M Deshmukh, Industrial safety management,1st edition, TATA McGraw Hill, 2005

19BEMEOE03 **TRANSPORT PHENOMENA** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To provide the basics of transport phenomena and its applications.
- To provide the knowledge over the properties of the systems and unit systems used.
- To understand the basics and mathematics involved in momentum transport.
- To provide the basics and applications of energy transport.
- To give basics and principles involved in the mass transport phenomena.
- To imparts a good knowledge about basic concept of fluid mechanics.

Course Outcomes

Upon completion of this course, the students can be able to

- Understand the basic concepts of transport phenomena
- Understand the essentiality of properties of a system and unit systems used.
- Understand the basic concepts involved in momentum transport.
- Apply the mathematics involved in fluid flow problems.
- Explain the various energy transport phenomena.
- Understand the basics of mass transport phenomena.

UNIT I INTRODUCTION AND BASIC CONCEPTS

General overview of transport phenomena including various applications, Transport of momentum, heat and mass , Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNIT II PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNIT IV ENERGY TRANSPORT

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heat transfer

UNIT V MASS TRANSPORT

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion- Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

Suggested Readings

1. Geankoplis, C. J, Transport Processes and Separation Processes Principles, 4th edition, Prentice Hall, 2013
2. R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, Transport Phenomena, 1st edition, John Wiley & Sons, 2007.
3. Edwin N. Lightfoot, Transport phenomena and living systems: biomedical aspects of momentum and mass transport, 1st edition, Wiley, 1973, 2007 (digital)

19BEMEOE04 INTRODUCTION TO BIOMECHANICS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- Biomechanics provides key information on the most effective and safest movement patterns, equipment
- To learn the relevant exercises to improve human movement.
- To make the student acquire the nine fundamentals of biomechanics.
- To acquaint the student with the need for biomechanics to understand muscle actions.
- To imparts a good knowledge in gross (Whole-Body) modeling.
- To familiarize the students with the biomechanics of the passive muscle and ligaments

Course Outcomes

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

- Understand the basics and importance of biomechanics.
- Present the nine fundamentals of biomechanics and its need.
- Explain the nine principles used for application of biomechanics.
- Describe the human anatomy
- Explain the need for biomechanics in muscle actions
- Understand the basics of the mechanics involved in musculoskeletal system.

UNIT I INTRODUCTION

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

UNIT IV ANATOMICAL DESCRIPTION

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method

of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch-Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

Suggested Readings

1. Duane Knudson, Fundamentals of Biomechanics, 1st edition,Springer Science+ Business Media, LLC, 2013
2. C. Ross Ethier Craig A. Simmons, Introductory Biom

OPEN ELECTIVE
Automobile Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BEAEOE01	**AUTOMOBILE ENGINEERING**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart the knowledge on constructional details and principle of operation of various automobile components.
- To learn the function and working of various components in transmission and drive lines.
- To study the concept and working of steering and suspension systems in an automobile.
- To give the knowledge on wheels, tyres and brakes of automobiles.
- To provide the information on current and future trends in automobiles.
- To imparts a good knowledge about anti-lock braking System.

Course Outcomes

Upon successful completion of the course, the students should be able to

- Demonstrate the operating principles and constructional details of various automobile components.
- Explain the function and working of components in transmission and drive lines.
- Identify and explain the types of steering system and suspension system.
- Classify and describe the types of wheels, tyres and brakes of automobiles.
- Discuss the current and future trends in the automobiles.
- Gain a good knowledge about ignition system.

UNIT I ENGINE AND AUXILIARY SYSTEMS

Classification of engines – construction and working of four-stroke spark ignition (SI) engine and compression ignition (CI) engine – construction and working of two-stroke SI and CI engine – firing order – carburettor – fuel injection systems – battery – dynamo – alternator – starting motor – lighting system – ignition system.

UNIT II TRANSMISSION SYSTEMS

Requirements of transmission system – flywheel – clutch – types of clutch – construction of single and multi-plate clutches – need, types and construction of transmission gear box – universal joint – propeller shaft – need, types and construction of differential – four wheel drive.

UNIT III STEERING AND SUSPENSION SYSTEMS

Principle of steering – steering linkages – types of steering gear box –power steering – suspension systems – need and types – independent suspension – coil spring, leaf spring, torsion bar and air suspension – shock absorbers.

UNIT IV WHEELS AND BRAKES

Wheels and tyres – construction – types and specifications – tyre wear and causes – brakes – need – braking distance – types – mechanical, hydraulic and pneumatic brakes – power brake – parking brake – redundant braking system.

UNIT V CURRENT AND FUTURE TRENDS

Anti-lock Braking System (ABS) – brake assist – Electronic Brakeforce Distribution (EBD) – airbags – automatic high-beam control – backup cameras – defogger – electric vehicles – hybrid vehicles – autonomous vehicles – vehicle-to-vehicle communication – vehicle tracking – alternative fuels.

Suggested Readings:

1. Kirpal Singh, Automobile Engineering Volume 1, Standard Publishers, New Delhi, 2018.
2. Sethi H M, Automobile Technology, Tata McGraw-Hill, New Delhi, 2003.
3. William H Crouse and Donald L Anglin, Automotive Mechanics, Tata McGraw-Hill, New Delhi, 2006.
4. Srinivasan S, Automotive Mechanics, Tata McGraw-Hill, New Delhi, 2003.
5. Ganesan V, Internal Combustion Engines, McGraw-Hill Education, New Delhi, 2012.

19BEAEOE02 TWO AND THREE WHEELER TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart the technical knowledge on construction and working of power train and drive train of two and three wheeler vehicles.
- To familiarize with the maintenance procedures of engine and subsystems of two and three wheelers.
- To make the student acquire the knowledge about the types of wheels, tyres and brakes for two and three wheelers.
- To acquaint the student with the construction and working of two-stroke and four-stroke engines
- To imparts a good knowledge about basics of kick start and auto-start mechanisms
- To familiarize the students with the mechanical and hydraulic brake control systems.

Course Outcomes

Upon successful completion of the course, the students should be able to

- Construct the frames of two and three wheelers of different layouts.
- Demonstrate the constructional details and principle of operation of various engine components.
- Identify and explain the types of transmission, steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
- Explain the servicing of two and three wheelers.
- Understand the basics of kick start and auto-start mechanisms.

