FACULTY OF ENGINEERING
DEGREE OF BACHELOR OF ENGINEERING IN BIOMEDICAL ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING

(REGULAR PROGRAMME)

CURRICULUM & SYLLABI

(2018-2019)

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Established Under Section 3 of UGC Act 1956)
COIMBATORE 641 021
INDIA.

Semester I & II

18BECC101 ENGLISH FOR ENGINEERS 3 0 0 3 100

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.
- To improve the students communication skill at interview level

COURSE OUTCOMES:

Upon completion of this course, the student 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.
- write business letters and other forms of technical writing.
- prepare for oral communication in formal contexts

Unit- I LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening –Types of listening- Listening to class reading - Video tapes/ Audio tapes. **Speaking** – Introduction on self. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. **Writing** – Formal and Informal letters- Letters to the Editor.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Tenses -Articles. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

Unit – II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (8)

Listening – Understanding the passage in English –Pronunciation practice. **Speaking** – Asking and answering questions. **Reading** – Critical reading – Finding key information in a given text (Skimming - Scanning). **Writing**– Coherence and cohesion in writing – Short paragraph writing – Writing short messages.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary** – Compound Nouns/Adjectives – Irregular verbs.

Unit – III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (8)

Listening – Listening for specific task – fill in the gaps. **Speaking** – Phonemes – Syllables – Role play – Conversation Practice. **Reading** –comprehension passages based on general topics or matters of current affairs. **Writing -** Autobiographical writing & Biographical writing.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Preposition – Infinitive & Gerund. **Vocabulary** – Foreign words used in English – British and American usage.

Unit- IV LSRW SKILLS & GRAMMAR, CAREER ORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (10)

Listening – Responding to questions – Reading in class for complete understanding and for better pronunciation. **Speaking** – Debate- Presentations in seminars. **Reading** – Making inference from the reading passage – Predicting the content of reading passages. **Writing -** Interpreting visual materials (tables, graphs, charts, etc) & Instruction writing.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Parts of Speech , Sentence pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.

Unit-V LSRW SKILLS & GRAMMAR, FIELD WORK

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (10)

Listening –Distinction between native and Indian English (Speeches by TED and Kalam). **Speaking**- Extempore talk –Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. **Writing -** Creative writing – Writing circulars and notices – Writing proposal.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Direct and Indirect speech – Conditional sentences - Auxiliary verbs. **Vocabulary** – Abbreviations & Acronyms.

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

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2009
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEBSITES:

www.learnerstv.com – Listening/ Speaking/ Presentation
www.usingenglish.com – Writing/ Grammar
www.englishclub.com – Vocabulary Enrichment/ Speaking
www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/ Speaking
www.teachertube.com – Writing Technically
www.Dictionary.com – Semantic / Grammar

18BECC102 ENGINEERING MATHEMATICS - I 3 2 0 4 100

COURSE OBJECTIVES:

The goal of this course is for the students

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To understand geometrical aspects of curvature and elegant application of differential calculus which are needed in Engineering applications.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model Engineering problems.
- To familiarize the student with functions of several variables which is the foundation for many branches of Engineering.
- To introduce sequence and series which is central to many applications in Engineering.
- To make the student to solve various engineering problems

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COURSE OUTCOMES:

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

- To solve the rank, Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices and the students will be able to use matrix algebra techniques for practical applications.
- To equip the students to have basic knowledge and understanding in one field of materials, differential calculus
- To solve simple standard examples using the ideas of differential equations.
- To apply various techniques to solve Partial Differential Equations
- To develop the tool of power series for learning advanced Engineering Mathematics.
- To apply the knowledge acquired to solve various Engineering problems.

UNIT I MATRICES (12)

Review of Matrix Algebra - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction.

UNIT II DIFFERENTIAL CALCULUS (12)

Limits, Continuity (Concepts only)- Differentiation- Differentiation Techniques: standard formulae, product rule, quotient rule, chain rule, method of substitution, implicit functions and successive differentiation.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS (12)

Curvature – centre, radius and circle of curvature in Cartesian co- ordinates – Evolutes – Envelope – Evolute as envelope of normals.

UNIT IV DIFFERENTIAL EQUATIONS (12)

Introduction to Ordinary differential equations: Linear ordinary differential equations of second and higher order with constant coefficients.

Introduction to Partial differential equations: Linear Partial differential equations of second and higher order with constant coefficients.

UNIT V VECTOR DIFFERENTIATION (12)

Vectors-Differentiation of vectors – scalar and vector point functions –vector operator – vector operator applied to scalar point functions: Gradient; vector operator applied to vector point functions: Divergence and curl; Physical interpretation of divergence and curl, Directional derivative, solenoidal and irrotational vectors.

Total: 60

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics	McGraw Hill Education (India) Private Limited, New Delhi.	2014
2	Sundaram, V. Lakhminarayan,K.A. &Balasubramanian,R .	Engineering Mathematics for first year.	Vikas Publishing Home, New Delhi.	2006
3	Bali, N.P. & Manish Goyal	A Text Book of Engineering Mathematics	Laxmi Publications Pvt. Ltd., New Delhi.	2014

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Grewel . B. S.	Higher Engineering Mathematics	Khanna Publications, New Delhi.	2014
2	BhaskarRao. P. B, Sri Ramachary SKVS, BhujangaRao. M	Engineering Mathematics I	BS Publications, India.	2010
3	Ramana. B.V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Company, New Delhi.	2007
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants
4. www. Intmath.com/calculus/calculus-intro.php

18BEBME103 PROGRAMMING FOR PROBLEM SOLVING 3 0 4 5 100

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 decompose a problem into functions and synthesize a complete program using divide and conquer approach.

INTENDED OUTCOME

The student will learn

- 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 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/Pseudocode 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-Arrays 1-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.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	E. Balagurusamy	Computing Fundamentals and C Programming	TMH Education	2017
2.	E. Balaguruswamy	Programming in ANSI C	Tata McGraw-Hill	2017
3	Byron Gottfried	Schaum's Outline of Programming with C	Tata McGraw-Hill	2017

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Brian W. Kernighan and Dennis M. Ritchie	The C Programming Language	Prentice Hall of India	2015

18BEPH103
18BEPH203 **ENGINEERING PHYSICS** **3 0 0 3**
100

COURSE OBJECTIVES:

The Goal of this course is for students to

- To understand the properties of matter and its applications.
- To study the basics of sound and ultrasonics with appropriate applications.
- To study the fundamentals of thermal and quantum physics and their applications.
- To introduce the concepts of light, laser and fiber optics for diverse applications.
- To comprehend the properties of crystal and its various crystal structures.
- To analyse the relevant problems in engineering stream.

COURSE OUTCOMES:

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

- Develop knowledge on the basics of properties of matter and its applications.
- Make use of the concepts of sound, ultrasonic and their applications.
- Illustrate the thermal properties of materials and advanced physics concepts of quantum theory
- Identify the basics of light, laser, fiber optics and their applications.
- Develop the basics of crystals and their structures.
- Make use of the knowledge gained from this course to solve the relevant problems in engineering stream.

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS (9)

Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), Poisson's ratio- Torsional pendulum- bending of beams - bending moment – uniform and non uniform bending

Thermodynamics – laws of thermodynamics- concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBER OPTICS (9)

Introduction – emission and absorption process- Einstein's coefficients derivation. Types of LASER - CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.

Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

UNIT III QUANTUM PHYSICS (9)

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 IV CRYSTAL PHYSICS (9)

Lattice – unit cell – Bravais lattice – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures, crystal defects – point, line and surface defects

UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, Medical applications – Sonogram. Introduction – basics about nuclear fission and fusion, Radiation detectors – semi conductor detector. Reactors – essentials of nuclear reactor- power reactor.

Total- 45

TEXT BOOK:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Serway and Jewett	Physics for Scientists and Engineers with Modern Physics	Thomson Brooks/Cole, Indian reprint, New Delhi	2010
2	Gaur, R.K. and Gupta, S.C	Engineering Physics	Dhanpat Rai Publications,New Delhi.	2011
3	M.N. Avadhanulu and PG Kshirsagar	A Text book of Engineering Physics	S.Chand and company, Ltd., New Delhi	2011
4	D.C. Ghosh, N.C. Ghosh, P.K. Haldar	Engineering Physics	University Science, New Delhi	2011
5	P. Khare, A. Swarup	Engineering Physics: Fundamentals and Modern Applications	Jones & Bartlett Learning	2009

WEBSITES:

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu
4. www.physics.org

18BECH103
18BECH203 **ENGINEERING CHEMISTRY** **3 0 0 3 100**

COURSE OBJECTIVES:

The goal of this course is for students :

- 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 understand the concept of chemical reactions
- To comprehend the basic organic chemistry and to synthesis simple drug

COURSE OUTCOMES:

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

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise bulk properties and processes using thermodynamic considerations.
- List major chemical reactions that are used in the synthesis of molecules.
- Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I WATER TECHNOLOGY (9)

Sources-Characteristics – Specification for drinking water, BIS &WHO-Alkalinity – Types of alkalinity and determination (No problems) – Hardness – Types and estimation by EDTA method (No problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination - Reverse osmosis.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES (9)

Electrolytic conductance-application (conductometric titration)- Electrochemical cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes – Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox - Fe^{2+}vs dichromate) –-Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery. An introduction to Fuel Cell- H_2-O_2 Fuel Cell.

UNIT III FUELS AND COMBUSTION (9)

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, Combustion of fuel-Introduction-GCV-NCV- Problems on Calculation of GCV & NCV - Flue gas analysis.

UNIT IV CORROSION SCIENCE (9)

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions – Inorganic coatings- Metallic coatings - Electroplating of Cu over Fe and Electro less plating (Ni) - Surface conversion coating - Hot dipping.- Anodizing of Al

UNIT V SURFACE CHEMISTRY AND PHASE RULE (9)

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Role of adsorbents in industries (catalysis and water softening).

Phase Rule: Definition -Phase diagrams – one component water system, two component Ag-Pb system.

Total: 45TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Vairam.S	Engineering Chemistry	Gems Publishers, Coimbatore.	2014
2.	Dr.Ravikrishnan.A	Engineering Chemistry I & II	Sri Krishna Hi tech Publishing Company (P) Ltd., Chennai.	2012

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Raman Sivakumar	Engineering Chemistry I &II	McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi.	2013
2.	Kuriakose. J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5th edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010
3.	Jain, P.C. and Monika Jain	Engineering Chemistry.	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.	2009
4.	Dara.S.S	Text book of Engineering Chemistry.	S.Chand & Co.Ltd., New Delhi	2008
5.	Sharma.B. K	Engineering Chemistry	Krishna Prakasam Media (P) Ltd., Meerut	2001

WEBSITES:

1. http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
3. http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm
4. http://ocw.mit.edu/courses/#chemistry

18BEBME104 INTRODUCTION TO BIOMEDICAL ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES:

- To give exposure on the basics of Biomedical engineering to the students.
- To have a basic knowledge on medical devices and equipment
- To understand the evolution of modern health care system
- To induce medical Morality and Ethics in the students
- To understand the various diagnostic methods and therapeutic systems available
- To get to know the various biomedical signals and other parameters associated with the Human body

COURSE OUTCOMES:

At the end of the course he student will be able to:

- Understand the basics of Bioinstrumentation
- Exposed to the ethics for Biomedical engineers
- Analyze models of physiological system.
- Handle biomedical equipments
- Know the various physiological systems of human body and the associated biopotentials
- Understand the codes of ethics for engineers

UNIT-I INTRODUCTION (9)

Historical Perspective-Evolution of modern health care system, Roles played by Biomedical engineers, Professional status of biomedical engineering, Electrical Signals – Conductivity & temperature.

UNIT-II DIAGNOSTIC DEVICES (9)

Sources of biomedical signals, Basic medical instrumentation system-General block diagram of a medical instrumentation system, Diagnostic devices-ECG, EEG, blood pressure measurement, Temperature and Respiration rate measurement, Blood cell counters, General constraints in design of medical instrumentation systems.

UNIT-III DIAGNOSTIC IMAGING (9)

X-rays, Nuclear Medical Imaging-Positron Emission Tomography, Magnetic Resonance Imaging Scanners, Diagnostic Ultrasound, Thermal imaging systems.

UNIT-IV THERAPEUTIC EQUIPMENT (9)

Cardiac Pacemakers, Cardiac Defibrillators, Artificial heart, Instruments for Surgery, Haemodialysis Machines-Artificial Kidney, Dialyzers, Ventilators-Humidifiers, Nebulizers and Aspirators, Anaesthesia Machine.

UNIT-V ETHICS FOR BIOMEDICAL ENGINEERS (9)

Morality and Ethics-A Definition of terms, Human Experimentation, Ethical issues in feasibility studies, Ethical issues in emergency use, Ethical issues in treatment use, Codes of ethics for bio engineers.

Total: 45

TEXT BOOKS

S. No.	Author (s) Name	Title of the book	Publisher	Year of Publication
1	Enderle, John D., Bronzino, Joseph D., Blanchard, Susan M	Introduction to Biomedical Engineering	Elsevier Inc	2nd edition, 2005
2.	R. S. Khandpur	Handbook of Biomedical Instrumetation	McGraw-Hill Publishing Company Limited	2nd edition, 2003
3.	Daniel A Vallero	Biomedical ethics for Engineers	Elsevier publication	1st edition, 2007

REFERENCE BOOKS

S. No.	Author (s) Name	Title of the book	Publisher	Year of Publication
1	Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer	Biomedical Instrumentation and Measurement	Prentice Hall of India, New Delhi	2nd edition2002
2.	John G Webster	Medical Instrumentation: Application and Design	John Wiley and sons, New York	4th edition, 2010
3.	Joseph J Carr, John M Brown	Introduction to Biomedical Equipment Technology	John Wiley & Sons, New York	4th edition, 2008

18BEBME105 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 3003 100

COURSE OBJECTIVES

- To impart the basic knowledge about the Electric circuits.
- To understand the working of various Electrical Machines.
- To know about various measuring instruments.
- To understand the basic concepts in semiconductor devices and digital electronics.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
- Highlight the importance of transformers in transmission and distribution of electric power

COURSE OUTCOMES

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

- The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines, basics of electronics and be able to apply them in practical situation
- Predict the behavior of any electrical and magnetic circuits.
- Formulate and solve complex AC, Dc circuits.
- Identify the type of electrical machine used for that particular application
- Understand the role of electronic components in biomedical field
- Know the various electric and electronic components

UNIT I ELECTRIC CIRCUITS & MEASUREMENTS 9

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase balanced Circuits.

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III MEASURING INSTRUMENTS 9

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode –Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics

UNIT V- DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems- simplification of Boolean expression - implementation of Boolean expressions using logic gates

Total: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mittle, V.M	Basic Electrical Engineering	Tata McGraw Hill Edition, New Delhi	2004
2	Sedha R.S	Applied Electronics	S. Chand & Co	2006

REFERENCES

S. No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Muthusubramanian R, and Muraleedharan K A	Basic Electrical, Electronics and Computer Engineering	Tata McGraw Hill, Second Edition	2006
2	Nagsarkar T K and Sukhija M S	Basics of Electrical Engineering	Oxford press	2005
3	Mahmood Nahvi and Joseph A	Electric Circuits	Schaum' Outline Series, McGraw Hill	2002
4	Premkumar N	Basic Electrical Engineering	Anuradha Publishers	2003

18BEPH111
18BEPH211 ENGINEERING PHYSICS LABORATORY 0 0 4 2 100

Course Objective:

- To develop basic laboratory skills and demonstrating the application of physical principles.
- To prepare for the lab experiment and perform individually a wide spectrum of experiments.
- To present experimental data in various appropriate forms like tabulation, and plots.
- To analyze, Interpret and Summarize experimental results.
- To communicate clearly understanding of various experimental principles, instruments/setup, and procedure.
- To analyse the relevant problems in engineering stream.