UNIT I INTRODUCTION

History of two and three wheelers – classification and layouts of two wheelers – classification and layouts of three wheelers – main frame for two wheelers and types – main frame for three wheelers and types.

UNIT II INTERNAL COMBUSTION ENGINES

Classification of engines – selection criteria of engine for two and three wheelers – design considerations for two and three wheeler engines – construction and working of two-stroke and four-stroke engines – fuel feed system – lubricating system – cooling system – scavenging system – cranking system – kick start and auto-start mechanisms.

UNIT III TRANSMISSION, STEERING AND SUSPENSION SYSTEMS

Clutch – single plate, multiple plate and centrifugal clutches – primary reduction – gear box – gear shifting mechanisms – automatic transmission – final drive and differential for three wheelers – steering geometry – steering column construction – steering system for three wheelers – front and rear suspension systems – spring and shock absorber assembly.

UNIT IV WHEELS, TYRES AND BRAKES

Spoked wheels, pressed steel wheels and alloy wheel – tyre construction – tyre with tube and tubeless tyre – theory of brake action – drum and disc brakes – brake links layout for front and rear wheels – mechanical and hydraulic brake control systems – anti-lock braking system.

UNIT V TWO AND THREE WHEELERS CASE STUDY

Case study of mopeds, scooters, motor cycles, sports bikes, auto rickshaws, pickup vans, delivery vans and trailers – servicing – factors affecting fuel economy and emission.

Suggested Readings

1. Dhruv U Panchal, Two and Three Wheeler Technology, PHI Learning, New Delhi, 2015.
2. Ramalingam K K, Two Wheelers and Three Wheelers: Theory, Operation and Maintenance, Scitech Publications, Chennai, 2017.
3. Irving P E, Motorcycle Engineering, Veloce Enterprises, USA, 2017.
4. Dennis Bailey and Keith Gates, Bike Repair and Maintenance for Dummies, John Wiley & Sons, USA, 2009.

19BEAEOE03 **VEHICLE MAINTENANCE** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To understand the need for vehicle maintenance and its importance.
- To familiarize the maintenance procedure for various components of an automobile.
- To make the student acquire the basics of power steering system.
- To acquaint the student with maintenance of engine and engine subsystem.
- To imparts a good knowledge about procedure for dismantling, servicing and assembling of engine components.
- To familiarize the students with the maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator etc.

Course Outcomes

Upon successful completion of the course, the students should be able to

- Describe and differentiate the types of maintenance.
- List the procedure for dismantling, servicing and assembling of engine components.
- Demonstrate the servicing of transmission and driveline components.
- Discuss the procedure for steering, suspension, wheel and brake maintenance.
- Explain the fault diagnosis in the electrical and air conditioner systems.
- Gain a good knowledge about the maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator etc.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES

Need for maintenance – preventive and breakdown maintenance – requirements of maintenance – preparation of check lists – inspection schedule – maintenance of records, log sheets and other forms – safety precautions in maintenance – workshop layout, tools and equipment.

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE

General engine service – dismantling of engine components – engine repair – service of basic engine parts, cooling and lubricating system, fuel system, intake and exhaust system – engine tune-up.

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE

General checks, adjustment and service of clutch – dismantling, identifying, checking and reassembling transmission, transaxle – road testing – removing and replacing propeller shaft – servicing of cross and yoke joint, and constant velocity joint – rear axle service points – removing axle shaft and bearings – servicing differential assemblies – fault diagnosis.

UNIT IV STEERING, SUSPENSION, WHEEL AND BRAKE MAINTENANCE

Inspection, maintenance and service of steering linkage, steering column, rack and pinion steering, recirculating ball steering, worm type steering, power steering system – inspection, maintenance and service of MacPherson strut, coil spring, leaf spring, shock absorbers – wheel alignment and balance – removing and fitting of tyres – tyre wear and tyre rotation – inspection, maintenance and service of hydraulic brake, drum brake, disc brake, parking brake – bleeding of brakes.

UNIT V ELECTRICAL AND AIR CONDITIONER MAINTENANCE

Maintenance of batteries, starting system, charging system and body electrical – fault diagnosis using scan tools – maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator – replacement of hoses – leak detection – air conditioner charging – fault diagnosis – vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Suggested Readings

1. Tim Gilles, Automotive Service: Inspection, Maintenance, Repair, Cengage Learning, USA, 2015.
2. Philip Knott and Adam Roylance, An Introductory Guide to Motor Vehicle Maintenance: Light Vehicles, EMS Publishing, UK, 2010.
3. James D Halderman and Curt Ward, Advanced Engine Performance Diagnosis, Pearson, USA, 2016.
4. Ed May and Les Simpson, Automotive Mechanics Volume 1, McGraw-Hill Australia, 2006.
5. James E Duffy, Modern Automotive Technology, Goodheart-Willcox, USA, 2017.
6. Service manuals of various OEMs.

19BEAEOE04 MODERN VEHICLE TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart the knowledge on trends in vehicle power plants.
- To learn about the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give the information about motor vehicle emission and noise pollution control.
- To provide the knowledge of vehicle telematics.
- To familiarize the students with the noise control techniques.

Course Outcomes

Upon successful completion of the course, the students should be able to

- Distinguish and describe the various modern vehicle power plant systems.
- List and explain the various driver assistant mechanisms.
- Identify and explain the working of advanced suspension and braking systems.
- Apply the knowledge of motor vehicle emission and noise pollution control.
- Describe the vehicle telematics and its applications.
- Understand the basics of hydrolastic suspension system

UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles – stratified charged / learn burn engines – hydrogen engines – battery vehicles – electric propulsion with cables – magnetic track vehicles.

UNIT II DRIVER ASSISTANCE SYSTEMS

Adaptive cruise control – intelligent speed adaptation – lane departure warning systems – traction control systems – driver drowsiness detection system – collision avoidance systems – hill descent control – anti spin regulation – parking assistance systems – night-vision systems – pedestrian detection.

UNIT III SUSPENSION, BRAKES AND SAFETY

Interconnected air and liquid suspensions – hydrolastic suspension system – hydragas suspension – closed loop suspension – indirect floating calliper disc brake – self energising disc brake – anti-skid braking system – retarders – regenerative braking – auto emergency braking – crumple zone – safety cage – airbags – seat belts – head rests.

UNIT IV EMISSION AND NOISE POLLUTION CONTROL

Engine emissions – types of catalytic converters – open loop and closed loop operation to the oxidizing catalytic converter – evaporative emission – internal and external noise – identification of noise sources – noise control techniques – adaptive noise control.

UNIT V VEHICLE TELEMATICS

Building blocks of vehicle telematics system – Global Positioning System (GPS) and Geographic Information System (GIS) for vehicle tracking – automotive navigation system – road recognition system – wireless vehicle safety communications – Usage Based Insurance (UBI).

Suggested Readings

1. Ljubo Vlacic, Michael Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann, UK, 2001.
2. Ronald K Jurgen, Navigation and Intelligent Transportation Systems, SAE International, USA, 1998.
3. Heinz Heisler, Advanced Vehicle Technology, Butterworth-Heinemann, UK, 2002.
4. James E Duffy, Modern Automotive Technology, Goodheart-Willcox, USA, 2017.
5. William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, UK, 2017.
6. Bosch Automotive Handbook, Robert Bosch, Germany, 2018.

19BEAEOE05 **FLEET MANAGEMENT** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To impart the knowledge on personnel management, selection process, training methods and motor vehicle act.
- To plan the vehicle routes, scheduling of vehicles and fare structure.
- To design the vehicle maintenance systems.
- To acquaint the student with the schedules and sections of the motor vehicle act.
- To imparts a good knowledge in evaluation of Preventive Maintenance Inspection (PMI) programme.
- To familiarize the students with the electronically controlled vehicle maintenance system.

Course Outcomes

Upon successful completion of the course, the students should be able to

- Apply the knowledge of personnel management and analyze the selection process and training methods.
- Apply the motor vehicle act in terms of registration and describe the various vehicles and conduct the test of competence to drive.
- Construct a fare structure and analyze the methods of fare collection.
- Analyze the vehicle parts, supply management and data processing.
- Demonstrate an electronically controlled vehicle maintenance system and analyze the work scheduling.
- Understand the basics about power wagons and fire fighting vehicles.

UNIT I INTRODUCTION

Personnel management – objectives and functions of personnel management – psychology, sociology and their relevance to an organization – selection process: job description, employment tests, interviewing, introduction to training objectives, methods of training, training procedure and psychological tests.

UNIT II MOTOR VEHICLE ACT

Schedules and sections of the motor vehicle act – traffic signs, fitness certificate, registration requirements, permit, insurance and constructional regulations – description of vehicle: goods carrier, tankers, tippers, delivery vans, recovery vans, power wagons and fire fighting vehicles – spread over, running time, test of competence to drive.

UNIT III SCHEDULING AND FARE STRUCTURE

Route planning – scheduling of transport vehicles – preparation of timetable – preparation of vehicle and crew schedule – principal features of operating costs for transport vehicles – fare structure and method of drawing up of a fare table – methods of fare collection.

UNIT IV VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

Cost of inventory – balancing inventory cost against downtime – parts control – bin tag systems – time management – time record keeping – budget activity and capital expenditures – classification of vehicle expenses – fleet management and data processing – data processing systems – computer controlling of fleet activity.

UNIT V MAINTENANCE

Scheduled and unscheduled maintenance – preventive maintenance – evaluation of Preventive Maintenance Inspection (PMI) programme – work scheduling – overtime – breakdown analysis – control of repair backlogs – cost of options – electronically controlled vehicle maintenance system.

Suggested Readings

1. Robert P Currie, Michelle B Currie and George M Keen, Fleet Management, Wandering Brothers Publishing, USA, 2006.
2. John Dolce, Fleet Management, McGraw-Hill, 1984.
3. SCC Editorial, Motor Vehicles Act, 1988, Eastern Book Company, New Delhi, 2019.
4. Rex W Faulks, Bus and Coach Operation, Butterworth-Heinemann, UK, 1987.
5. John E Dolce, Analytical Fleet Maintenance Management, SAE International, USA, 2009.

OPEN ELECTIVE
Civil Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BECEOE01 HOUSING PLAN AND MANAGEMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
- Analyze the Innovative construction methods and Materials
- Analyze city management strategies and strengthen the urban governance through a problem solving approach.
- To imparts a good knowledge in problems related with pricing o f housing units, rents.
- To familiarize the students with the housing laws at state level.

Course Outcomes

The students will be able to

- Know the Importance of basic housing policies and building bye laws
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials
- Know Housing finance and loan approval procedures
- Understand Construction as well as managing techniques

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

Suggested Readings

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 2001.
3. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
4. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 2000.

19BECEOE02 **BUILDING SERVICES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Defining and identifying of eng. services systems in buildings.
- The role of eng. services systems in providing comfort and facilitating life of users of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques.
- To imparts a good knowledge in design of modern lighting.
- To familiarize the students with the air conditioning systems for different types of buildings.

Course Outcome

The students will be able to

- Machineries involved in building construction
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design
- Know the principle of Refrigeration and application
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

Suggested Readings

1. E.R.Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 2002.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
4. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, The Architectural Press, London, 2005.
5. National Building Code.

19BECEOE03 REPAIR AND REHABILITATION OF STRUCTURES 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To learn various distress and damages to concrete and masonry structures
- To know the influence of corrosion in durability of structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To learn various techniques involved in demolition of structures.
- To imparts a good knowledge about assessment procedure for evaluating a damaged structure causes of deterioration.