Course Outcomes:

- The students will have the knowledge on Physics practical experiments and that knowledge will be used by them in different engineering and technology applications.
- Prepare for the lab experiment and perform individually a wide spectrum of experiments.
- Present experimental data in various appropriate forms like tabulation, and plots.
- Analyze, Interpret and Summarize experimental results.
- Communicate clearly understanding of various experimental principles, instruments/setup, and procedure.
- Prepare to develop the skills for understanding basic electric circuits

LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of Young's modulus of the material – Non uniform bending (or) Uniform bending.
4. Determination of Viscosity of liquid – Poiseuille's method.
5. Spectrometer Dispersive power of a prism.
6. Torsional pendulum – Determination of Rigidity modulus.
7. Particle size determination using Diode Laser
8. Determination of Laser parameters – Wavelength, and angle of divergence.
9. Determination of acceptance angle in an optical fiber.
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Wheatstone Bridge

18BECH111
18BECH211 ENGINEERING CHEMISTRY LABORATORY 0 0 4 2 100

COURSE OBJECTIVES

The goal of this course is for students :

- 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 estimate the amount of sodium carbonate and sodium hydrogen carbonate, hardness, chloride in water sample
- To make the student acquire practical skills in the determination of conductance of solutions, EMF etc
- To understand the use of Spectrophotometry.
- To acquaint the students with the determination of rate constant of a reaction
- To carried out different types of titrations for estimation of concerned in materials

COURSE OUTCOMES

Upon completion of the course the students will be able to

- 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
- Determine the partition coefficient of a substance between two immiscible liquids.
- Acquaint the students with the determination of acid value of an oil
- Carrying out different types of titrations for estimation of concerned in materials using comparatively more qualities and quantities of materials involved for accurate results

LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of alkalinity of Water sample.
2. Estimation of hardness of Water by EDTA
3. Estimation of chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Conductometric Titration (Simple acid base).
6. Conductometric Titration (Mixture of weak and strong acids).
7. Conduct metric Titration using $BaCl_2$ vs $Na_2\ SO_4$.
8. pH Titration (acid & base).
9. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$).
10. Estimation of Ferric ion by Spectrophotometry.
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Determination of molecular weight and degree of polymerization using Viscometry.
13. Determination of chemical oxygen demand.

18BEBME112 COMPUTER PRACTICE AND PROGRAMMING LABORATORY 1 0 4 3 100

COURSE OBJECTIVES

- To familiarize with open source office packages
- To write programs for Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings and Functions.
- To discuss the fundamental principles of C Programming, as well as in-depth data and information processing techniques
- To solve problems, explore real-world software development challenges, and create practical and contemporary applications
- To learn about data structures
- To apply the string handling functions to solve the given problem

COURSE OUTCOMES

- Study logical structure of a computer program
- analyze logical structure of a computer program
- understand computer program, and different constructor to develop a program in 'C' language
- Utilize the basic data structures.
- Distinguish and use the fundamental data types.
- Utilize a simple programming environment, compile programs and interpret compiler errors.

THEORY:

What is computer- Computer Components- What is C- C Character set- Constants, Variables and Keywords-General form of C Program - Relational and Logical Operators - Selection Structures- If and nested if - Switch Case - Loops-Definition and types- Functions- Arrays- Introduction to Strings- Pointers.

PRACTICALS:

1. Working with word Processing, Spreadsheet and presentation software in Linux

2. Programming in Scratch:

   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming
3. C Programming:

   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function, implementation of pointers.

REFERENCES: **Total: 45**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	E. Balagurusamy	Computing Fundamentals and C	TMH Education, 5th Edition	2014
2	Yashavant Kanetkar	Let us "C"	BPB Publications, 13th Edition	2013

18BEBME113 ENGINEERING GRAPHICS 1 0 3 3 100

COURSE OBJECTIVES

The Goal of this course is for students to

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.
- Apply auxiliary or sectional views to most practically represent engineered parts
- To understand Dimension and annotate two-dimensional engineering drawings
- Understand the application of industry standards and techniques applied in Engineering graphics
- To prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice

COURSE OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of
- objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.
- Use various graphic tools

UNIT I INTRODUCTION 9

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), 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.

UNIT II SCALES AND PLANE CURVES 8

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNIT III FREE HAND SKETCHING 9

Representation of Three Dimensional objects – General principles of orthographic projection – 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 IV PROJECTION OF POINTS, LINES AND PLANE SURFACES 8

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT V PROJECTION OF SOLIDS 8

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

Introduction to Drafting Software/Package (Not for Exam) 3

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venugopal K and Prabhu Raja V	Engineering Graphics	New Age International Publishers	2007
2	VTU	A Primer on Computer Aided Engineering Drawing	Belgaum	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kumar M S	Engineering Graphics	D D Publications, Chennai	2007
2	Bureau of Indian Standards	Engineering Drawing Practices for Schools and Colleges SP 46-2003	BIS, New Delhi	2003
3	Luzadder W J	Fundamentals of Engineering Drawing	Prentice Hall Book Co., New York	1998

WEB REFERENCES

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

18BECC151 YOGA 1 0 0 100

OBJECTIVE:

- To enable the **student** to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.
- To Develop The Self Discipline, and Self Control

OUTCOME:

- Gain the knowledge about the theory and practice of Yoga and its nature
- Gain knowledge about Definition of psychology, Methods of psychological sciences
- Demonstrate Kriyas, Asanas, Mudras, Pranayama and meditative postures.
- To aware of Yoga Psychology and Definition & characteristics of Personality
- understand the knowledge of Advance Asanas
- To aware of Scope and substance of Indian Psychology, Cognitive process like Sensation, Perception, Attention, Memory and Thinking

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- ArdhaChakrasana- Ardha Kati Chakrasana- Thandasana- Gomugasana- Padmasana- Vajrasana- Paschimottasana- Matsyendrasana-BavanaMukthasana- SuptaPadhangusthasana-Sethubhandhasana- Navasana- ArdhaBavanamukthasana- 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- AnulomVilom- Pranay Pranayama- Benefits Of Pranayama. Neti - JalaNeti , 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.

REFERENCES:

S.No	Author Name	Title Of Book	Publisher	Yearof Publication
1.	Dr.K.Chandrasekaran	Sound Health Through Yoga	PremKalyan	2009
2.	B.K.S.Iyangar	Light On Pranayama	Crossroad Centuary	2013
3.	Thirumular	Thirumandhiram	Sriramakrishna Math	2016

18BECC201A BUSINESS COMMUNICATION 3 0 0 3 100

OBJECTIVES:

- To help students comprehend the role of listening skills in effective communication.
- To familiarize students with verbal and non-verbal communication.
- To expose students to neutral accent.
- To develop emotional intelligence skills in them for enhancing their self-esteem.
- To assist them in setting goals and developing positive attitude.
- To enable students to acquire decision making skills, problem solving skills and assertive skills .

INTENDED OUTCOMES:

Students undergoing this course will be able to

- Design and deliver a persuasive presentation that convinces the audience of the topic's relevance and overcomes resistance, using appropriate visual support and adhering to a specified time limit.
- Use a strategic communication model and critical thinking to identify objectives, analyze audiences, and choose the most effective structure and style for delivering strategically sound written and spoken messages.
- Practice principles of effective business writing and document design in all written documents.
- Build an understanding of different organizational cultures, business practices, and social norms to communicate more effectively in domestic and cross-cultural business contexts.
- Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- Make decisions and solve problems by their own

UNIT I

What is Business Communication? - Types of Communication – Formal and informal communication – Process of Communication- modes of Communication – Barriers to communication.

UNIT II

Written Business Communication – Style- word-usage- organisation of Ideas – mechanics of writing and fill up of forms - Cover Letter- Letter for Job Application- Letter of Complaint - Memos - Resumes - Email- Reports Revising and proofreading- Advertising slogans- jargons- interpretation of graphs using expressions of comparison and contrast .

UNIT III

Reading and Understanding the news articles - Oral Business Communication - First Impressions - Attire – Effective Presentation strategies- Nuances of delivery – Controlling nervousness and stage fright- Visual aids Presentations- Capturing Audience - Tone - Behavior - Telephone

Etiquette- Non - verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body langage – Etiquette- Organization of presentation – brain storming- Negotiations.

UNIT - IV

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

UNIT - V

Intrapersonal skills - Self-analysis - Thought process – Interpersonal skills - Confidence building - Resolving conflicts- Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Communicating via e-mail. Ethical perspectives and their implications for responsible communication - Proposal Presentation

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Meenakshi Raman ; Prakash Singh	Business Communication	Oxford University Press	2012

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Murthy, G .R. K.	Soft Skills for Success**.**	The ICFAI University Press, Hyderabad.	2008
2	Jagadeesan, G & Santanakrishnan,R .	Soft Skills Development: Training and Evaluation.	The ICFAI University Press, Hyderabad.	2008
3	Sherfield, Robert M., Rhonda J. Montgomery, & Patricia G. Moody	Developing Soft Skills.	Pearson Education, New Delhi.	2005

WEBSITES

http://tribehr.com/social-hr-software/talent-management/skills-tracking
www.ispeakyouspeak.blogspot.com
https://alison.com/subjects/6/Personal-Development-Soft-Skills
www.learning-development.hr.toolbox.com
http://www.niit.com/solution/soft-skill-training
http://mybcommlab.com to test your understanding of the concepts presented in each chapter and explore additional materials that will bring the ideas to life in videos, activities, and an online multimedia e-book.

18BECC201B TECHNICAL ENGLISH 3 0 0 3 100

COURSE OBJECTIVES:

- To motivate learners to acquire listening & speaking skills in both formal and informal context.
- To focus on question forms & to make them understand the importance of using question tags and also the functional use of transformation of sentences.
- To improve their reading habit and to train them in critical and analytical reading.
- To equip them to write for academic as well as work place context.
- To enable students to face interviews.
- Understand the English grammar and develop communication skills

COURSE OUTCOMES:

Students undergoing this course will be able to

- Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicative strategies.
- Enhance them reading texts critically and analytically.
- Develop writing effectively, persuasively and producing different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Enrich the ability to face interviews with confidence.
- Speak English confidentially and write technical papers
- Read technical papers and review them

UNIT-1 LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening - Difference between Hearing & Listening –Listening to informal conversation. Speaking - Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., Reading – Extensive and Intensive reading. Writing – Report writing - Writing a covering letter.
Grammar & Vocabulary (Function Grammar & Technical Vocabulary)
Regular & Irregular verbs - Kinds of sentences - Question tags. Homonyms and Homophones.

UNIT-II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Note Taking- Improving grasping ability. Speaking – Welcome address - Vote of thanks - Master of ceremony. Reading – Active and Passive reading - Reading for vocabulary- Reading for a purpose. Writing - Writing a review (Film review) - Summary of a story. Grammar & Vocabulary (Function Grammar & Technical Vocabulary)
Modal verbs – Conjunction - Expression of cause and effect. Phrasal verbs - Idioms.

UNIT – III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening - Barriers to listening (Physical, Psychological, Linguistic & Cultural). **Speaking** – Stress, Pause and Intonation. **Reading** – Rapid reading – Skimming, Scanning and Surveying. (SQ3R)**Writing** - Essay writing -Minutes of meeting - Agenda

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Active and Passive voice - Purpose expression. Same words used as noun and verb - Often misspelt and confused words.

UNIT-IV LSRW SKILLS & GRAMMAR, CAREER ORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Listening to telephone conversation - Viewing model interviews. **Speaking** – Group Discussion - Correlation between verbal & non - verbal communication. **Reading** – Reading comprehension (short & long text) - Reading job advertisements and profile of a company. **Writing** – Checklist preparation.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Grammar - Numerical expressions – Collocations. Singular and Plural (Nouns)

UNIT- V LSRW SKILLS & GRAMMAR, FIELD WORK

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Types of listening- Improving listening comprehension**. Speaking** - Oral presentation - Vocal communication techniques - Voice, quality, volume, pitch etc., **Reading** -Note making - Making notes from books/ any forms of writing materials. **Writing** - Describing process & products - Recommendation writing – Short essays writing-

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Transformation of sentences (Simple, Compound & Complex).Collection of Technical Vocabularies with their meanings.

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

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEBSITES :

www.learnerstv.com – Listening/ Speaking/ Presentation

www.usingenglish.com – Writing/ Grammar

www.englishclub.com – Vocabulary Enrichment/ Speaking

www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/ Speaking

www.teachertube.com – Writing Technically

www.Dictionary.com – Semantic / Grammar

18BECC202 ENGINEERING MATHEMATICS II 3 2 0 4 100

COURSE OBJECTIVES:

The goal of this course is for students :

- 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 enable the students to apply the knowledge of Mathematics in various Engineering fields by making them to identify the functions in engineering problems as analytic function and their study as a functions of a complex variables.
- Develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence.
- To specify some difficult integration that appear in applications can be solved by complex integration in application areas such as fluid dynamics and flow of the electric current.
- To make the student understand the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

COURSE OUTCOMES:

The student will be able to

- To apply the Eigen values and eigenvectors, diagonalization of a matrix, nature and they will also be able to use matrix algebra techniques for practical applications.
- To find grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities, to evaluate line, surface and volume integrals in simple coordinate systems and to use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
- To find the Analytic functions using the Cauchy Riemann equations and they will learn mapping properties of elementary functions and mapping properties of some special transcendental functions. They will understand relations between conformal mappings and quadratic differentials and how geometric structures are changing under conformal mappings.
- To evaluate complex integrals using the Cauchy's integral formula and the Residue theorem and to appreciate how complex methods can be used to prove some important theoretical results.
- To apply Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.
- In applying the concept of Matrices , Vector calculus, Analytic functions, Complex integration and Laplace transforms in their respective fields.

UNIT I INTEGRAL CALCULUS (12)

Definite and indefinite integrals – Techniques of integration – Substitution rule, Trigonometric integrals, Integration by parts , Integration of rational functions by partial fraction, Integration of irrational functions – Improper Integrals.

UNIT II MULTIPLE INTEGRALS (12)

Double integral – Cartesian coordinates – Polar coordinates – Area as double integrals- Change the order of integration – Triple integration in Cartesian co-ordinates.

UNIT III VECTOR INTEGRATION (12)

Integration of vectors – line integral- surface integral- volume integral- Green's theorem - Gauss divergence theorem and Stoke's theorems (Statement Only), hemisphere and rectangular parallelopipeds problems.

UNIT IV ANALYTIC FUNCTIONS (12)

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z and bilinear transformation.

UNIT V COMPLEX INTEGRATION (12)

Complex Integration - Cauchy's integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy's residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi-circle (excluding poles on the real axis).

Total: 60

TEXT BOOKS:

S.NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics I & II	McGraw-Hill Education Pvt.Ltd, New Delhi	2014
2	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2014

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Erwin Kreyszig	Advanced Engineering Mathematics.	John Wiley & Sons. Singapore	2011
2	Venkataraman, M. K.	Engineering Mathematics.	The National Publishing Company, Chennai	2005
3	Narayanan. S, Manicavachagam pillay.T.K and Ramaniah.G	Advanced Mathematics for Engineering Students.	Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.	2002

4	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1.www.efunda.com
2. www.mathcentre.ac.uk
3. www.sosmath.com/diffeq/laplace/basic/basic.html
4. www.mathworld.wolframe.com

18BECC204 ENVIRONMENTAL SCIENCES 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students :

- To give a comprehensive insight into natural resources.
- To impart knowledge on ecosystem and biodiversity.
- To educate the ways and means of the environment.
- To protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters

COURSE OUTCOME:

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

- 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 TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (9)

Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

UNIT II ECOSYSTEM (9)

Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY (9)

Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION (9)

Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-causes, effects and control measures of urban and industrial wastes– Role of an individual in prevention of pollution–Disaster management-earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT (9)

From Unsustainable to Sustainable development, Urban problems related to energy sources, Water conservation, Rain water harvesting and Watershed management, Resettlement and rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change-Green house effect and Global warming, Acid rain, Ozone layer depletion, Wasteland reclamation-Environment Protection Act- Human Rights- Value education, Role of Information Technology in Environment and Human health-Population growth, Variation of population among nations-Population explosion.