Course Outcomes

By the end of this course students will have the capability/knowledge of

- A differential principle applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- Analyses the forces in any structures.
- Solving rigid body subjected to dynamic forces.
- Application of friction in real life problems
- Kinetics, Kinematics, Impulse and Momentum principles
- Solving real time Engineering problems

UNIT I INTRODUCTION

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNIT II DURABILITY OF STRUCTURES

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES

Non-destructive Testing Techniques, Corrosion protection techniques , Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies

Suggested Readings

1. Repair of Concrete Structures R.T.Allen and S.C.Edwards Blakie and Sons, UK, 2011
2. Rehabilitation of concrete structures Dr.B.Vidivelli Standard publishers, Chennai.2011

Websites

1. Http://Www.Icivilengineer.Com
2. http://www.engineeringcivil.com/
3. http://www.aboutcivil.com/
4. http://www.engineersdaily.com
5. http://www.asce.org/
6. http://www.cif.org/
7. http://icevirtuallibrary.com/
8. http://www.ice.org.uk/
9. http://www.engineering-software.com/ce/

19BECEOE04 COMPUTER-AIDED CIVIL ENGINEERING DRAWING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact.
- Imparts a good knowledge about English bond and Flemish bond

Course Outcome

The students will be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact
- Planning and designing of structures

UNIT I INTRODUCTION

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II SYMBOLS AND SIGN CONVENTIONS

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT III MASONRY BONDS

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV BUILDING DRAWING

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

UNIT V PICTORIAL VIEW

Principles of isometrics and perspective drawing. Perspective view of building.

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows.
2. Single storey RCC building
3. Multistorey RCC building

Suggested Readings

1. Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), " Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education,
4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.,
5. Balagopal and Prabhu (1987), " Building Drawing and Detailing", Spades publishing KDR buildin

OPEN ELECTIVE
Chemical Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BTCEOE01 ENERGY MANAGEMENT IN CHEMICAL INDUSTRIES 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Teaching the basic concepts and fundamental aspects of industrial and domestic thermal systems' design.
- Prepare the students for the positions of energy management in energy intensive industries.
- To make the student acquire the knowledge about patterns of consumption in developing and developed countries.
- To acquaint the student with various forecasting techniques for energy needs.
- To imparts a good knowledge about production analysis and production using fuel inventories.
- To familiarize the students with the energy conservation using optimization techniques.

Course Outcomes

After completion of the course, students are able to

- Plan to optimize energy using systems and procedures to meet energy demand
- Describe the movement of substances in the entire globe
- Examine the relationship between energy systems and society
- Use optimization techniques for conservation of energy in chemical industries
- Evaluate the production rate and analyze the cost from economic balance for energy consumption.
- Understand the commercial generation of power requirements and benefits.

UNIT I PLANNING FOR ENERGY NEEDS

Forecasting techniques; energy demand; magnitude and pattern; input and output analysis; energy modeling and optimal mix of energy sources.

UNIT II ENERGY AND ENVIRONMENT

Energy; various forms; energy storage; structural properties of environment; bio-geo-chemical cycles; society, environment population and technology.

UNIT III ENERGY AND SOCIETY

Energy and evolution; growth and change; patterns of consumption in developing and advanced countries; commercial generation of power requirements and benefit.

UNIT IV MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES

Chemical industries; classification; conservation in unit operations such as separation; cooling tower; drying; conservation applied to refineries, petrochemical, fertilisers, cement, pulp and paper, food and chlor-alkali industries; conservation using optimization techniques.

UNIT V ECONOMIC BALANCE IN ENERGY CONSUMPTION

Cost analysis; capacity; production rate; system rate; system cost analysis; corporate models; production analysis and production using fuel inventories; input-output analysis; economics; tariffs

Suggested Readings

1. Jerrold H Kertz, Energy Conservation and Utilization, Allyn and BacurInc, 1976.
2. Gemand M Gramlay, Energy, Macmillion publishing Co, Newyork, 1975
3. Krentz J. H., Energy Conservation and Utilization, Allyn and Bacur Inc., 1976.
4. Gramlay G. M., Energy, Macmillan Publishing Co., New York, 1975.
5. Rused C. K., Elements of Energy Conservation, McGraw-Hill Book Co., 1985

19BTCEOE02 **FERTILIZER TECHNOLOGY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

- To enable the students to learn the fertilizer manufacturing including new or modified fertilizer products and new techniques.
- To make the student acquire the process for the production of sulphuric and phosphoric acids.
- To acquaint the student with the liquid and gaseous pollution from ammonia urea and NPK fertilizer industries.
- To imparts a good knowledge about the methods of production of ammonia and urea.
- To familiarize the students with the fertilizer production in India.
- To inculate the methods of production of potassic fertilizers.

Course Outcomes

After completion of the course, students are able to

- Illustrate chemical, organic fertilizers and nutrients
- Develop the flow chart for manufacture of nitrogenous fertilizers
- Analyze the various processes and develop the flow chart for the manufacture of phosphatic fertilizers.
- Develop the flow chart for the manufacture of potassic fertilizer and analyze the unit operations involved in theprocess.
- Illustrate the quality and pollution standards permissible in fertilizer industry.
- Understand the methods of production of potassic fertilizers.

UNIT I INTRODUCTION

Chemical Fertilizers and Organic Manures - Types of chemical Fertilizers.Secondary nutrients, micro nutrients.

UNIT II NITROGEN FERTILIZERS

Nitrogenous Fertilizers - Methods of production of Ammonia and Urea. Nitric acid, Ammonium sulphate, Ammonium Nitrate,Calcium Ammonium Nitrate, Ammonium Chloride - Their methods of production, characteristics, storage and handling specifications.

UNIT III PHOSPHATIC FERTILIZERS

Raw materials, phosphate rock, Sulphur pyrites -Process for the production of Sulphuric and Phosphoric acids. Ground phosphate rock, bone meal. Single Super Phosphate, Triple Super phosphate -Methods of production, characteristics and specifications.

UNIT IV POTASSIC FERTILIZERS

Potassium chloride, Potassium sulphate, Potassium schoenite - Methods of production, specification, characteristics. Complex Fertilizers, NPK Fertilizers, Mono ammonium phosphate, Diammonium phosphate, Nitro phosphate Methods of production.

UNIT V FERTILIZERS IMPACTS AND STANDARDS

Fluid fertilizers.Controlled Release of fertilizers. Solid, Liquid and Gaseous pollution from ammonia urea and NPK fertilizer industries and standards laid down for them. Fertilizer production in India.

Suggested Readings

1. GopalaRao M., Marshall Sittig, Dryden's Outlines of Chemical Technology, Third Edition, WEP East-West Press, New Delhi, 2010.
2. George T. Austin., Shreve's Chemical Process Industries, Fifth Edition, McGraw Hill Professional, 2012
3. Vincent Sauchelli., The Chemistry and Technology of Fertilizers, Reinhold Pub. Corp., 1960
4. Editorial Committee - FAI Seminar on Fertilizer in India in the Seventies (Proceedings), The Fertilizer Association of India,New Delhi, 1973.
5. Editorial Committee - Seminar on Recent Advances in Fertilizer Technology, The Fertilizer Association of India, New Delhi,1972.
6. Sauchelli V., Manual on Fertilizer Manufacture, Industry Publication Inc, New Jersy, 1963.
7. CHEMTECH - II - (Chapter on Fertilizers by Chari, K.S.), Chemical Engineering Education Development Centre, I.I.T.,Madras, 1977.
8. Menon M.G., Fertilizer Industry - Introductory Survey, Higginbothams, Madras, 1973

19BTCEOE03 INDUSTRIAL WASTEWATER TREATMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce students to the principles of wastewater and solid waste treatment and management.
- The students will learn the fundamental concepts in water and wastewater treatment technologies.
- To learn about the hazardous solid waste disposal and management issues related to sludge treatment and disposal.
- To acquaint the student with concepts biological nitrification and de-nitrification.
- To imparts a good knowledge about inorganic non-metallic constituents and metallic constituents.
- To familiarize the students with the waste water treatment in textile and pharmaceutical Industries.

Course Outcomes

After completion of the course, students are able to

- Examine the constituents of waste water and its effects.
- Separate the contaminants from the effluent for treatability.
- Determine the biomass yield and substrate utilization rate for biological treatment process and design of activated sludge process.
- Develop a flow sheet for the waste water treatment from dairy, sugar, pulp and paper, textile and pharmaceutical industries.
- Develop process flow diagram for water reuse and sludge disposal.
- Understand the waste water reclamation technologies and reuse.

UNIT I INTRODUCTION TO WASTE WATER ENGINEERING

Waste Water Engineering - Overview, inorganic non-metallic constituents and metallic constituents, physical and biological Characteristics.

UNIT II OPERATIONS AND UNIT PROCESS

Screening, Flow Equalization, Mixing, Flocculation, Grit removal, Sedimentation, Coagulation, Precipitation, Oxidation and Neutralization

UNIT III FUNDAMENTALS OF BIOLOGICAL TREATMENT

Introduction, Microbial growth kinetics, types of biological process for wastewater treatment - aerobic and anaerobic oxidation,Biological Nitrification and De-nitrification, biological phosphorous removal, activated sludge process (with design
Considerations), trickling filters and lagoons.

UNIT IV WASTE WATER TREATMENT IN SPECIFIC INDUSTRIES

Dairy, Sugar, Pulp and Paper, Textile and Pharmaceutical Industries.

UNIT V WATER REUSE

Wastewater reclamation technologies and reuse, Solid processing flow diagrams, sludge and scum pumping, grinding, screening, degritting, blending, anaerobic digestion, composting, conditioning, dewatering and incineration.

Suggested Readings

1. Metcalf Eddy, Wastewater Engineering -Treatment and Reuse, Fourth Edition, Tata McGraw Hill, New Delhi, 2002.
2. Mark J. Hammer, Water and Wastewater Technology, Seventh Edition, Prentice Hall of India Pvt Limited, New Delhi, 2012.
3. James M. Montgomery, Water Treatment Principles and Design, First Edition, A Wiley Interscience publication, New York,1985

19BTCEOE04 SOLID AND HAZARDOUS WASTE MANAGEMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To provide an understanding of solid and hazardous waste engineering principles and management issues
- This course is designed to provide students with the necessary background and knowledge pertaining to the engineering design of solid and hazardous waste facilities.
- To acquaint the student with national and international legislation for hazardous waste management.
- To imparts a good knowledge in salient features of indian legislations on management and handling of municipal solid wastes.
- To familiarize the students with the various collection systems.
- To inculate the knowledge about nuclear power corporation and nuclear power plants in India.

Course Outcomes

After successful completion of the course, student will be able to

- Outline the salient features of solid waste management and handling.
- Deduce the source reduction, recycling and reuse techniques of solid waste.
- Analyze the collection systems and method of transfer of solid waste.
- Describe the processing techniques for solid and hazardous waste.
- Select the suitable methods for disposal of solid and hazardous waste.
- Interpret the legislation for management, handling and disposal of solid and hazardous waste.

UNIT I CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological properties of solid wastes - Percapita generation rates - Sampling and characterization of solid waste - Source reduction of wastes -Waste exchange - Recyclingand reuses - Salient features of Indian legislations on management and handling of municipal solid wastes.

UNIT II COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services:municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary containersystem (SCS) - Vehicle and

labour assessment - Assessment of collection route - Transfer and transport - Transfer stationlocation- Means and methods of transfer.

UNIT III PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversiontechnologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement andcontrol of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes.

UNIT IV HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardouswastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design ofhazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management – AtomicEnergy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India.

UNIT V NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear wastevitrification, ion exchange, synroc – long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse ofwaste - nuclear safety and waste regulation - case study on nuclear disaster - source of e-waste - material composition ofe-waste - recycling and recovery - integrated approaches to e-waste recycling - socio economic factors - treatment option - disposal option - e-waste legislation.

Suggested Readings

1. Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York, 1993.
2. Ronald E. Hester, Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.
3. Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition, 1985.
4. Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publication, 2002

OPEN ELECTIVE
Food Technology

B.E Electronics and Communication Engineering **2019-2020**

19BTFTOE01	**PROCESSING OF FOOD MATERIALS**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds
- Summarize the production and processing methods of fruits and vegetables
- Discuss the chemical composition, processing, production, spoilage and quality of milk and milk products
- Outline the overall processes involved in the production of meat, poultry and fish products
- Review the production and processing methods of plantation and spice products.
- To familiarize the students with methods of processing of pepper, cardamom, ginger, vanilla.

Course Outcomes

- Discuss the various processing technologies involved in cereal, pulses and oilseed technology
- Demonstrate the major operations applied in fruits and vegetable processing
- Illustrate the techniques involved in the processing of dairy products
- Infer the production of different types of milk
- List the overall processing of meat, poultry and fish processing
- Outline the processing of spices and plantation products

UNIT I CEREAL, PULSES AND OIL SEEDS TECHNOLOGY

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies -Pasta products -Tortilla - Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

UNIT III DAIRY PROCESSING

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Icecream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

UNIT IV MEAT, POULTRY AND FISH PROCESSING

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing .

UNIT V PLANTATION PRODUCT TECHNOLOGY

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

Suggested Readings

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.
2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.
3. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

19BTFTOE02 **NUTRITION AND DIETETICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

- Explain the basic concepts of food and nutrition
- Define the overall classification, function, and source of carbohydrates, lipids and proteins
- Discuss the overall aspects of vitamins
- Outline the role of health and nutritional importance of micro and macro minerals
- Summarize the recent trends in nutrition.
- To familiarize the students with recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

Course outcomes

- Discuss the basics in the area of nutritional assessment in health and disease
- Categorize the recommended dietary allowances for different age groups
- Express the classifications, functions and sources of carbohydrates, lipids and proteins
- List the various attributes of fat and water soluble vitamins
- Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals
- Recognize the diets and concepts of foods suggested for nutrional, chronic and acute disorders

UNIT I HUMAN NUTRITION

Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II BIOMOLECULES Carbohydrates-

Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

UNIT III VITAMINS

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

UNIT IV MINERALS

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNIT V RECENT TRENDS IN NUTRITION

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

Suggested Readings

1. Gordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.
2. Shubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016.
3. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017.
4. Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003.
5. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018.

19BTFTOE03 **READY TO EAT FOODS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Outline the current status of snack food Industry
- Describe the production, processing and marketing trends of potato and tortilla chips
- Outline the overall processing of popcorn
- Explain the production and processing of fruits involved in snack food preparation
- Summarize the sensory analysis methods and packaging techniques of snack foods.
- To familiarize the students with the ccurrent issues in snack foods packaging.

Course Outcomes

- Review the overall aspects of snack food industry
- Develop ready to eat foods from potato and maize flour
- Demonstrate the various unit operations involved in the production of potato and tortilla chips
- Illustrate the overall aspects of popcorn production
- List the production, processing and manufacturing of fruit based snacks
- Recognize the sensory analysis and packaging methods of snack foods

UNIT I SNACK FOOD INDUSTRY

Introduction-History-Past innovations- Outline of snack food industry- Nutrition-Total Quality Management of Technology-Domestic Snack Food Market-Global Market-Snack Food Association Future Considerations

UNIT II POTATO AND TORTILLA CHIPS PROCESSING

Potato Production- Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato.

Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations.

UNIT III POPCORN PROCESSING

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT IV FRUIT BASED SNACKS

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits.

UNIT V SENSORY EVALUATION AND PACKAGING

Introduction- Analytical methods-Sensory methods- Sensory Aspect of Processing- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Current Issues in Snack Foods Packaging

Suggested Reading

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
3. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

19BTFTOE04 AGRICULTURAL WASTE AND BYPRODUCTS UTILIZATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- Categorize the types of agricultural wastes
- Outline the production and utilization of biomass
- Explain the various parameters considered to be important in the designing of biogas units
- Review the various methods employed in the production of alcohol from the byproducts of agricultural wastes
- Summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes.
- To imparts a good knowledge in selection and design of biogas plant.

Course Outcomes

- List and group the types of agricultural wastes
- Develop a number of value added products from agriculture wastes
- Discuss the techniques and production involved in the utilization of biomass
- Assess the various parameters considered to be important in the designing of biogas units
- Illustrate the various methods employed in the production of alcohol from the byproducts of agricultural wastes
- Choose the appropriate materials to produce paperboards and particle boards from agricultural wastes

UNIT I TYPES OF AGRICULTURAL WASTES

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II BIOMASS PRODUCTION AND UTILIZATION

Biomass Gasifier, Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

UNITIII BIOGAS DESIGN AND PRODUCTION

Biogas: Definition, composition, history of biogas, Production of biogas; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogas plant.

UNIT IV PRODUCTION OF ALCOHOL FROM WASTE MATERIALS

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V PRODUCTION OF PAPERBOARDS AND PARTICLEBOARDS FROM AGRICULTURAL WASTE

Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps- Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

Suggested Readings

1. K M Sahay and K K Singh. Unit Operations of Agricultural Processing. Vikas Publishing House Pvt Ltd, Noida, Uttar Pradesh. 2nd Edition 2013.
2. Beggs C. Energy Management and Conservation. Elsevier Pulication. 2nd Edition 2009.
3. Chaturvedi P. 2009. Energy Management: Challenges for the Next Millennium. Concept Publishing Co. 1st Edition 2000.
4. Fardo SW, Patrick DR, Richardson RE and Fardo BW. Energy Conservation Guidebook. The Fairmont Press. 3rd Edition 2014.
5. Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press. 2000.

OPEN ELECTIVE
Biomedical Engineering

B.E Electronics and Communication Engineering **2019-2020**

19BEBMEOE01	**ROBOTICS IN MEDICINE**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To uunderstand the basics of Robotics, Kinematics.
- To uunderstand the basics of Inverse Kinematics.
- To explore various kinematic motion planning solutions for various Robotic configurations.
- To explore various applications of Robots in Medicine.
- To imparts a good knowledge in robot vision image representation.
- To familiarize the students with the task planner simulation.

Course Outcome

- At the end of the course, the student would have learnt about various kinds robotics techniques, vision, planning and applications.
- This course is very effective in the area of robotics Design.
- Gain a good knowledge in robot vision image representation.
- Acquire knowledge about homogeneous coordinates link coordination arm equation for five-axis robot, four-axis robot and six-axis robot.
- Understand the robotics in neural engineering field.
- Understand the concept of task planning and task level programming.

UNIT I INTRODUCTION

Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot

UNIT II KINEMATICS

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

UNIT III ROBOT VISION

Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers,

Perspective transformation, Structured illumination, Camera calibration.

UNIT IV PLANNING

Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation.