Total: 45

TEXT BOOKS:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Ravikrishnan, A	Environmental Science	Sri Krishna Hi tech Publishing Company Private Ltd., Chennai	2012
2.	Anubha kaushik C.P. Kaushik	Environmental Science and Engineering	New Age International (P) Ltd., New Delhi.	2010

REFERENCES:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William P.Cunningham	Principles of Environmental Science	Tata Mc Graw -Hill Publishing Company, New Delhi.	2008
2.	Linda D. Williams	Environmental Science Demystified	Tata Mc Graw -Hill Publishing Company Ltd., New Delhi.	2005
3.	Bharucha Erach	Environmental Science	Mapin Publishing (P) Ltd., Ahmedabad.	2005

		Demystified		
4.	Tyler Miller G. Jr	Environmental Science	Thomson & Thomson Publishers, New Delhi.	2004
5.	Trivedi, R.K. and Goel, P.K	Introduction to Air Pollution	Techno-Science Publications, Jaipur.	2003

WEBSITES:

1. http://people.eku.edu/ritchisong/envscinotes1.html
2. http://nptel.ac.in/courses.php?disciplineId=120
3.www.newagepublishers.com/samplechapter/001281.
4.www.unesco.org/ext/field/beijing/scienceb.htm,www.infinitepower.org/education.htm
5. http://www.sciencedaily.com/news/top/environment/

18BEBME205 MATERIALS SCIENCE 3 0 0 3

COURSE OBJECTIVE:

The goal of this course is for students

- To enrich the understanding of various types of materials and their applications in engineering and technology
- To review physics and chemistry in the context of materials science & engineering.
- To describe the different types of bonding in solids, and the physical ramifications of these differences.
- Give an introduction to metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding of bonding.
- Give an introduction to the relation between processing, structure, and physical properties.
- Give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class.

COURSE OUTCOME:

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

- The students will have the knowledge on different types of materials and that knowledge will be used by them in different engineering and technology applications
- Given a type of material, be able to qualitatively describe the bonding scheme and its general physical properties, as well as possible applications.
- Given a type of bond, be able to describe its physical origin, as well as strength.
- Be able to qualitatively derive a material's Young's modulus from a potential energy curve.
- Given the structure of a metal, be able to describe resultant elastic properties in terms of its 1D and 2D defects.
- Given a simple set of diffraction data, be able to index the peaks and infer the structure. Be able to describe a polymer's elastic behavior above and below the glass transition.

UNIT I CONDUCTING MATERIALS (9)

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS (9)

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS (9)

Origin of magnetic moment – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.
Superconductivity: properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Temperature superconductors – Applications of superconductors – Magnetic levitation.

UNIT IV DIELECTRIC MATERIALS (9)

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – ferroelectricity and applications.

UNIT V ADVANCED MATERIALS AND CHARACTERIZATION TECHNIQUES (9)

Nano materials: synthesis – Physical and chemical vapour deposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: structure – properties and applications.

Spectroscopy: Basic concepts, Theory and Experimental techniques – Raman Spectroscopy, Nuclear Magnetic Resonance Spectroscopy (NMR).

Total- 45

TEXT BOOK:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ganesan.S and Baskar.T	Engineering Physics II	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	William D Callister Jr	Material Science and Engineering-An Introduction	John Wiley & Sons Inc., New York.	2013
2	James F Shackelford	Introduction to Materials Science for Engineers	Macmillan Publication Company, New York	2014
3	Charles Kittel	Introduction to Solid State Physics	John Wiley & sons, Singapore.	2005
4	Colin N. Banwell, Elaine M. McCash	Fundamentals of Molecular Spectroscopy	McGraw-Hill Companies, New Delhi	2008

WEBSITES:

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www. oyc.yale.edu
4. www.physics.org

18BEBME212 ENGINEERING WORKSHOP PRACTICE 0 0 4 2 100

COURSE OBJECTIVES:

The goal of this course is for students

- To provide exposure to the students with hands on experience on various basic engineering practices in civil, mechanical, electrical and electronics engineering.
- To understand carpendry works
- To understand Plumbing works
- To understand smithy and foundry works
- To classify various tools used in carpendry ,plumbing and foundry works
- To understand basic concept of machining

COURSE OUTCOMES:

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

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures.
- Demonstrate carpendry works
- Demonstrate Plumbing works
- Demonstrate smithy and foundry works
- Ability to fabricate electrical and electronics circuits

PART – A (MECHANICAL)

1. WELDING

i. Preparation of arc welding of butt joints, lap joints and tee joints.

2. BASIC MACHINING

i. Simple Turning and Taper turning
ii. Drilling and Tapping
iii. Sheet Metal Work
iv. Model making – Trays, funnels, etc.

3. DEMONSTRATION ON

i. Smithy operations
ii. Foundry operations
iii. Plumbing Works
iv. Carpentary Works

PART –B (ELECTRICAL & ELECTRONICS)

4. ELECTRICAL ENGINEERING

i. Study of electrical symbols and electrical equipments.
ii. Construct the wiring diagram for Stair case wiring and Fluorescent lamp wiring.
iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.
v. Measurement of energy using single phase energy meter.

5. ELECTRONICS ENGINEERING

i. Study of Electronic components– Resistor (color coding), capacitors and inductors.
ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
iii. Study of logic gates AND, OR, NOT, NOR and NAND.

TOTAL 45

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jeyachandran, K. and Balasubramanian, S	A Premier on Engineering Practices Laboratory	Anuradha Publications, Kumbakonam	2007
2	Jeyapoovan, T., Saravanapandian, M	Engineering Practices Lab Manual	Vikas Puplishing House Pvt. Ltd, Chennai	2006
3	Bawa, H.S	Workshop Practice	Tata McGraw – Hill Publishing Company Limited, New Delhi	2007

18BEBME213 C PROGRAMMING LAB 0 0 3 2 100

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
- 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

LEARNING OUTCOMES:

- Able to understand the basic terminology used in computer programming
- Able to write, compile and debug programs in C language.
- Able to use different data types in a computer program.
- Able to design programs involving decision structures, loops and functions.
- Able to understand the dynamics of memory by the use of pointers
- Understand the concept of function and operator
- Develop programming skill and to solve engineering related problems.

List of Experiments

1. Write a C program to find Factorial of a given number using do while loop.
2. Write a C Program to print Fibonacci series using while loop.
3. Write a C Program to check a given number is Prime or Not.
4. Write a C Program to compute the sum of even numbers for a given n value.
5. Write a C Program to check the given string is Palindrome or Not.
6. Write a C Program to check the given number is Armstrong or Not using functions.
7. Write a C Program to count the number of vowels from the given string using switch case.
8. Write a C Program to read a line of text from keyboard and print the number of characters, words and spaces.
9. Write a C Program to print the student‟s record using structure.
10. Write a C Program to find factorial of a number using recursion function.

18BEBME251 BUSINESS APTITUDE SKILLS 1 0 0 - 100

BUSINESS PLAN

COURSE OBJECTIVE:

The goal of this course is for students

- To describe the content and delivery of a business planning course.
- To examine the perceived effectiveness of the business planning course relating to entrepreneurial skills gained by students
- To examine the usefulness of business plans as a pedagogical tool in imparting knowledge and skills to identify and integrate key business functional areas.
- To explain relevance of Ethics while taking business decisions.
- To understand the risk assessments and business plan process
- To learn about the various market research

SOURCE OUTCOMES:

After this course the student wil be able to:

- Think about self business
- Know the various risk factorsin business
- Read various business articles and know the market research
- Get familiar with various Government policies
- Various factors of successful business
- Have a good knowedge about various markets

UNIT I

Entrepreneurship – Types- Entrepreneurial Competencies -Business Plan – Meaning - Basic parameters - Project parameters - Factors of successful business - Term Loans and Working Capital Management.

UNIT II

Business Plan Process - Sources of Information – Online Resources - Offline Resources - Sources of Market Research - Benefits of market study - Coverage of market study.

UNIT III

Business Plan components - Company description - Industry Analysis - Target Market - Competition - Strategic position - Risk assessment - Technology plan - Management and Organization – Government policy

REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rhonda Abrams	The Successful business Plan Secret $ Strategies	Prentice Hall	-
2	Rhonda Abrams	The business plan in a day	Prentice Hall	-

18BEBME301A OPTIMIZATION AND CALCULUS OF VARIABLES 3 2 0 4 100

COURSE OBJECTIVES:

The goal of this course is for students :

- To develop analytical skills for solving engineering problems
- To teach the students the basic concepts of LPP, Transportation and Assignment problems
- To make the students to study about the Integer Programming and Network Analysis
- To teach the students the basic concepts PERT & CPM
- To teach the students the basic concepts of Hungarian Algorithm
- To make students understand the concept of Branch Bound Method

COURSE OUTCOMES:

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

- Be able to solve problems in different environments and develop critical thinking
- Be able to build and solve Transportation Models
- Be able to analyse Assignment Models,
- Be able to solve integer programming and Nonlinear programming
- Be able to understand Hungarian Algorithm
- Analyse and apply branch bound method in engineering problems

UNIT I LINEAR PROGRAMMING PROBLEM (12)

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 AND ASSIGNMENT PROBLEM (12)

Transportation Model- finding initial basic feasible solutions- moving towards optimality- Degeneracy. Solution of an Assignment problem - Hungarian Algorithm.

UNIT III INTEGER PROGRAMMING (11)

Integer Programming Problem – Gromory's fractional cut Method – Branch Bound Method

UNIT IV NETWORK ANALYSIS (11)

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis.

UNIT V CALCULUS OF VARIATIONS (14)

Calculus of Variations - Basic definition, Simplest problem, Isoperimetric problem, Problems with Higher order derivatives, Euler Lagrange Equation, Weierstrass - Erdmann conditions; Pontryagin Maximum Principle; Transversality condition; Applications

Total : 60

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi.	2013
2	Dr. Grewal B.S.	Higher Engineering Mathematics	Khanna Publishers, New Delhi.	2013

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Natarajan A.M., Balasubramani P., Thamilarasi A	Operations Research	Pearson Education, New Delhi.	2005
2	Srinivasan G	Operations Research: Principles and Applications	PHI Private Limited, New Delhi.	2007
3	Winston	Operations Research, Applications and Algorithms	Cengage Learning India Pvt. Ltd, New Delhi.	2004
4	Kanti Swarup, Manmohan, Gupta	Operations Research	Sultan Chand & Sons, New Delhi.	2010

WEBSITES:

1. www.mathworld. Wolfram.com
2. www.mit.edu
3. www.nptel.com

18BEBME301B LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4 100

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.

INTENDED OUTCOMES:

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Able to solve various types of partial differential equations.
- Able to solve 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 linear transformations - Eigen values 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.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Friedberg, A.H., Insel, A.J. and Spence, L	Linear Algebra‖	Prentice – Hall of India Private Limited, New Delhi .	2004
2	Dr. Grewal B.S.	Higher Engineering Mathematics	Khanna Publishers, New Delhi.	2014
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	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

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	T.S.Blyth.,E.F.Robertson	Basis Linear Algebra	Springer	2002

18BECC302 DIGITAL ELECTRONICS 3 0 0 2 100

COURSE OBJECTIVES

The goal of this course is for students

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits
- To summarize the concept of memories and programmable logic devices.

COURSE OUTCOMES:

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

- Understand number systems and codes
- Understand basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- Understand the methods for simplifying Boolean expressions
- Understand the formal procedures for the analysis and design of combinational circuits and sequential circuits
- Understand the concept of memories and programmable logic devices.
- Interpret the concept of synchronous and asynchronous sequential circuits

UNIT-I NUMBER SYSTEMS AND BOOLEAN ALGEBRA (12)

Binary, Octal, Decimal, Hexadecimal-Number base conversions – complements – signed Binar y numbers. Binar y Arithmetic- Binar y codes: Weighted –BCD-Gray code-Excess 3 code-ASCII – Error detecting code – conversion from one code to another-Boolean postulates and laws –De-Morgan's Theorem- Principle of Duality- Boolean expression – Boolean function- Minimization of Boolean expressions – Sum of Products (SOP) –Product of Sums (POS)-Minterm- Maxterm-Canonical forms – Conversion between canonical forms –Karnaugh map Minimization – Don't care conditions.

UNIT-II LOGIC GATES AND COMBINA TIONAL CIRCUITS (12)

LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive – OR and Exclusive – NOR-Implementations of Logic Functions using gates, NAND –NOR implementations –Multi level gate implementations.

COMBINATIONAL CIRCUITS: Design procedure – Adders-Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor- Carr y look ahead adder- BCD adder- Magnitude Comparator-Multiplexer/ Demultiplexer- encoder / decoder – parit y checker. Implementation of combinational logic using MUX.

UNIT-III SEQUENTIAL CIRCUIT (12)

Flip flops SR, JK, T, D and Master slave – Characteristic table and equation– Edge triggering – Level Triggering –Realization of one flip flop using other flip flops –Asynchronous– Synchronous counters –Classification of sequential circuits – Moore and Meal y -Design of Synchronous counters: state diagram- State table –State minimization –State assignment- Register – shift registers- Universal shift register

UNIT-IV ASYNCH RONOUS SEQUENTIAL CIRCUITS (12)

Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles – Races –Hazards: Static –Dynamic –Essential –Hazards elimination.

UNIT-V MEMORY DEVICES (12)

Classification of memories –RAM organization– Static RAM Cell-Bipolar RAM cell – MOSFET RAM cell –Dynamic RAM cell –ROM organization - PROM –EPROM –EEPROM –Programmable Logic Devices – Programmable Logic Array (PLA)- Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA).

Total : 60

TEXT BOOKS:

S.No.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Morris Mano.M	Digital Design	Prentice Hall of India Pvt. Ltd., New Delhi	2003
2	John M .Yarbrough	Digital Logic Applications and Design	Thomson- Vikas publishing house, New Delhi	2002

REFERENCES:

S.No.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Salivahanan.S and Arivazhagan.S	Digital Circuits and Design	Vikas Publishing House Pvt. Ltd, New Delhi	2004
2	Charles H.Roth	Fundamentals of Logic Design	Thomson Publication Company, New Delhi.	2003
3	Donald P.Leach and Albert Paul Malvino	Digital Principles and Applications	Tata McGraw Hill Publishing Compan y Limited, New Delhi	2003
4	Jain.R.P	Modern Digital Electronics	Tata McGraw–Hill publishing compan y limited, New Delhi	2003
5	Thomas L. Flo yd	Digital Fundamentals	Pearson Education, New Delhi	2003

WEBSITES:

http://www.allaboutcircuits.com/vol_2/chpt_9/2.html
http://www.educypedia.be/electronics/digital.html

18BEBME303 C++ AND DATA STRUCTURES 3 0 0 3 100

COURSE OBJECTIVE

The goal of this course is for students

- To develop programming skill and to solve engineering related problems using C++, Object Oriented Programming (OOP) and Data Structure Concepts.
- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
- Demonstrate the use of various OOPs concepts with the help of programs
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.

COURSE OUTCOME

After the successful completion of the course the student will be able to :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs.
- Understand the concept of function overloading, operator overloading, virtual functions and polymorphism
- Develop programming skill and to solve engineering related problems using C++, Object Oriented Programming (OOP) and Data Structure Concepts

UNIT – I INTRODUCTION TO DATA STRUCTURES

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

UNIT – II 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.

UNIT – III 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 – IV 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 – V 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.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	N.S. Kutti and P.Y. Padhye	Data Structures in C++	Prentice Hall of India Pvt., Ltd., New Delhi	2001
2	Liberty & Keogh	C++: An introduction to programming	Prentice Hall of India Pvt., Ltd., New Delhi	2002

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Bjarne Stroustrup	The C++ Programming Language	Addison Wesley by publication, New York	1994
2	Jean – Paul Tremblay and Paul G.Sorenson	An Introduction to Data Structures with Applications	Tata McGraw Hill	1998
3	E. Balagurusamy	Object oriented Programming with C++	Tata McGraw Hill, New Delhi	1996

18BEBME304 ELECTRONIC DEVICES AND CIRCUITS 3 0 0 3 100

COURSE OBJECTIVES

The goal of this course is for students :

- To understand the operational characteristics of a Semiconductor in Equilibrium and Non-Equilibrium conditions.
- To understand the working of PN junction diodes and special purpose diodes.
- To understand the basic working physics of BJT and FET both in ideal and non- ideal conditions.
- To understand the working of Rectifiers and Voltage regulators.
- To understand the fabrication process of Monolithic ICs
- To improve knowledge about the working of Rectifiers and Voltage regulators.

COURSE OUTCOMES

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

- Understand the fundamental concepts
- Logically analyze any electronic circuit
- Apply the logic in any application
- Understand the specifications of regulators and power supply circuits.
- Apply positive feedback principle and design oscillators.
- Design multivibrator circuits.

UNIT I SEMICONDUCTOR DIODES AND SPECIAL PURPOSE DIODES (10)

Semiconductors: Intrinsic semiconductor – extrinsic semiconductor – Fermi level in an intrinsic semiconductor – intrinsic semiconductor and extrinsic semiconductor. Semiconductor diodes : Formation of PN junction – working principle – VI characteristics – PN diode currents – diode current equation – diode resistance – transition and diffusion capacitance. Special purpose diodes : Zener diode, schottky diode

UNIT II BIPOLAR TRANSISTORS (8)

Bipolar Transistors: Construction – working – transistor currents –transistor configurations and input-output characteristics – Early effect (base width modulation) – transistor as an amplifier Transistor as a switch.

UNIT III FIELD EFFECT TRANSISTORS (9)

Field-Effect Transistors: construction, working and VI characteristics of JFET – comparison of BJT and JFET – MOSFET – enhancement MOSFET, depletion MOSFET - working principle and VI characteristics, comparison of MOSFET with JFET.

UNIT IV DC POWER SUPPLIES (9)

Rectifiers and Filters: Block schematic of a typical DC power supply, single phase HWR, FWR, full-wave bridge rectifier, power supply filters (ripple factor and efficiency analysis), Voltage regulators: voltage regulation, Zener diode shunt regulator, transistor series regulator, transistor shunt regulator, switching regulators.

UNIT V OSCILLATORS AND MULTIVIBRATORS (9)

RC phase shift oscillator, Wein-bridge oscillator, Hartley oscillator, Colpitts oscillator, types of multivibrators, Astable, monostable and bistable multivibrators.

Total : 45

TEXT BOOKS:

S.NO	Author(s) Name	Title of the book	Publisher	Year of publication
1	Millman and Halkias	Electronic devices and Circuits	Tata McGraw Hill International	2010
2	David A.Bell	Fundamental of electronic devices and circuits	Oxford press	2009

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Street Man	Solid State Electronic Devices'	Prentice Hall Of India,6th edition	2005
2	Mathur Kulshrestha and Chadha	Electron devices and Applications and Integrated circuits'	Umesh Publications	2005
3	Thomas L. Floyd	Electron Devices	Charles and Messil Publications	2012
4	G.K.Mithal	Electronic Devices and Circuits	Khanna Publishers	2013
5	Robert L. Boylestad and Louis Nashelsk y	Electronic Devices and Circuit Theor y	Pearson Education, 9th Edition,	2009.
6	B. Somanathan Nair	Electronic Devices and Applications	PHI,	2006

18BEBME305 FUNDAMENTALS OF BIOCHEMISTRY 3 0 0 3 100

COURSE OBJECTIVES

The goal of this course is for students

- To study about the biochemistry of living cells, metabolism of biomolecules and the methods of investigation and diagnostic tools.
- To summarize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules.
- To analyse the structural and functional properties of carbohydrates, proteins and lipids
- To discuss about functions of each organelles and Transport of substances across biological membranes
- To infer about the biochemistry of living cells
- Demonstrate the concepts of biochemistry of living cells

COURSE OUTCOMES

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

- Demonstrate the concepts of biochemistry of living cells
- Understand the concepts of protein biochemistry
- Explain about functions of each organelles and Transport of substances across biological membranes
- Illustrate the structural and functional properties of carbohydrates, proteins and lipids
- Perceive the concepts of investigation of metabolism.
- Understand the structural and functional properties of various organelles and biomolecules

UNIT I BIOCHEMISTRY OF LIVING CELLS (9)

Biochemistry of living cells, sub cellular fractionation using the differential centrifugation method. Functions of each organelles, redox potential, oxidative phosphorylation, Transport of substances across biological membranes.

UNIT II CARBOHYDRATES (9)

Carbohydrates: Definition, classification, biological functions; glycolysis, TCA cycle, glycogenesis, glycogenolysis, Diabetes Mellitus – Blood Sugar analysis and glucose tolerance test.

UNIT III PROTEINS (9)

Proteins: Definition, classification, architecture, biological functions; Classification of amino acids, Oxidative and non oxidative deamination, transamination, decarboxylation, urea cycle, Purification of proteins.

UNIT IV LIPIDS (9)

Lipids: Definition, classification, biological functions; biosynthesis of long chain fatty acids, degradation of fatty acids - oxidation of fatty acids.

UNIT V METHODS OF INVESTIGATION OF METABOLISM (9)

Liver function tests, Real function tests, Gastric function tests. Diagnostic tools: Principles and applications of photometry, spectrophotometry, flurometry, flame photometry, automation in clinical laboratory. Uses of isotopes in biochemistry.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	. Ambiga Shanmugam	Fundamentals of Biochemistry for Medical Students	Karthick Printers, Madras	1997

REFERENCE BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Lehninger.A .L., Nelson D.L., Cox .M.M.,	Principles of Biochemistry	CBS Publications	1993
2	Varley	Clinical Biochemistry	CBS Publications	1988

18BEBME306 ANATOMY AND HUMAN PHYSIOLOGY 3 0 0 3 100

COURSE OBJECTIVE

The goal of this course is for students

- To provide the students a basic understanding of the structure and function of the human body.
- To perceive structure and functions of the various types of systems of human body.
- To outline about eye, ear and Endocrine glands of human
- To learn organs and structures involving in system formation and functions.
- To understand all systems in the human body.
- To infer basic understanding of the interconnection of various organ systems in human body

COURSE OUTCOMES

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

- Explain basic structure and functions of cells and its organelles
- Demonstrate about anatomy and physiology of various organ systems
- Illustrate eye, ear and Endocrine glands of human
- Explain the interconnect of various organ systems in human body
- Enlighten organs and structures involving in system formation and functions.
- Elucidate special senses in the human body.

UNIT I CELL (9)

Structure of Cell – Organelles and description – Function of each component of the cell – Membrane potential – Action Potential – Generation and Conduction – Electrical Stimulation. Blood Cell – Composition – Origin of RBC – Blood Groups – Estimation of RBC, WBC and Platelet.

UNIT II CARDIAC AND NERVOUS SYSTEM (9)

Heart, Major blood vessels – Cardiac Cycle – ECG – Blood Pressure – Feedback Control for Blood Pressure – Nervous Control of Heart - Cardiac output – Coronary and Peripheral Circulation – Structure and function of Nervous tissue – Neuron - Synapse - Reflexes -Receptors -Brain - Brainstem -Spinal cord – Reflex action – Velocity of Conduction of Nerve Impulses - Electro Encephalograph – Autonomic Nervous System.

UNIT III RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM (9)

Physiological aspects of respiration – Trachea and lungs - Exchange of gases – Regulation of Respiration - Disturbance of respiration function - Pulmonary function test - Muscles - tissue - types - structure of skeletal muscle - types of muscle and joints.

UNIT IV DIGESTIVE AND EXCRETORY SYSTEM (9)

Organisation of GI System, Digestion and absorption – Movements of GI tract – Intestine - Liver - Pancreas - Structure of Nephron – Mechanism of Urine formation – Urine Reflex – Skin and Sweat Gland – Temperature regulation.

UNIT V EYE, EAR, ENDOCRINE GLANDS (9)

Optics of Eye – Retina – Photochemistry of Vision – Accommodation - Neurophysiology of vision – EOG. Physiology of internal ear – Mechanism of Hearing – Auditory Pathway, Hearing Tests - Endocrine glands.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Sarada Subramanyam, K.Madhavan Kutty and H.D.Singh	Text Book of 'Human Physiology	S.Chand & Company	1996
2	Ranganathan, T.S	Text Book of Human Anatomy	S.Chand &Co. Ltd., Delhi	1996

REFERENCE BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Tobin, C.E.,	Basic Human Anatomy	McGraw-Hill Publishing Co. Ltd.,	1997
2	J.Gibson	Modern Physiology and Anatomy for Nurses	Blackwell SC Publishing	1981
3	Arthur.C.Guyton	John E Hall – ,Textbook of Medical Physiology	W.B. Saunders Company	2000

18BEBME311 BIOCHEMISTRY AND HUMAN PHYSIOLOGY LAB 0 0 4 2 100

OBJECTIVE:

The goal of this course is for students

- To estimate and quantify biomolecules.
- To divide amino acid molecules
- To evaluate and interpret of biochemical parameter
- To understand differential count of WBCs
- To understand the Ishihara chart
- To understand the auditory conduction

INTENDED OUTCOMES:

- Upon completion of this course, students will be able to:
- Solve the quantitative test of different biomolecules
- Label the separation technology of proteins and amino acids.
- Blood group identification
- Estimate of blood glucose
- Estimate of Hemoglobin
- Perceive the Biochemistry laboratory functional parameters

LIST OF EXPERIMENTS:

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
4. Estimation of serum cholesterol.
5. Estimation of creatinine in urine.
6. Separation of amino acids using thin layer chromatography.
7. Estimation of Hemoglobin
8. Differential count of different WBCs and Blood group identification
9. Ishihara chart for color blindness and Snellen's chart for myopia and hyperopia – by letters reading and opthalmoscope to view retina.
10. Weber's and Rinnee's test for auditory conduction.

18BEBME312 DIGITAL ELECTRONICS LABORATORY 0 0 4 2 100

OBJECTIVE:

The goal of this course is for students

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To Learn about counters
- To Learn about Shift registers
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits

INTENDED OUTCOMES:

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

- Analyse different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Interpret the concept of synchronous and asynchronous sequential circuits
- Implement shift registers using Flip-flops.
- Apply the knowledge on digital circuits design

LIST OF EXPERIMENTS:

1. Study of logic gates.
2. Design and implementation of adders and Subtractors using logic gates.
3. Design and implementation of code converters using logic gates BCD to excess-3 code
4. Design and implementation of 4 bit binary Adder/Subtractor and BCD adder using IC 7483.
5. Design and implementation of 2 bit Magnitude Comparator using logic gate 8 bit Magnitude Comparator using IC 7485.
6. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
7. Design and implementation of Multiplexer and Demultiplexer using logic gates and study of IC74150 and IC74154.
8. Design and implementation of encoder and Decoder using logic gates and study of IC 7445 and IC 74147.
9. Construction and verification of 4 bit ripple counter and Mod-10/ Mod- 13 Ripple counters.
10. Design and implementation of 3 bit Synchronous up/down counter.

11. Implementation of SISO, SIPO,PISO and PIPO shift registers using Flip-flops.

18BEBME313	**Course Oriented project-I**	**0 0 2 1**	**100**

18BEBME351	**SOFT SKILLS FOR BIOMEDICAL ENTREPRENEURS**	**1 0 0 -**	**100**

Course Objectives :

- To encourage the all round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and the content of soft skills
- To give instruction, knowledge acquisition, demonstration and practice on soft skills
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioural aspects
- To build the right attitudinal through activities

Course Outcomes:

On completion of the course, student will be able to

- Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents .
- Actively participate in group discussion / meetings / interviews and prepare & deliver presentations .
- Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Function effectively in multi-disciplinary and heterogeneous teams
- Handle team work, Inter-personal relationships, conflict management and leadership quality.

People skills – social skills – communication skills – character traits – attitudes – career attributes – emotional intelligence coefficient – common sense – cognitive or emotional empathy– interpersonal skills – courtesy – flexibility – integrity – interpersonal skills – positive attitude – professionalism – responsibility – team work – work ethics.

TOTAL: 15

18BEBME401 PROBABILITY AND STATISTICS 3 2 0 4 100

COURSE OBJECTIVES:

The goal of this course is for students

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

COURSE OUTCOMES:

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

- To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- To understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- To apply the concept of testing of hypothesis for small and large samples in real life problems.
- To apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- To have the notion of sampling distributions and statistical techniques used in engineering and management problems.
- To make the student acquire sound knowledge of techniques in quality control that model engineering problems.

UNIT- I PROBABILITY (11)

Probability – Definition – Law - conditional probability-Bayes theorem- Probability mass function - Probability density functions.

UNIT- II RANDOM VARIABLES (13)

Introduction to one dimensional random variables – Discrete – Continuous - Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression.

UNIT- III TESTING OF HYPOTHESIS (12)

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions – Tests for independence of attributes and Goodness of fit.

UNIT – IV DESIGN OF EXPERIMENTS (12)

Analysis of variance – one way classification – CRD – Two-way classification – RBD – Latin square.

UNIT – V RELIABILITY AND QUALITY CONTROL (12)

Concepts of reliability – hazard functions – Reliability of series and parallel systems – control charts for measurement ($\bar{X}$ *and* R *charts*) - Control charts for attributes (p, c and np charts).

Total : 60

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	P.S.S.Sundar Rao and J.Richard	Introduction to Biostatistics and Research Methods	Prentice Hall of India, New Delhi.	2012
2	R.A.Johnson and C.B.Gupta	Miller and Freund's Probability and Statistics for Engineers	Pearson Education Asia, New Delhi.	2007
3	S.C.Gupta and V.K.Kapoor	Fundamentals of Applied Statistics	Sultan Chand & Sons, New Delhi	2007

WEBSITES:

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld.

18BECC402 LINEAR INTEGRATED CIRCUITS 3 0 0 2 100

COURSE OBJECTIVES

The goal of this course is for students :

- To discuss the basic concepts of linear integrated circuits
- To study the circuit configuration and introduce practical applications of linear integrated circuits.
- To introduce the concept of Passive and Active filters
- To infer the theory and applications of PLL
- To make use of the theory of ADC and DAC using OP – AMPS
- To demonstrate the concepts of waveform generation and introduce some special function ICs

COURSE OUTCOMES:

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

- Define linear and non linear applications of OP – AMPS
- Create waveforms using OP – AMP Circuits
- Ability to design new analog linear circuits and develop linear IC based Systems.
- Understand the concept of application of waveform generators
- Design ADC and DAC using OP – AMPS
- Analyze special function ICs

UNIT I OPERATIONAL AM PLIFIER CHARACTERISTICS (9)

Op-amp - Block diagram Representation of op-amp- Open loop & closed loop configurations – DC & AC performance characteristics of op-amp – Frequency compensation - Noise – Differential amplifiers -Electrical Characteristics and internal schematic of 741 op - amps.

UNIT II OPAMP APPLICATIONS (9)

Inverting & Non-inverting voltage amplifiers -Voltage follower –Summing & averaging amplifiers - AC amplifiers, Instrumentation Amplifiers-V-to-I and I-to-V converters-Differentiators and Integrators. Wave Shaping Circuits - Clipper and Clampers–Comparators and its applications.

UNIT III WAVEFORM GENERATORS AND PLL (9)

Waveform Generators: Sine-wave Generators – Square / Triangle / Sawtooth Wave generators. IC 555 Timer: Monostable operation and its applications, Astable operation and its applications P LL: Operation of the Basic P LL-Closed loop analysis of P LL-Voltage Controlled Oscillator-PLL Applications

UNIT IV ACTIVE FILTERS & VOLTAGE REGULATOR (9)

Filters: Passive and Active Networks – Filter Approximations-Design of LPF, HPF, BPF and Band Reject Filters , Voltage Regulators: Basics of Voltage Regulator – Linear Voltage Regulators using Op-amp – IC Regulators (78x x, 79xx, LM 317, 723)-Switching Regulators.