UNIT V APPLICATIONS

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical – Gynecology, Orthopedics, Neurosurgery

Suggested Readings

1. Robert Schilling Fundamentals of Robotics-Analysis and control Prentice Hall 2003
2. J.J.Craig Introduction to Robotics Pearson Education 2005
3. Staugaard, Andrew C Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning Prentice Hall Of India 1987
4. Grover, Wiess, Nagel, Oderey Industrial Robotics: Technology, Programming and Applications McGraw Hill 1986.
5. Wolfram Stadler Analytical Robotics and Mechatronics McGraw Hill,1995
6. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications Prentice Hall 2001
7. K. S. Fu, R. C. Gonzales and C. S. G. Lee Robotics McGraw Hill 2008

19BEBMEOE02 VIRTUAL REALITY AND AUGMENTED REALITY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality.
- To acquaint the student with concepts JS-pros and cons-building blocks.
- To imparts a good knowledge in virtual reality applications in different fields.
- To familiarize the students with the model management in VR development process

Course Outcomes

- Applications of virtual reality are military and robotics.
- Importance of virtual reality is getting optimized results.
- Gain a good knowledge about Google VR for android-scripts
- Understand the commercial VR technology.
- Acquire knowledge about VR health and safety issues.
- Understand the model management in VR development process

UNIT I INTRODUCTION

The three I‘s of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback..

UNIT II VR DEVELOPMENT PROCESS

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR ON THE WEB & VR ON THE MOBILE

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT V APPLICATIONS

Medical applications-military applications-robotics applications- Advanced Real time Tracking other applications- games, movies, simulations, therapy.

Suggested Readings

1. C. Burdea & Philippe Coiffet Virtual Reality Technology Second Edition, Gregory, John Wiley & Sons, Inc 2008
2. Jason Jerald The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool New York, NY, US
3. Dieter Schmalstieg & Tobias Hollerer Augmented Reality: Principles and Practice (Usability)Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States 2016
4. Steve Aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability) Addison-Wesley Professional 1 edition, 2016
5. Robert Scoble & Shel Israel The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Patrick Brewster Press 2016
6. Tony Parisi, Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile O'Reilly Media; 1 edition 2015
7. Tony Parisi Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages O'Reilly Media; 1 edition 2014
8. Jos Dirksen Learning Three.js: The JavaScript 3D Library for WebGL Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015

19BEBMEOE03 ARTIFICIAL ORGANS AND IMPLANTS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To have an overview of artificial organs & transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To study about various blood interfacing implants.
- To imparts a good knowledge in neural and neuromuscular implants.
- To familiarize the students with the soft tissue repair,replacement and its augmentation.

Course Outcomes

- Understand the implant design parameters and solution in use
- Knowledge about various blood interfacing implants.
- Gain a good knowledge about tissue engineering.
- Understand the design specifications for tissue bonding and modulus matching,
- Understand the immunological considerations and blood transfusions.
- Acquire knowledge in dialysis membrane and artificial blood.

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS

ARTIFICIAL ORGANS:-Introduction, outlook for organ replacements, design consideration, evaluation process.TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN

Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

Suggested Readings

1. Kopff W.J Artificial Organs John Wiley and sons, New York, 1st edition 1976
2. Park J.B., Biomaterials Science and Engineering Plenum Press 1984
3. J D Bronzino Biomedical Engineering handbook Volume II CRC Press / IEEE Press 2000
4. R S Khandpur Handbook of Biomedical Instrumentation Tata McGraw Hill 2003
5. Joon B Park Biomaterials – An Introduction Plenum press, New York 1992
6. Yannas, I. V Tissue and Organ Regeneration in Adults New York, NY: Springer 2001
7. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino Clinical Engineering CRC Press, 1st edition 2010
8. Myer Kutz Standard Handbook of Biomedical Engineering & Design McGraw- Hill 2003

LIST OF OPEN ELECTIVES OFFERED BY ELECTRONICS AND COMMUNICATION ENGINEERING TO OTHER DEPARTMENTS

B.E Electronics and Communication Engineering **2019-2020**

19BEECOE01 REAL TIME EMBEDDED SYSTEMS 3H-3C

Instruction Hours/week: L: 3 T: 1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To study about task management
- To learn about semaphore management and message passing
- To study about memory management
- To imparts knowledge on

Course Outcomes

At the end of the course the students will be able to

- Understand overview of embedded systems architecture
- Acquire knowledge on embedded system, its hardware and software.
- Gain knowledge on overview of Operating system
- Discuss about task Management
- Gain knowledge about semaphore management and message passing.
- Gain knowledge about memory management.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM

Introduction- Embedded systems description, definition, design considerations & requirements- Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systems- embedded processor selection & tradeoffs- Embedded design life cycle -Product specifications- hardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

UNIT II OPERATING SYSTEM OVERVIEW

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks-Real Time Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- Reentrant Functions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion– Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- Task Management– Memory Management-Time Management–Clock Ticks.

UNIT III TASK MANAGEMENT

Introduction-µ C/OS-II Features-Goals ofµ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Under µC/OS-II –Clock Tick-µ C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks–Stack Checking–Task's Priority–Suspending Task– esuming Task. Time Management: Delaying a Task–Resuming a Delayed Task–System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

UNIT IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box–Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue–Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue– Flushing a Queue.

UNIT-V MEMORY MANAGEMENT

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block–Returning a Memory Block. Getting Started withµ C/OS-II–Installingµ C/OS-II–Portingµ C/OS-II: Development Tools–Directories and Files– Testing a Port -IAR Workbench withµ C/OS-II-µ C/OS- II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help ofµ C/OS-II.

Suggested Readings

1. Floyd JeanJ. Labrosse Micro C/OS–II The Real Time Kernel CMPBOOKS 2009
2. David Seal ARM Architecture Reference Manual.Addison-Wesley 2008
3. Steve Furbe, ARM System-on-Chip Architecture, Addison-Wesley Professional, California 2000.
4. K.V.K.K.Prasad Embedded Real-Time Systems: Concepts, Design & Programming Dream Tech Press 2005.
5. Sriram V Iyer, Pankaj Gupta Embedded Real Time Systems Programming Tata Mc Graw Hill 2004

19BEECOE02 CONSUMER ELECTRONICS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study about various speakers and microphone
- To learn the fundamental of television systems and standards
- To learn the process of audio recording and reproduction
- To study various telephone networks
- To discuss about the working of home appliances
- To familiarize with TV services like ISDN.