UNIT V DATA CONVERSION DEVICES (9)

DAC circuits: Weighted Resistor DAC, R-2R Ladder DAC- Inverted R-2R Ladder DAC Monolithic DAC; Analog to Digital conversion: Ramp Type ADC-Successive Approximation ADC-Dual Slope ADC-Flash Type ADC.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Roy Choudhur y and Shail Jain	Linear Integrated Circuits	New Age International Publishers	2003
2	Ramakant A.Ga yakwad	Op-Amps and Linear Integrated Circuits	Prentice Hall of India, New Delhi	2000

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Robert F. Coughlin, Frederick F. Driscoll	Operational-Amplifiers and Linear Integrated Circuits	Prentice Hall of India, New Delhi	2001
2	Sergio Franco	Design with operational amplifier and analog integrated circuits	McGraw Hill	2015

18BEBME403 BIOSENSORS AND TRANSDUCERS 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students

- To define the basic concepts such as generalized instrumentation system, general properties of input transducers, static and dynamic characteristics of transducers and sensors
- To perceive a thorough understanding of principle of sensors
- To know the principle of transduction, classifications and the characteristics of different transducers
- To create the biomedical applications of the transducers and sensors.
- To discuss working of some of the above transducers and sensors.
- To know the different display and recording devices.

COURSE OUTCOMES:

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

- Have a clear understanding of generalized medical instrumentation system, general properties of input transducers, static and dynamic characteristics of transducers and sensors.
- Demonstrate various transducers and sensors in the course.
- Describe the purpose and methods of measurements.
- Explain the principle of different sensors and its applications
- Apply the transducers and sensors learnt in the course in suitable medical contexts.
- Implement working knowledge of some of the transducers and sensors

UNIT I INTRODUCTION TO TRANSDUCERS AND ITS CHARACTERISTICS (10)

Introduction: Generalized Instrumentation System, General Properties of Input Transducer Static Characteristics: Accuracy, Precision, Resolution, Reproducibility, Sensitivity, Drift, Hysteresis, Linearity, Input Impedance and Output Impedance. Dynamic Characteristics: First Order and Second Order Characteristics, Time Delay, Error Free Instrument, Transfer Functions. Design Criteria, Generalized Instrument Specifications.

UNIT II MEASUREMENTS (8)

Displacement, motion and Pressure Measurement: (with applications) Resistive: Potentiometers, Strain Gauges and Bridge Circuits. Inductive: Variable Inductance and LVDT Capacitive type, Piezoelectric Transducers. Types of Diaphragms, Bellows, Bourdon Tubes.

UNIT III THERMAL MEASUREMENTS (6)

Temperature Measurement: Thermistor, Thermocouple, Resistive Temperature Detector, IC based Temperature Measurement, Radiation Sensors and Applications .

UNIT IV ELECTRODES (10)

Biopotential Electrodes: Electrodes Electrolyte Interface, Half-Cell Potential, Polarization, Polarizable and Non Polarizable, Electrodes, Calomel Electrode, Electrode Circuit Model, Electrode Skin-Interface and Motion Artifact. Body Surface Electrodes. Internal Electrodes: Needle and Wire Electrodes (Different Types). Microelectrodes: Metal, Supported Metal Micropipette (Metal Filled Glass And Glass Micropipette Electrodes)

UNIT V **BIOSENSORS** **(11)**

Chemical Sensors: Blood gas and Acid- Base Physiology Potentiometric Sensors, Ion Selective Electrodes, ISFETS. Amperometric Sensors, Clark Electrode with examples - pH, pO2, pCO2 Electrodes, Transcutaneous Arterial Oxygen Tension, Carbon Dioxide measurements: capnostat. Fiber Optic Sensors: Design Principles in Fabrication of Fiber Optic Sensors - Temperature, Chemical, Pressure. Biosensor: Classifications: Biological phenomenon, Transduction Phenomenon i.e. Enzyme Sensor and Electrode based: Affinity Sensors (Catalytic Biosensors), Two examples of each Biosensors and Immunosensors.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Richard S.C. Cobbold	Transducers for Biomedical Measurements: Principles and Applications	John Wiley & Sons	1974
2	Hermann K P. Neubert	Instrument Transducer – An Intro to their performance and	Hermann K P. Neubert	2000
3	Harry N, Norton.	Biomedical sensors – fundamentals and application	Harry N, Norton.	2001
4	Tatsuo Togawa, Toshiyo Tamma and P. Ake Öberg	Biomedical Transducers and Instruments	Tatsuo Togawa,	1994
5	Nandini K	Electronics in Medicine and Biomedical Instrumentation	Jog PHI Second Edition	2013

REFERENCE BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	La Geddes and L.E. Baker	Principles of applied Biomedical Instrumentation	La Geddes and L.E. Baker	1997
2	Leslie Cromwell, Fred. J. Weibell and Pfeiffer	Biomedical instrumentation and measurement	Leslie Cromwell, Fred. J. Weibell and Pfeiffer	2002
3	Richard Aston	Principles of Biomedical Instrumentation and Measurement	Merril Publishing Co., Columbus	1990
4	Ernest O. Doeblin	Measurement Systems, Application and Design	McGraw-Hill	1985
5	Jacob Fraden	Handbook of Modern Sensors – Physics, Design and Application	AIP press	2000

18BEBME404 MICROPROCESSOR AND MICROCONTROLLER 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students :

- To infer processor architecture and its programming
- To discuss interfacing concepts
- To appraise advanced processor architecture
- To utilize the concepts of Interfacing with Peripherals for building applications
- To demonstrate the concepts Reduced Instruction Set Computer (RISC) architecture and Advanced RISC Machine (ARM) architecture
- To develop skill to explore system design technique .

COURSE OUTCOMES:

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

- Design assembly language programming (ALP) for different applications for 8085
- Compile assembly language programming (ALP) for different applications for 8086
- Perceive knowledge on advanced processors and controllers
- Create application by Interfacing memory and I/O device with controllers
- Demonstrate the architectures of Reduced Instruction Set Computer (RISC) and Advanced RISC Machine (ARM) processors
- Design and deploy the Interfacing peripherals in real time scenario.

UNIT -I THE 8085 MICROPROCESSOR 9

Introduction to 8085 – Microprocessor architecture – Instruction set – Programming the 8085 – Code conversion.

UNIT II THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

TOTAL: 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Yu-Cheng Liu, Glenn A.Gibson	Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming and Design	Second Edition, Prentice Hall of India	2007
2	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	Second Edition, Pearson education	2011

REFERENCE:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Doughlas V.Hall	Microprocessors and Interfacing, Programming and Hardware	TMH	2012

18BEBME405 Environmental Science & Engineering 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To understand the various ecosystems and biodiversity
- To study the tole of engineers in the ecosystem

COURSE OUTCOMES

After this course the student will be able to:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To understand the various ecosystems and biodiversity
- To study the tole of engineers in the ecosystem

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India

UNIT II ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy, sources, use of alternate energy sources.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TEXT BOOK

Benny Joseph, _Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, _Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, _Environmental law‘, Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, ―Textbook of Environmental Studies‖, Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, _Environmental Studies-From Crisis to Cure‘, Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science‖, Cengage Learning India PVT, LTD, Delhi, 2014.

18BEBME406 Analog and Digital communication 3 0 0 3 100

COURSE OBJECTIVES

The goal of this course is for students:

- To familiarize students with the fundamentals of analog and digital communication systems
- to provide students with tools for communication signal analysis
- to familiarize students with various techniques for amplitude modulation and demodulation of analog signals
- to develop the students' ability to determine the effects of receiver frequency and phase errors in synchronous modulation systems
- to familiarize students with techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals
- to familiarize students with basic techniques for generating and demodulating pulse code modulated signals
- to familiarize students with issues pertaining to the transmission of digital signals over bandwidth

COURSE OUTCOMES

Upon completion of this course, students should be able to do the following:

- apply Fourier analysis to communication signals
- explain how channel imperfections distort signals
- derive the energy or power spectral density of signals
- determine the number of levels in a quantizer given signal-to-noise ratio and maximum input voltage
- describe the different types of line codes
- describe the use of controlled intersymbol interference to achieve maximum data rates

UNIT I ANALOG COMMUNICATION

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

UNIT II PULSE AND DATA COMMUNICATION

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.

UNIT III DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT IV SOURCE AND ERROR CONTROL CODING

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.

UNIT V MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

TEXT BOOK:

1. Wayne Tomasi, ―Advanced Electronic Communication Systems‖, 6th Edition, Pearson Education, 2009

References ;

Simon Haykin, ―Communication Systems‖, 4th Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
3. H.Taub, D L Schilling and G Saha, ―Principles of Communication‖, 3rd Edition, Pearson Education, 2007.
4. B. P.Lathi, ―Modern Analog and Digital Communication Systems‖, 3rd Edition, Oxford University Press, 2007.
5. Blake, ―Electronic Communication Systems‖, Thomson Delmar Publications, 2002.
6. Martin S.Roden, ―Analog and Digital Communication System‖, 3rd Edition, Prentice Hall of India, 2002.

18BEBME411 MICROPROCESSOR & MICROCONTROLLER LABORATORY 0032 100

COURSE OBJECTIVES:

The goal of this course is for students :

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Be familiar with MASM
- To design and implement programs on 8085 microprocessor
- To interface different I/Os with Microprocessors

COURSE OUTCOME:

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

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Use Serial and Parallel Interface
- Perform A/D and D/A conversion

LIST OF EXPERIMENTS:

8085 Programs using kits

1. Basic arithmetic and Logical operations
2. Sorting and searching

8086 Programs using kits

3. Basic arithmetic and Logical operations
4. Code conversion, decimal arithmetic and Matrix operations.
5. Floating point operations, string manipulations, sorting and searching

Peripherals and Interfacing Experiments

6. Traffic light control
7. Stepper motor control
8. Key board and Display
9. Serial interface and Parallel interface
10. A/D and D/A interface and Waveform Generations

8051 Experiments using kits and MASM

11. Basic arithmetic and Logical operations
12. Code conversion

TOTAL: 45

18BEBME412 BIOSENSORS AND TRANSDUCERS LAB 0 0 3 2 100

OBJECTIVES:

The goal of this course is for students,

- To discuss working principle of Transducers and various Biomedical sensors.
- To experiment with basic functions of Biosensors.
- To make use of different physiological signals.
- To learn about various biosensors
- To distinguish contact and non-contact method of skin temperature measurement
- To learn about data acquisition of physiological signal

INTENDED OUTCOMES:

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

- Interpret the characteristics of various biosensors
- Illustrate the importance of the sensors and transducers for medical applications.
- Analyse the characteristics of physiological signals
- Measure skin temperature
- Perform data acquisition of physiological signals
- Choose the biosensors for relevant application

LIST OF EXPERIMENTS

1. Study of Biological Sensors
2. Displacement measurement using LVDT
3. Characteristics of temperature sensors – thermistor and RTD.
4. Characteristics of thermocouple
5. Characteristics of Flow Transducer
6. Characteristics of photo diodes, phototransistor
7. Characteristics of Piezoelectric Transducer.
8. Data acquisition of physiological signals
9. Measurement of skin temperature by both contact and non-contact method.
10. Study of the characteristics of capacitor level sensor for saline level measurement in a I-V set.

18BEBME451 HANDS ON TRAINING IN BIOMEDICAL EQUIPMENTS 0 0 1 100

OBJECTIVE:

- To gain the knowledge on various electronic equipments
- To learn the working principle of voltmeter
- To learn the working principle of digital voltmeter
- To discuss the working principle of Ammeter
- To distinguish analog multimeter digital multimeter
- To understand the operation of function generator

OUTCOME:

- Understand the working of various electronic equipments
- Analyse the operations of voltmeter and Ammeter
- Use RLC meter and LCR meter
- Understand the applications of EMF meter
- handle analog multimeter digital multimeter
- Demonstrate the operation of function generator

Study of Voltmeter – Ammeter – ohmmeter – capacitance meter – regulated power supply – oscilloscope – function generator – time-domain reflectometer – digital voltmeter – digital counter – Analog multimeter & Digital multimeter – Signal injector – RLC meter – LCR meter – EMF meter – Electrometer -

18BEBME501 BIO CONTROL SYSTEM 3 2 0 4 100

COURSE OBJECTIVES:

The goal of this course is for students :

- To analyse the systems in time and frequency domain
- To understand the concept of stability
- To acquire knowledge about the Bio Control system, Process regulation.
- To understand the concept behind feedback and continuum in various systems and subsystems.
- To apply mathematical modelling principles in understanding the various fundamental biological systems
- To study system concept of biological control

COURSE OUTCOME:

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

- Understand the need for mathematical modelling of various systems,
- Understand the representation of systems in block diagrams and signal flow graphs
- Analyze the process regulation
- Understand the concept of modelling basic physiological systems
- Understand the concept of oxygen and carbon dioxide transport in blood
- Explain the concept of Endocrine control system

UNIT I INTRODUCTION TO BIO CONTROL SYSTEM (9)

Introduction: Technological control system, transfer function, mathematical approaches, system stability, introduction to biological control system, Modeling and block diagram, closed loop dynamics of first order and second order control system, similarities between biological and engineering control system, biological receptors and receptor characteristics.

UNIT II PROCESS REGULATION (9)

Acid-base balance, extra-cellular water and electrolyte, interstitial fluid volume, blood pressure, blood glucose, CO2.

UNIT III MODELING OF HUMAN THERMAL REGULATORY SYSTEM (9)

Parameters involved, control system model etc. Biochemistry of digestion, types of heat loss from body, models of heat transfer between subsystems of human body like skin - core etc. and systems like within body, body environment.

UNIT IV BIOLOGICAL CONTROL I (9)

Cardiac rate, blood pressure, respiratory rate, mass balancing of lungs, oxygen uptake by RBC and pulmonary capillaries, oxygen and carbon dioxide transport in blood and tissues.

UNIT V BIOLOGICAL CONTROL II (9)

Urine formation and control, Pupil control systems, skeletal muscle servomechanism and semicircular canal. Free swinging limbs, Endocrine control system.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Sujit K.Chaudhuri	Concise Medical Physilogy	New Central Book agency	1997
2	Ogata Katsuhika	Modern control engineering	2nd edition, Prentice Hall of	-

REFERENCE BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Barry R. Dworkin	Learning and Physiological Regulation (Hardcover)	University Of Chicago Press	March 1993
2	E. Carson, E. Salzsieder	Modelling and Control in Biomedical Systems 2000 (including Biological Systems)	Pergamon Publishing	January 2001

18BEBME502 MEDICAL INSTRUMENTATION 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To illustrate origin of bio potentials and its propagations
- To understand the basic theory of Bio potential Electrodes and Bio potential measurement.
- To appraise the different types of electrodes and its placement for various recordings
- To design bio amplifier for various physiological recordings
- To study the various bio chemical measurements.
- To perceive the different measurement techniques for non-physiological parameters.

COURSE OUTCOMES:

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

- Differentiate different bio potentials and its propagations.
- Describe the electrode behavior and circuit models
- Illustrate different electrode placement for various physiological recordings
- Design bio amplifier for various physiological recordings
- Explain various technique for non-electrical physiological measurements
- Measure various biochemical parameters.

UNIT I BIO POTENTIAL ELECTRODES (9)

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits.

UNIT II ELECTRODE CONFIGURATIONS (9)

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode.EMG, ERG and EOG – unipolar and bipolar mode.

UNIT III BIO AMPLIFIER (8)

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier.

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETER (10)

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers - systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT (9)

Biochemical sensors - pH, pO2 and pCo2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer

TOTAL : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Joseph J. Carr and John M. Brown	Introduction to Biomedical Equipment Technology	Pearson Education	2004
2	John G. Webster	Medical Instrumentation Application and Design	John Wiley and sons	2004

REFERENCES

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Leslie Cromwell	Biomedical Instrumentation and	Prentice hall of India, New Delhi	2007
2	Khandpur R.S	Handbook of Biomedical Instrumentation	Tata McGraw-Hill, New Delhi	2003
3	Myer Kutz	Standard Handbook of Biomedical Engineering & Design	McGraw-Hill	2003

18BEBME503 BIOMEDICAL SIGNAL PROCESSING 3 0 0 3 100

COURSE OBJECTIVES

The goal of this course is for students:

- To study the characteristics of different biosignals
- To learn linear and non-linear filtering techniques to extract desired information
- To analyse the characteristics of some of the most commonly used biomedical signals, including ECG, EEG, EOG, and EMG.
- To perceive choice of filters to remove noise and artifacts from biomedical signals.
- To apply established engineering methods to analyse ECG signal problems.
- To discuss established engineering methods to analyse neurological signals.

COURSE OUTCOMES

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

- Design different types of biomedical signals and identify their spectral components.
- Utilize different filters on biomedical signals and judge filter performance.
- Identify physiological interferences and artifacts affecting ECG signal.
- Assess power and correlation spectra of EEG signal.
- Analyze biosignals in time and frequency domains.
- perform classification and recognition Biosignals

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS (9)

Sampling of Analogue signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification methods – linear and circular convolution – difference equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS (9)

Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS (9)

Symmetric and Asymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackmann Windows – Realisation of FIR filters

UNIT IV ANALYSIS OF BIO –SIGNALS (9)

Removal of artifacts-ECG, Event detection –ECG,P wave, QRS Complex, T wave, correlation analysis of ECG signals, Averaging of signals-PCG, ECG and EMG.

UNIT V PROCESSING OF BIO SIGNALS (9)

Heart rate variability Analysis, Analysis of PCG signals, Analysis of Time variant systems, Fixed segmentation –STFT, ACF, SEM and GLR.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	John G. Proakis and Dimitris G.Manolakis	Digital Signal Processing, Algorithms and Applications	PHI of India Ltd., New Delhi, 3rd Edition	2000
2	Rangaraj.M.Rangayyan	Biomedical signal processing	-	-

REFERENCES

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Sanjit K.Mitra	Digital Signal Processing', A Computer Based Approach	Tata McGraw-Hill, New Delhi	1998

18BECC504 PROFESSIONAL ETHICS 3 0 0 2 100

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

COURSE OBJECTIVES

The goal of this course is for students:

- To develop managerial and entrepreneurial skills our culture and ethics
- To Distinguish Direct and Preventive Control
- To perceive Knowledge on the principles of management is essential for all kinds of people in all kinds of organisations
- To have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling
- To create an awareness and practice through engineering ethics and human values
- To outline how business ethics works

COURSE OUTCOMES

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

- Advanced philosophical knowledge of the profession of recreation and leisure
- Synthesis of trends and issues as related to current professional practice
- Evaluate organizational theories and human resource management principles
- Analyse the information competency
- Follow Ethical practice and ethical management
- Understand Models of Professional Roles

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – variety of moral issued – 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 II FACTORS OF CHANGES 9

Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws.Social changes – Meaning and nature – Theories.

UNIT III HISTORICAL DEVELOPMENT, PLANNING, ORGANISING 9

Definition of Management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies and Planning Premises– Forecasting – Decision–making – Formal and informal organization – Organization Chart –.

UNIT IV DIRECTING AND CONTROLLING 9

Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment –Process of Communication – System and process of Controlling – Requirements for effective control – Control of Overall Performance – Direct and Preventive Control – Reporting

UNIT V ENTREPRENEURSHIP AND MOTIVATION 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

Total : 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Harold Kooritz and Heinz Weihrich	Essentials of Management	Tata McGraw Hill, New Delhi	2010
2	Khanka S.S	Entrepreneurial Development	S.Chand and Co. Ltd., NewDelhi	2006
3	Mike Martin and Roland Schinzinger	Ethics in Engineering	McGraw–Hill, NewYork	2005

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Tripathy P.C and Reddy P.N	Principles of Management	Tata McGraw Hill, New Delhi	2008
2	Rabindra N Kanungo	Entrepreneurship and innovation	Sage Publications, New Delhi	1998
3	Charles E Harris, and Michael J Rabins	Engineering Ethics – Concepts and Cases	Wadsworth Thompson Learning, New Delhi	2013

WEB REFERENCES

1. http://www.managementstudyguide.com/taylor_fayol.htm
2. http://tutor2u.net/business/gcse/people_motivation_theories.htm
3. http://lfkkb.tripod.com/eng24/gilliganstheory.html
4. http://www.developingeyes.com/five–types–of–entrepreneurs/

18BEBME5E-- Professional Elective I 3 0 0 3 100

18BEBME5E-- Professional Elective II 3 0 0 3 100

18BEBME512 BIOMEDICAL INSTRUMENTATION & SIGNAL PROCESSING LAB 0 0 3 2 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To discuss the working principle of Biomedical Instrumentation systems.
- To infer the basic acquisition techniques of bioelectric signals.
- To learn about Audiometer
- To understand the concept of Signal Averaging
- To analyse ECG signal
- To experiment with basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB

COURSE OUTCOMES:

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

- Create coding for different convolution and correlation techniques.
- Develop preamplifiers and amplifiers for various bio signal recordings.
- Measure various non-electrical parameters using suitable sensors/transducers
- Perform biosignal Acquisition
- Analyse ECG signal
- Understand about SNR improvement

Laboratory Experiments:

1. Acquisition and recording of Electrocardiogram.
2. Acquisition of Electromyogram and determining conduction velocity.
3. Study of Audiometer and Air conduction thresholds testing; Plotting of Audiogram.
4. Study of Blood Pressure meter and Phonocardiograph.
5. Design and implementation of circuits with biomedical applications (like QRS detector, ECG Amplifier, EMG …..etc)
6. Study and acquisition of PPG signals.
7. Spectral Modeling and Analysis of ECG Signals
8. Detection of QRS complex and heart rate measurement.
9. Auto-correlation and cross correlation of ECG signals.
10. Signal Averaging to improve the SNR.
11. Design of 50 Hz notch filter for ECG signal and display PSD.

18BEBME513 Course Oriented project-III 0 0 2 1 100

18BECC551 FUNDAMENTALS OF MARKETING FOR BIO-MEDICAL ENTREPRENEURS **1 0 0 100**

OBJECTIVE

- To equip the students with requisite knowledge and skills
- To equip the students with right attitude necessary to provide effective leadership in a global environment.
- To develop competent management professionals with strong ethical values,
- To develop the students with capable of assuming a pivotal role in various sectors of the Indian Economy &Society, aligned with the national priorities.
- To develop proactive thinking so as to perform effectively in the dynamic socio-economic and business ecosystem.
- To harness entrepreneurial approach and skillsets.

OUT COME

- Competent managers with requisite knowledge, skills and right attitude
- Sustenance in globally competitive environment.
- Management professionals with pro-active thinking and Innovative approach
- Sensitive professionals with ethical values.
- Leaders with concern towards Nation and society at large
- Entrepreneurial approach and skillsets to contribute for socio-economic development

Basic table mannerism – common sense – public behaviour – attitude – genuinity & Uniqueness – roles and functions of marketing executives - Voice modulation - tone and phonetics – Market Analysis – telemarketing – E & Online Marketing – customer support and handling

18BEBME601 BIOMEDICAL IMAGE PROCESSING 3 0 0 2 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To study the formation of an image and its acquisition
- To introduce the use and application of transforms in image processing
- To explain the fundamentals of medical image acquisition, processing and storage.
- To discuss simple image enhancement techniques in Spatial and Frequency domain.
- To appraise the concepts of degradation function and restoration techniques.
- To apply image compression and recognition methods.

COURSE OUTCOMES:

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

- Explain the image fundamentals and mathematical transforms necessary for image processing.
- Illustrate the image enhancement techniques.
- Preprocess the image using filtering techniques
- Utilize image restoration procedures.
- Segment the region of interest in images.
- Apply the image compression procedures.

UNIT I DIGITAL IMAGE FUNDAMENTAL (9)

Elements of digital image processing systems, Elements of Visual perception, Image sampling and quantization, – Some Basic relationships between pixels, Matrix and Singular Value representation of discrete images.

UNIT II IMAGE TRANSFORMS (9)

2D DFT, Cosine, Sine Hadamard, Haar, Slant, KL transform and their properties.

UNIT III IMAGE ENHANCEMENT (9)

Histogram – Modification and specification techniques, Enhancement by point processing Image smoothening, Image sharpening, generation of spatial masks from frequency domain specification, Homomorphic filtering, and color image processing.

UNIT IV IMAGE RESTORATIONAND RECONSTRUCTION OF MEDICAL IMAGES (9)

Image degradation models, Unconstrained and Constrained restoration, inverse filtering, Least mean square filter, Image reconstruction from projections – Radon transforms, Filter back projection algorithm, Fourier reconstruction of MRI Images.

UNIT V MEDICAL IMAGE COMPRESSION TECHNIQUES (9)

Run length, Huffman coding, arithmetic coding, Pixel coding, transform coding, JPEG Standard, predictive techniques, Application of image processing techniques in thermography, SPECT, PET images.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Rafael C., Gonzalez and Richard E. Woods	Digital Image Processing	Pearson Education Asia	2001
2	Anil K. Jain	Fundamentals of Digital Image Processing	Prentice Hall of India	1997

REFERENCE BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	William K. Pratt	Digital Image Processing	John Wiley	1987

18BEBME602 BIOMECHANICS 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To perceive about the principles of biomechanics.
- To study about the mechanics involved with various physiological systems.
- To gain knowledge about musculoskeletal mechanics
- To infer the mechanics of physiological systems.
- To discuss the mechanics of joints.
- To create mathematical models used in the analysis of biomechanical systems

COURSE OUTCOMES:

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

- Explain the principles of biomechanics.
- Discuss the mechanics of physiological systems.
- Demonstrate the mechanics of joints.
- Analyze the biomechanical systems using mathematical models.
- Design and develop the models specific to orthopedic applications
- Illustrate the mathematical models used in the analysis of biomechanical systems.

UNIT I INTRODUCTION TO MECHANICS

Introduction – Scalars and vectors, Statics – Force types, Resolution and composition of forces, Moments of force and couple, Resultant force determination, parallel forces in space, equilibrium coplanar forces, Dynamics, Basic principles – Linear motion, Newton‘s laws of motion, Impulse and Momentum, Work and Energy Kinetics – Velocity and acceleration, Kinematics – Link segment models, Force transducers, Force plates, Introduction to Constitutive equations – Constitutive equations of Nonviscous fluid, Newtonian Viscous fluid and Hookean Elastic solid

UNIT II BIOFLUID MECHANICS

Intrinsic fluid properties – Density, Viscosity, Compressibility and Surface Tension, Viscometers – Capillary, Coaxial cylinder and cone and plate, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids, Fluid mechanics in straight tube – Steady Laminar flow, Turbulent flow, Flow development, Viscous and Turbulent Sheer Stress, Effect of pulsatility, Boundary Layer Separation, Structure of blood vessels, Material properties and modeling of Blood vessels, Heart –Cardiac muscle characterisation, Native heart valves – Mechanical properties and valve dynamics, Prosthetic heart valve fluid dynamics.

UNIT III BIOSOLID MECHANICS

Constitutive equation of viscoelasticity – Maxwell &Voight models, anisotropy, Hard Tissues – Structure, blood circulation, elasticity and strength, viscoelastic properties, functional adaptation, Soft Tissues – Structure, functions, material properties and modeling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle – Muscle action, Hill‘s models, mathematical modeling, Bone fracture mechanics, Implants for bone fractures.

UNIT IV BIOMECHANICS OF JOINTS

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder,

spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video.

UNIT V MODELING AND ERGONOMICS

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; Ergonomics – Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted vibrations.

TEXT BOOKS:

1. Y.C. Fung, ―Bio-Mechanics- Mechanical Properties of Tissues‖, Springer-Verlag, 1998.
2. Subrata Pal, ―Textbook of Biomechanics‖, Viva Books Private Limited, 2009.

REFERENCES:

1. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, ―Biofluid Mechanics: The Human Circulation‖, Taylor and Francis, 2007.
2. Sheraz S. Malik and Shahbaz S. Malik, ―Orthopaedic Biomechanics Made Easy‖, Cambridge University Press, 2015.
3. Jay D. Humphrey, Sherry De Lange, ―An Introduction to Biomechanics: Solids and Fluids, Analysis and Design‖, Springer Science Business Media, 2004.

18BEBME603 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – I 3003 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To perceive the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them.
- To analyze some of the cardiac assist devices.
- To understand the principle of diathermy
- To discuss about the measurement of the signals generated by muscles.
- To summarize the need and use of some of the extracorporeal devices.
- To learn the patient safety measures

COURSE OUTCOMES:

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

- Utilize different medical devices applied in measurement of parameters related to cardiology, neurology
- Explain about cardiac assist devices, its continuous monitoring and transmission
- Measure signals generated by muscles
- Analyze different types of diathermy units.
- Identify the electrical hazards and Implement methods of patient safety
- Interpret the need and use of the extracorporeal devices.

UNIT I CARDIAC EQUIPMENT 9

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, Plethysmography. Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External

UNIT II NEUROLOGICAL EQUIPMENT 9

Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation.

UNIT III SKELETAL MUSCULAR EQUIPMENT 9

Generation of EMG, recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT IV PATIENT MONITORING AND BIOTELEMETRY 9

Patient monitoring systems, ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

UNIT V SPECIAL DIAGNOSTIC TECHNIQUES 9

Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy.Thermography – Recording and clinical application, ophthalmic instruments.

Total : 45

TEXT BOOK:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Khandpur R.S	Handbook of Biomedical Instrumentation	Tata McGraw Hill	2003

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Myer Kutz	Standard Handbook of Biomedical Engineering & Design	Mc Graw Hill	2003
2	L.A Geddes and L.E.Baker	Principles of Applied Biomedical Instrumentation	Mc Graw Hill	2008
3	Leslie Cromwell	Biomedical Instrumentation and Measurement	Pearson Education, New	2007
4	Antony Y.K.Chan	Biomedical Device Technology, Principles and design	Charles ThomasPublisher Ltd	2008
5	Joseph J. Carr and John M. Brown	Introduction to Biomedical Equipment Technology	Pearson education	2004
6	John G.Webster	Medical Instrumentation Application and Design	John Wileyand Sons	2006

18BECC604 HEALTHCARE & HOSPITAL MANAGEMENT 3 0 0 2 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To discuss the fundamentals of hospital administration.
- To analyze the market related research process.
- To summarize the quality and safety aspects in hospital.
- To perceive knowledge about human resource management in hospital
- To explain about hospital information systems

COURSE OUTCOMES:

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

- Explain various information management systems and relative supportive services.
- Interpret market related research processes in healthcare and hospital sectors.
- Illustrate the quality and safety aspects in hospital.
- Demonstrate about human resource management in hospital
- Understand about NABH and NABL
- Explain the importance of supportive services

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TEXT BOOKS:

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCES:

1. Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New

York, 1977.
2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Peter Berman ―Health Sector Reform in Developing Countries‖ - Harvard University Press, 1995.
4. William A. Reinke ―Health Planning For Effective Management‖ - Oxford University Press.1988
5. Blane, David, Brunner, ―Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press 2002.
6. Arnold D. Kalcizony & Stephen M. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

18BEBME6E--	**Professional Elective III**	**3 0 0 3**	**100**
18BEBME6E--	**Professional Elective IV**	**3 0 0 3**	**100**

18BEBME611 BIO-MEDICAL IMAGE PROCESSING LAB 0 0 3 2 100

COURSE OBJECTIVES:

The goal of this course is for students to:

- To implement fundamental image processing techniques in Biomedical Images.
- To infer enhancement and Transformation of Medical Images.
- To perceive knowledge about reconstruction of images.
- To learn about pre processing of image
- To understand the CT images
- To study the MATLAB implementation

COURSE OUTCOMES:

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

- Apply various pre-processing techniques in Medical Images.
- Outline enhancement and transformation of Medical Images.
- Simplify and reconstruct medical images.
- Use MATLAB tool for image processing application
- Perform Image analysis
- Perform image compression

LIST OF EXPERIMENTS:

1. Digital image Fundamentals.
2. Image Enhancement and Transformation.
3. Edge detection and boundary tracing techniques.
4. Removal of noise in medical images.
5. Image compressions.
6. Restoration of CT images.
7. Reconstruction of images.
8. Image Analysis.
9. Matlab implementation.