Course Outcomes

At the end of the course the students will be able to

- Understand working of various type of loud speakers
- Acquire knowledge on various types of picture tubes
- Demonstrate the working of various optical recording systems
- Distinguish various standards for color TV system
- Acquire knowledge on various telecommunication networks
- Demonstrate the working of various home appliances

UNIT I LOUDSPEAKERS AND MICROPHONES

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT II TELEVISION STANDARDS AND SYSTEMS

Components of a TV system–interlacing–composite video signal. Colour TV– Luminance and Chrominance signal; Monochrome and Colour Picture Tubes- Color TV systems– NTSC, PAL, SECAM-Components of a Remote Control.

UNIT III OPTICAL RECORDING AND REPRODUCTION

Audio Disc– Processing of the Audio signal–readout from the Disc –Reconstruction of the audio signal–Video Disc–Video disc formats- recording systems–Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS

Telephone services-telephone networks–switching system principles–PAPX switching–Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems.

UNIT V HOME APPLIANCES

Basic principle and block diagram of microwave oven; washing machine hardware and software; Components of air conditioning and refrigeration systems.

Suggested Readings

1. S.P. Bali Consumer Electronics Pearson Education 2007
2. J.S.Chitode Consumer Electronics Technical Publications 2007
3. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998

19BEECOE03 NEURAL NETWORKS AND ITS APPLICATIONS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic concepts of neural networks and its applications in various domain
- To educate how to use Soft Computing to solve real-world problems
- To have a solid understanding of Basic Neural Network.
- To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
- To gain exposure in the field of neural networks and relate the human neural system into the digital world
- To provide knowledge of computation and dynamical systems using neural networks

Course Outcomes

At the end of the course the students will be able to

- Understand the basic concepts of neural networks and its applications in various domains
- Gain knowledge about learning process in Neural Networks
- Apply perception concept in design
- Design using ART phenomena
- Gain knowledge on SOM concepts
- Ability to develop the use of Soft Computing to solve real-world problems

UNIT I INTRODUCTION TO NEURAL NETWORKS

Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT II LEARNING PROCESS

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION

Single layer Perception-Adaptive filtering-unconstrained Optimization-Least-mean square algorithm- Leaning Curve-Annealing Technique-perception convergence Theorem-Relationship between perception and Baye's Classifier-Back propagation algorithm

UNIT IV ATTRACT OR NEURAL NETWORK AND ART

Hopfield model-BAM model -BAM Stability-Adaptive BAM -Lyapunov function-effect of gain- Hopfield Design-Application to TSP problem-ART-layer 1-layer 2-orienting subsystem-ART algorithm-ARTMAP.

UNIT-V SELF ORGANIZATION

Self-organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical Vector Quantization. Applications of self-organizing maps: The Neural Phonetic Type Writer Learning Ballistic Arm Movements.

Suggested Readings

1. SimonHaykin Neural Networks and Learning Machines 3rd Edition Pearson/Prentice Hall 2009
2. SatishKumar Neural Networks: A Classroom Approach TMH 2008
3. Rajasekaran.S, Vijayalakshmi Pai.G.A Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications PHI, New Delhi 2003.
4. LaureneFausett Fundamentals of Neural Networks: Architectures, Algorithms, and Applications Pearson/Prentice Hall 1994
5. Wasserman P.D Neural Computing Theory & Practice Van Nortrand Reinhold 1989.
6. Freeman J.A, S kapura D.M Neural networks, algorithms, applications, and programming techniques AdditionWesley 2005.

19BEECOE04 FUZZY LOGIC AND ITS APPLICATIONS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To introduce the basic concepts of Fuzzy logic and its applications in various domain
- To educate how to use Fuzzy computation to solve real-world problems
- To have a solid understanding of Basic fuzzy models.
- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- To learn about applications on Fuzzy based systems
- To familiarize with fuzzy fiction and de fuzzy fiction procedures

Course Outcomes

At the end of the course the students will be able to

- Understand the basic concepts of Fuzzy logic and its applications in various domain
- Gain knowledge on theory of Reasoning
- Develop fuzzy controllers
- Understand concepts of adaptive fuzzy control
- Ability to develop how to use Fuzzy computation to solve real- world problems
- Design fuzzy based model for any application

UNIT I BASICS OF FUZZY LOGIC

Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II THEORY OF APPROXIMATE REASONING

Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III FUZZY KNOWLEDGE BASED CONTROLLERS

Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzy fiction and de fuzzy fiction procedures–Design of Fuzzy Logic Controller

UNIT IV ADAPTIVE FUZZY CONTROL

Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT V FUZZY BASED SYSTEMS

Simple applications of FKBC-washing machines-traffic regulations-lift control-fuzzy in medical Applications-Introduction to ANFIS.

Suggested Readings

1. D .Diankar ,H. Hellendoom and M .Rein frank An Introduction to Fuzzy Control Narosa Publishers India 1996
2. G.J. KlirandT.A. Folger Fuzzy Sets Uncertainty and Information PHI IEEE 1995
3. Timothy J. Ross Fuzzy Logic with Engineering Applications McGraw Hill1997
4. George. J Klir and Bo Yuan Fuzzy Sets and Fuzzy Logic Prentice Hall, USA 1995

19BEECOE05 PRINCIPLES OF MODERN COMMUNICATION SYSTEM 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To provide students with an overview of communication systems
- To provide an overview on mobile communication
- To make students to have a better understanding on satellite and radar communication
- To understand the basic communication techniques which in turn are used as the building blocks of the larger and more complex communication systems.
- To acquire the basic engineering understanding to the modern communication systems and; the relevant theory and technique.
- Design simple systems for landing and navigation.

Course Outcomes

At the end of the course the students will be able to

- Understand past, present and future trends in mobile communication.
- Gain knowledge about mobile cellular communication
- Understand various standards in use for wireless communication and its application.
- Demonstrate some basic application of GPS.
- Gain knowledge about RADAR working and its applications
- Demonstrate how a simple radar system works and its applications.

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION

From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III WIRELESS COMMUNICATION

Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION

History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION

Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

Suggested Readings

1. S.Haykin, ―Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, ―Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson Education India, 2010
4. Vijay. K. Garg, ―Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.
5. T.Pratt, C. Bostian and J.Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried ―Avionics Navigation Systems, John Wiley & Sons 1997.