18BEBME612 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To provide practice on recording and analysis of different Bio potentials
- To learn different non-electrical parameters using various methods
- To learn about Electrical safety measurements
- To study the function of different Therapeutic equipment.
- To understand the concept the ultrasonic diathermy
- To understand the concept of biotelemetry

COURSE OUTCOMES:

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

- Measure different bioelectrical signals using various methods
- Assess different non-electrical parameters using various methodologies
- Illustrate various diagnostic and therapeutic techniques.
- Handle therapeutic equipment
- Design ECG amplifier
- Design and simulate by using Lab View

LIST OF EXPERIMENTS:

1. Simulation of ECG – detection of QRS complex and heart rate
2. Study of shortwave and ultrasonic diathermy
3. Study of biotelemetry
4. Electrical safety measurements.
5. Measurement of Respiratory parameters using spirometry.
6. Study of medical stimulator.
7. Study of ESU – cutting and coagulation modes
8. Recording of Audiogram
9. Design of ECG amplifier, recording and analysis using Lab View

Total: 45

18BEBME651 Mini Project 0 0 1 - 100

18BEBME652 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C 3 0 0 3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To understand Data, expressions and statements
- To learn about Python finctions
- To know about files and dictonaries

COURSE OUTCOMES:

- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python
- To write python programmes in biomedical applications
- To work with files and dictionaries
- To get familiar with condiotionals and loops

UNIT I ALGORITHMIC PROBLEM SOLVING

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters;Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Allen B. Downey	Think Python: How to Think Like a Computer Scientist	Shroff/O'Reilly Publishers	2016
2	Guido van Rossum and Fred L. Drake Jr	An Introduction to Python – Revised and updated for Python 3.2	Network Theory Ltd	2011

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	John V Guttag	Introduction to Computation and Programming Using Python	MIT Press	2013
2	Robert Sedgewick, Kevin Wayne, Robert Dondero	Introduction to Programming in Python- An Inter-disciplinary Approach	Pearson India Education Services Pvt. Ltd	2016
3	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India)	2015
4	Kenneth A. Lambert	Fundamentals of Python: First Programs‖	CENGAGE Learning	2012
5	Charles Dierbach	Introduction to Computer Science using Python: A	Wiley India Edition	2013.
6	Paul Gries, Jennifer Campbell and Jason	Practical Programming: An Introduction to Computer	Pragmatic Programmers, LLC	2013

18BEBME701 VIRTUAL BIOINSTRUMENTATION 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To introduce virtual instrumentation concepts and applications.
- To discuss about programming structure in LabVIEW.
- To analyze data acquisition hardware.
- To infer knowledge on VI programs for specific applications.
- To perceive the basics of virtual instrumentation.
- To program virtual instrumentation software for biomedical applications

COURSE OUTCOMES:

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

- Illustrate programming concepts of virtual instruments.
- Compile programming structure in LabVIEW.
- Understand the use of VI for data acquisition.
- analyze different types of interfaces.
- Choose data from hardware systems.
- Develop VI programs for specific applications.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION (9)

Historical perspectives, Need of VI, advantages, Define VI, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES (9)

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Graphical programming in data flow, comparison with conventional programming.

UNIT III DATA ACQUISITION BASICS (9)

ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware Installation. GPIB/IEEE 488 concepts, and embedded system buses - PCI, EISA, CPCI, and USB & VXI. A

UNIT IV COMMON INSTRUMENT INTERFACES (9)

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office &.Industrial applications, Visa and lVI, image acquisition and processing. Motion control. ADC, DAC, DIO, DMM, waveform generator.

UNIT V USE OF ANALYSIS TOOLS (9)

Fourier transforms, power spectrum correlation methods, windowing & filtering, Major equipments- Oscilloscope, Digital Multimeter, Pentium Computers, Application in Biomedical field

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Gary Jonson	Labview Graphical Programming	Second Edition, McGraw Hill, NewYork	1997
2	Lisa K.wells & Jeffrey Travis	Labview for everyone	, Prentice Hall Inc., New Jersey	1997

REFERENCE BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Sokol off	Basic concepts of Labview 4	Prentice Hall Inc., New Jersey	1998
2	S.Gupta, J.P: Gupta	PC interfacing for Data Acquisition & Process Control	Instrument Society of America	1994
3	L.T.Amy	Automation System for Control and Data Acquisition	ISA	1992

18BEBME702 Rehabilitation Engineering 3003 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To perceive the rehabilitation concepts and Rehabilitation team for future development and applications.
- To understand the Primary & secondary Disabilities
- To discuss various Principles of Rehabilitation Engineering.
- To infer the various orthotic devices and prosthetic devices to overcome orthopedic problems.
- To explain the need for medical aids.
- .To explain about different types of models of Hand and arm replacement

COURSE OUTCOMES:

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

- Elaborate about the needs of rehabilitations and its future development.
- Understand the terminologies used by the rehabilitation team
- Demonstrate Engineering Concepts in Sensory & Motor rehabilitation. Apply the different types of Therapeutic Exercise Technique to benefit the society.
- and their application in biomedical field and hence the benefit of the society.
- Understand the need of virtual reality based rehabilitation
- Simplify about different types of models of Hand and arm replacement.

UNIT I INTRODUCTION TO REHABILITATION

What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II PRINCIPLES OF REHABILITATION

Introduction, The Human Component, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles - Practice of Rehabilitation and Assistive Technology.

UNIT III THERAPEUTIC EXERCISE TECHNIQUE

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT IV MANAGEMENT OF COMMUNICATION & VIRTUAL REALITY

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids. Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT V ORTHOTIC, PROSTHETIC DEVICES & RESTORATION TECHNIQUES
General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Calipers- FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics, Myoelectric controlled prosthetics and Externally powered limb prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

TEXT BOOKS:
1 Sunder 'Textbook of Rehabilitation', Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi, 2nd Edition, Reprint 2007
2. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third edition-3 volume set, Taylor & Francis, 2006
REFERENCES:
1. Horia- Nocholai Teodorecu, L.C.Jain ,Intelligent systems and technologies in rehabilitation Engineering; CRC; December 2000.
2. Keswick. J., What is Rehabilitation Engineering, Annual Reviews of Rehabilitation- SpringerVerlag, New York, 1982.
3. Warren E. Finn,Peter G. LoPresti; Handbook of Neuroprosthetic Methods CRC; edition 2002.
4. Rory A Cooper (Editor), Hisaichi Ohnabe (Editor), Douglas A. Hobson (Editor), 'An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering' CRC Press, 2006.

17	**____OE__**	**OPEN ELECTIVE - 1**	**0033**	**100**
17	**____OE__**	**OPEN ELECTIVE - 2**	**0033**	**100**
18BEBME7E--		**PROFESSIONAL ELECTIVE V**	**3003**	**100**

18BEBME711 VIRTUAL BIOINSTRUMENTATION LAB 0032 100

COURSE OBJECTIVE:

The goal of this course is for students:

- To familiarizethestudentswithVirtualInstrumentationandtodoprogrammingforapplications
- To perceive the basics of virtual instrumentation.
- To program virtual instrumentation software for biomedical applications
- To analyse timing issues
- To learn about GPIB
- To do program with Lab view software for biomedical applications

COURSE OUTCOME

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

- study about Programming Techniques
- study about Data Acquisition and inter facing techniques
- do programming for process control and other applications
- use D/A acquisition interface
- use serial communication interface
- use Lab view software for biomedical signal analysis

LIST OF EXPERIMENTS

1. Getting Started with Lab VIEW – Basic operations, controls and indicators.
2. Simple programming structures and Timing Issues
3. Lab VIEW – Debugging a VI, Sub-VI's
4. Lab VIEW – Traffic Light - Programming Structure, Sub-Vis, Clusters
5. GPIB-Serial poll Byte
6. Communication via RS232/ Serial Port.
7. Oscilloscope - Attribute Nodes, Menus
8. RC Circuit measurement - Timing issues
9. Lab VIEW – Incorporating user written C subroutines
10. Digital-to-Analog acquisition interfacing - Analog I/O
11. The RS232 Interface – Function Generator
12. Importing pictures, Global/ local variables. Arrays, Clusters

18BEBME712	**Hospital Training**	**0 0 3 2**	**100**
18BEBME791	**Project Work Phase I**	**0 0 8 4**	**100**

18BEBME801 Artificial organs and Implants 3 0 0 3 100

COURSE OBJECTIVES

The aim of the course is to:

- 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 study about soft tissue replacement and hard tissue replacement
- TO learn about various implants

COURSE OUTCOMES

After the course the student will be able to:

- Understand of artificial organs & transplants
- Know the principles of implant design with a case study
- Explain the implant design parameters and solution in use
- Know about various blood interfacing implants
- Understand about soft tissue replacement and hard tissue replacement
- Know about various implants

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.

TEXT BOOKS:

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.

REFERENCES:

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
2. R S Khandpur, Handbook of Biomedical Instrumentation,Tata McGraw Hill, 2003
3. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
4. Yannas, I. V, ―Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001. ISBN:9780387952147.
5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, ―Clinical Engineering‖, CRC Press, 1st edition,2010.
6. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw- Hill, 2003

18BEBME8E--	**PROFESSIONAL ELECTIVE VI**	**3 0 0 3**	**100**
18BEBME8E--	**PROFESSIONAL ELECTIVE VII**	**3 0 0 3**	**100**
18BEBME891	**PROJECT WORK PHASE II AND VIVAVOCE**	**0 0 32 16**	**100**

FOR SEMESTER V (ELECTIVE-I & II)

18BEBME5E01 MEDICAL PHYSICS 3 0 0 3 100

COURSE OBJECTIVES

The Goal of this course is for students:

- To study the complete non-ionizing radiations including light and its effect in human body.
- To demonstrate the principles of ultrasound radiation and its applications in medicine.
- To appraise about radioactive nuclides and also the interactions of radiation with matters and how isotopes are produced.
- To perceive the role of Physics in cardiopulmonary system.
- To analyse the harmful effects of radiation and radiation protection regulations.
- To study the effects of sound and light in human body

COURSE OUTCOMES

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

- Analyze the low and high frequency effects of non-ionizing radiation and physics of light.
- Define various clinical applications based on ultrasound wave.
- Explain the process of radioactive nuclide production using different techniques.
- Analyze radiation mechanics involved with various physiological systems.
- Apply the concept of physics in the function of cardiopulmonary system.
- Outline the detrimental effects of radiation and regulations for radiation safety.

UNIT I NON IONIZING RADIATION AND ITS MEDICAL APPLICATION 9

Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light, Measurement of light and its unit- limits of vision and color vision an overview, Thermography– Application

UNIT II SOUND IN MEDICINE 9

Physics of sound, Normal sound levels –ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter; Cavitations, Reflection, Transmission- Scanning systems – Artifacts- Ultrasound- Doppler-Double Doppler shift-Clinical Applications

UNIT III PRINCIPLES OF RADIOACTIVE NUCLIDES 9

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Technetium generator.

UNIT IV INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation ,Interaction of neutron with matter and their clinical significance.

UNIT V BASIC RADIATION QUANTITIES 9

Introduction -exposure- Inverse square law-KERMA-Kerma and absorbed dose –stopping power -

relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg's curve- concept of LD 50- Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	John R Cameran , James G Skofronick	Medical Physics	John-Wiley & Sons	1978
2	W.J.Meredith and J.B. Massey	Fundamental Physics of Radiology	Varghese Publishing house	1992

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	P.Uma Devi, A.Nagarathnam , B S SatishRao	Intorduction to Radiation Biology	B.I ChurChill Livingstone pvt Ltd	2000
2	S.Webb	The Physics of Medical Imaging	Taylor and Francis	1988
3	J.P.Woodcock	Ultrasonic,Medical Physics Handbook series	Adam Hilger,Bristol	2002
4	Hylton B.Meire and Pat Farrant	Basic Ultrasound	John Wiley& Sons	1995

18BEBME5E02 BIOMETRIC SYSTEMS 3 0 0 3 100

COURSE OBJECTIVES:

The aim of the course is to:

- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- **To** recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.
- Identify the correct advantages and disadvantages of each biometric method
- Demonstate knowledge engineering principles underlying biometric systems.

COURSE OUTCOMES:

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

- Demonstrate knowledge engineering principles underlying biometric systems.
- Analyze design basic biometric system applications.
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- identify issues in the realistic evaluation of biometrics based systems.
- Identify the correct advantages and disadvantages of each biometric method

UNIT I INTRODUCTION TO BIOMETRICS 9

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and policy – Biometric applications – biometric characteristics

UNIT II FINGERPRINT TECHNOLOGY 9

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III FACE RECOGNITION AND HAND GEOMETRY 9

Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm – Biometric fusion.

UNIT IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION 9

Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy – training and adaptability – examples of multimodal biometric systems – Performance evaluation- Statistical Measures of Biometrics – FAR – FRR – FTE – EER – Memory requirement and allocation.

UNIT V BIOMETRIC AUTHENTICATION 9

Introduction - Biometric Authentication Methods - Biometric Authentication Systems – Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. -. Expectation-Maximization theory - Support Vector Machines. Biometric authentication by fingerprint –biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) – Multibiometrics and Two-Factor Authentication

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	James Wayman, Anil Jain, Davide Maltoni	Biometric Systems, Technology Design and Performance Evaluation	Springer	2005
2	S.Y. Kung, S.H. Lin, M.W.Mak	Biometric Authentication: A Machine Learning Approach	Prentice Hall	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Paul Reid	Biometrics for Network Security	Pearson Education	2004
2	Nalini K Ratha, Ruud Bolle	Automatic fingerprint Recognition System	Springer	2003
3	L C Jain, I Hayashi, S B Lee, U Halici	Intelligent Biometric Techniques in Fingerprint and	CRC Press	1999
4	John Chirillo, Scott Blaul	Implementing Biometric Security	John Wiley	2003
5	Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain	Handbook of Multibiometrics	Springer	2006

18BEBME5E03 Medical Optics 3 0 0 3 100

COURSE OBJECTIVES

To Study about:

- The optical properties of the tissues and the interactions of light with tissues.
- The instrumentation and components in Medical Optics.
- The Medical Lasers and their applications
- The optical diagnostic applications
- The emerging optical diagnostic and therapeutic techniques
- To understand photodynamic therapy.

COURSE OUTCOMES:

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

- Understand optical properties of the tissues and the interactions of light with tissues.
- Know the instrumentation and components in Medical Optics.
- Design therapeautic equipments
- Work with optical diagnostic applications
- Work with optical therapeautic components
- Know the laser safety measures

UNIT I OPTICAL PROPERTIES OF THE TISSUES

Fundamental Properties of light - Refraction, Reflection, Laws (Snell's law and Fresnel law) Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology, Laser tissue Interactions – Photo chemical, Photo thermal and Photo mechanical interactions, Fluorescence, Speckles, Photo ablative processes.

UNIT II INSTRUMENTATION IN PHOTONICS

Instrumentation for absorption, Scattering and emission measurements, Excitation light sources – high pressure arc lamps, LEDs, Lasers, Optical filters – Prism and Monochromators, Polarizers, Optical detectors – Single Channel and Multichannel detectors, Time resolved and phase resolved detection methods, Optical fibers – Total Internal Reflection.

UNIT III SURGICAL THERAPEUTIC APPLICATIONS OF LASERS

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and Speckle applications of lasers in biology and medicine.

UNIT V DIAGNOSTIC AND THERAPEUTIC TECHNIQUES

Near field imaging of biological structures, In vitro clinical diagnostics, Phototherapy, Photodynamic therapy (PDT) - Principles and mechanisms - Oncological and non-oncological applications of PDT - Biostimulation effect – applications - Laser Safety Procedures.

TEXT BOOKS:

1. Tuan Vo Dirh, ―Biomedical Photonics – Handbook‖, CRC Press, Bocaraton, 2014.
2. Paras N. Prasad, ―Introduction to Biophotonics‖, A. John Wiley and Sons, Inc. Publications, 2003

REFERENCES:

1. Markolf H.Niemz, ―Laser-Tissue Interaction Fundamentals and Applications‖, Springer, 2007
2. G.David Baxter ―Therapeutic Lasers – Theory and practice‖, Churchill Livingstone publications Edition- 2001.
3. Leon Goldman, M.D., & R.James Rockwell, Jr., ―Lasers in Medicine‖, Gordon and Breach, Science Publishers Inc., 1975.

18BEBME5E04 BIOMATERIALS 3 0 0 3 100

COURSEOBJECTIVES:

The objective of this course is for:

- the student to gain a solid appreciation for the special significance of the word biomaterial
- Rapid and exciting evolution and expansion of biomaterials science and its applications in medicine.
- Learn the functional performance of biomaterials.
- Ceramic, polymeric, composite and "smart" biomaterials will be covered in detail.
- Understand the structure and properties of these types of biomaterials.
- Know the important biomaterials and their processing, properties and applications

COURSE OUTCOMES

The student should be made to:

- Learn characteristics and classification of Biomaterials
- Understand different metals, ceramics and its nanomaterial's characteristics as biomaterials
- Learn polymeric materials and its combinations that could be used as a tissue replacement implants
- Get familiarized with the concepts of Nano Science and Technology
- Identify and understand the main terms largely used in biomaterials literature, basic properties of various biomaterials
- correctly associate terms with processes/phenomena, and be able to correlate related events

UNIT I INTRODUCTION TO BIO-MATERIALS

Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, Nano scale phenomena.

UNIT II METALLIC AND CERAMIC MATERIALS

Metallic implants - Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics.

UNIT III POLYMERIC IMPLANT MATERIALS

Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin. Medical Textiles, Materials for ophthalmology: contact lens, intraocular lens. Membranes for plasma separation and Blood oxygenation, electro spinning: a new approach.

UNIT IV TISSUE REPLACEMENT IMPLANTS

Small intestinal sub mucosa and other decullarized matrix biomaterials for tissue repair: Extra cellular Matrix. Softtissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, tissue scaffolding and engineering using Nano biomaterials.

UNIT V TESTING OF BIOMATERIALS:

Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.

TEXT BOOKS:

1. Sujata V. Bhatt, ―Biomaterials‖, Second Edition, Narosa Publishing House, 2005.
2. Sreeram Ramakrishna, MuruganRamalingam, T. S. Sampath Kumar, and Winston O. Soboyejo, ―Biomaterials: A Nano Approach‖, CRC Press, 2010.

REFERENCES:

1. Myer Kutz, ―Standard Handbook of Biomedical Engineering & Design‖, McGraw Hill, 2003
2. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, ―Introduction to Biomedical Engineering‖, Elsevier, 2005.
3. Park J.B., ―Biomaterials Science and Engineering‖, Plenum Press, 1984.
4. A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran,―Woodhead Medical Textiles and Biomaterials for Healthcare‖, Publishing Limited 2006.
5. D F Williams, ―Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume‖, VCH Publishers 1992.
6. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and KratiJain. ―Implant biomaterials: A comprehensive review‖, World Journal of Clinical Cases, 2015.

18BEBME5E05 INTERNET OF THINGS 3 0 0 3 100

COURSE OBJECTIVES:

- Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
- Understanding the need for migrating towards software defined networks and integrating time series data from wireless sensor networks.
- Hardware platforms and operating systems commonly used in IoT systems.
- Big data predictive analytics and transformation from IT to IOT.
- Awareness of IoT related cyber legislation.
- To understand Smart Objects and IoT Architectures

Course objectives

After the course the student should be able to:

- Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
- Understand Smart Objects and IoT Architectures
- learn about various IOT-related protocols
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Understand data analytics and cloud in the context of IoT
- Know Hardware platforms and operating systems commonly used in IoT systems.

UNIT I FUNDAMENTALS OF IoT

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework –

Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).

3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

18BEBME6E02 TELEHEALTH TECHNOLOGY 3 0 0 3 100

COURSEOBJECTIVES:

The student should be made to:

- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications.
- Understand various applications of Body Area Network
- Know the different network protocols
- Familiarise various Communication technology

COURSE OUTCOMES:

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

- Apply multimedia technologies in telemedicine.
- Explain Protocols behind encryption techniques for secure transmission of data.
- Apply telehealth in healthcare.
- Know various safety and regulatory issues
- Understand Data Security and Standards
- Get familiar with Real-time Telemedicine

UNIT I TELEMEDICINE AND HEALTH 9

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II TELEMEDICAL TECHNOLOGY 9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN,POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antenna, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data – local and centralized.

UNIT III TELEMEDICAL STANDARDS 9

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series (Video phone based ISBN) T. 120, H.324 (Video phone based PSTN), Video Conferencing, Real-time Telemedicine integrating doctors / Hospitals, Clinical laboratory data, Radiological data, and other clinically significant biomedical data, Administration of centralized medical data, security and confidentially of medical records and access control, Cyber laws related to telemedicine.

UNIT IV MOBILE TELEMEDICINE 9

Tele radiology: Definition, Basic parts of teleradiology system: Image Acquisition system Display system, Tele pathology, multimedia databases, color images of sufficient resolution, Dynamic range, spatial resolution, compression methods, Interactive control of color, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.

UNIT V TELEMEDICAL APPLICATIONS 9

Telemedicine access to health care services – health education and self care. · Introduction to robotics surgery, Telesurgery, Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability., Telemedicine access to health care services – health education and self care, Business aspects - Project planning and costing, Usage of telemedicine.

Total : 45

TEXT BOOK

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	.Norris, A.C	Essentials of Telemedicine and Telecare	Wiley	2002

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Wootton, R., Craig, J., Patterson, V	Introduction to Telemedicine. Royal Society of Medicine	Taylor & Francis	2006
2	O'Carroll, P.W., Yasnoff, W.A., Ward,	Public Health Informatics and Information Systems	Springer	2003
3	Ferrer-Roca, O., Sosa - Iudicissa, M.	Handbook of Telemedicine. Technology and Informatics	IOS Press (Studies in Health) Volume 54	2002
4	Simpson, W.	Video over IP, A practical guide to technology and applications	Focal Press Elsevier	2006
5	Bemmel, J.H. van, Musen, M.A.	Handbook of Medical Informatics	Springer	1997
6	Mohan Bansal	Medical Informatics	Tata McGraw-Hill	2004

18BEBME6E03 CANCER BIOLOGY 3 0 0 3 100

COURSE OBJECTIVES

- To develop skills of the students in the area of Cancer Biology.
- Growth factors related to transformation, Telomerases.
- . Cancer screening and early detection,
- Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer
- Know Different forms of therapy, chemotherapy, radiation therapy,
- Understand about detection of cancers, prediction of aggressiveness of cancer

COURSE OBJECTIVES

At the end of the course, the student would have learnt about

- pathogenesis of cancer,
- identifications of cancer through tools developed by biotechnology research
- molecules synthesized for cancer therapy.
- This will be very beneficial for the student to take up projects in Cancer Biology.
- x-ray radiation-mechanisms of radiation carcinogenesis.
- Detection using biochemical assays

UNIT I FUNDAMENTALS OF CANCER BIOLOGY 9

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II PRINCIPLES OF CARCINOGENESIS 12

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity, Growth factors related to transformation, Telomerases.

UNIT IV PRINCIPLES OF CANCER METASTASIS 9

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V NEW MOLECULES FOR CANCER THERAPY 6

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Maly B.W.J	Virology A Practical Approach	“”, IRLl Press, Oxford	1987
2	Dunmock N.J And Primrose S.B	Introduction to Modern Virology	Blackwell Scientific Publications,	1988

REFERENCE

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Maly B.W.J	An Introduction Top Cellular And Molecular Biology of Cancer	Oxford Medical Publications	1991

18BEBME6E04 BIOSIGNAL CONDITIONING CIRCUITS 3 0 0 3 100

COURSE OBJECTIVE

- To Design biomedical signal conditioning circuits
- To Work in various health related companies
- To Become familiar with various clinical devices
- To Promote research in the field of biomedical engineering
- To Work with and service various clinical devices
- To Excel in hardware and software applications in medical field

COURSE OUTCOME:

- gain in depth knowledge of fundamentals of operational amplifier circuits
- learn the various applications using operational amplifiers.
- understand various Filters
- Familiarise A/D and D/A convertors
- Apply op-amp in various conditioning circuits
- Need for digital circuits in biomedical field

UNIT 1 INTRODUCTION TO OPAMP 9

Introduction, Signal conditioning, 741 General purpose OPAMP: ideal characteristics, offset voltages and currents. Open & Closed Loop Configuration. Inverting, Non-Inverting, Summing, Voltage Follower, Integrator, differentiators, Log & Anti-Log Amplifiers, Differential Amplifiers, CMRR.

UNIT 2 APPLICATION OF OPAMPS 9

Comparator- Zero crossing detector, Inverting and non inverting comparator, Schmitt Trigger, Precision rectifiers- Half wave and Full wave rectifiers, Peak detectors, Monostable, Astable multivibrators, Sawtooth generator, Triangular waveform generator, Sine Wave Generators-RC Phase Shift Oscillator, Wein Bridge oscillator.

UNIT 3 FILTERS 9

Introduction- Analog Filters, Active Filters and Passive Filters, First order and Second order Low Pass Filters, High Pass Filters, Band Pass Filters- Narrow Band Pass, Wide band Pass Filters,, Band Reject Filters- Notch Filter, All Pass filters and higher Order filters- Design and applications.

UNIT 4 A/D AND D/A CONVERTERS 9

Sample and Hold circuit - D/A converters: Resistive divider and R-2R ladder networks, A/D converters: Counting type, Successive approximation, parallel comparator, Voltage to Current Converter, 555 Timer and its applications- Astable multivibrators and Monostable Multivibrator.

UNIT 5 AMPLIFIERS

Instrumentation amplifiers, Bridge Amplifiers, Bioelectric Amplifiers: - Properties desired, Isolation Amplifiers:- Battery Powered, Carrier, Optically Coupled, Current Loading, Chopper Stabilized amplifier, Input Guarding.

Total : 45

TEXT / REFERENCE BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Ramakant A Gayakwad	Operational Amplifiers & Linear Integrated Circuits	Prentice Hall	2000
2	Joseph J. Carr & John M. Brown	Introduction to Biomedical Equipment Technology	Pearson Education Pvt. Ltd, 4th edition	2001
3	Roy Choudhary	Linear Integrated Circuits	New Age International (P) Ltd,	2004
4	John P.Bentley	Principles of Measurement System	Longman Science & Technology	1995
5	Jacob Mill man	Micro Electronics	McGraw-Hill	1987
6	Robert Coughlin and Fredrer	Operational Amplifiers & Linear Integrated Circuits	Prentice Hall	2001

18BEBME6E04 Hospital Waste Management 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To introduce the relevance of this course to the existing technology
- The student should be made to understand the principles, practices and areas of application in Hospital management
- To know the hazardous materials used in hospital and its impact on health.
- To get knowledge on biomedical waste management.
- To infer the hazards in biomedical waste management.
- To develop knowledge on facility safety and infection control.

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COURSE OUTCOMES:

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

- Distinguish various waste disposal procedures and management.
- Understand the biomedical waste disposal concept.
- Explain the importance of supportive services.
- Demonstrate Biomedical Waste Management techniques.
- Elaborate the hazards in biomedical waste management.
- Apply knowledge on facility safety and infection control.

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS

Healthcare Hazard Control : Introduction, Hazard Control, Hazard Control Management, Hazard Control Responsibilities, Addressing Behaviors, Hazard Control Practice, Understanding Hazards, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees, Hazard Control Evaluation, Hazards, System Safety, Ergonomics. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers‘ Compensation, Orientation, Education, and Training.

UNIT II BIOMEDICAL WASTE MANAGEMENT

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III HAZARDOUS MATERIALS

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT IV FACILITY SAFETY

Facility Safety : Introduction, Facility Guidelines Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colors, and Marking Requirements, Scaffolding, Fall Protection, Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Permit Confined Spaces, OSHA Hearing Conservation Standard, Heating, Ventilating, and

Air-Conditioning Systems, Assessing IAQ, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centered Healthcare, Quality Improvement Tools and Strategies, Healthcare-Associated Infections, Medication Safety.

TEXT BOOKS:

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylor and Francis (2014).
2. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).

REFERENCE:

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006
2. V.J. Landrum, ―Medical Waste Management and disposal‖, Elsevier, 1991

FOR SEMESTER VII (ELECTIVE-V)

18BEBME7E01 REHABILITATION ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES:

The goal of this course is for students:

- To perceive the rehabilitation concepts and Rehabilitation team for future development and applications.
- To understand the Primary & secondary Disabilities
- To discuss various Principles of Rehabilitation Engineering.
- To infer the various orthotic devices and prosthetic devices to overcome orthopedic problems.
- To explain the need for medical aids.
- .To explain about different types of models of Hand and arm replacement

COURSE OUTCOMES:

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

- Elaborate about the needs of rehabilitations and its future development.
- Understand the terminologies used by the rehabilitation team
- Demonstrate Engineering Concepts in Sensory & Motor rehabilitation. Apply the different types of Therapeutic Exercise Technique to benefit the society.
- Design and apply different types Hearing aids, visual aids and their application in biomedical field and hence the benefit of the society.
- Understand the need of virtual reality based rehabilitation Simplify about different types of models of Hand and arm replacement

UNIT I MEDICAL X-RAY EQUIPMENT 9

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

UNIT II COMPUTED TOMOGRAPHY 9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.

UNIT III MAGNETIC RESONANCE IMAGING 9

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR MEDICINE SYSTEM 9

Radio Isotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera- Principle of operation, collimator, photo multiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT V RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Steve Webb	The Physics of Medical Imaging	Adam Hilger, Philadelpia	1988
2	R.Hendee and Russell Ritenour	Medical Imaging Physics	Fourth Edition William, Wiley-Liss	2002

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Gopal B. Saha	Physics and Radiobiology of Nuclear Medicine	Third edition Springer	2006
2	B.H.Brown, PV Lawford, R H Small	Medical physics and biomedical Engineering	CRC Press	1999
3	Myer Kutz	Standard handbook of Biomedical Engineering and	McGraw Hill	2003
4	P.Ragunathan	Magnetic Resonance Imaging and Spectroscopy in Medicine	-	-

18BEBME7E02 LASERS AND FIBER OPTICS IN MEDICINE 3 0 0 3 100

Course Objectives

The goal of this course is for students

- To Understand Biomedical Laser principles and applications.
- To be familiar with optical properties of tissues
- To infer the knowledge of photonics
- To be exposed to Optical Holography
- To explain the various applications of Laser
- To understand photodynamic therapy.

Course Outcomes

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

- Analyse the optical properties of tissues
- Use the Photonics instrumentation
- Apply lasers in different areas of medicine.
- Perceive the lasers in ophthalmology
- Discuss about optical hologram
- Explain the special techniques of Lasers.

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9

Refraction, scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

UNIT II INSTRUMENTATION IN PHOTONICS 9

Instrumentation for absorption, scattering and emission measurements, excitation light sources –high pressure arc lamp, solid state LEDs, optical filters, polarisers, time resolved and phase resolved detectors.

UNIT III APPLICATIONS OF LASERS 9

Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

UNIT IV OPTICAL HOLOGRAPHY 9

Wave fronts, interference patterns, principle of hologram, optical hologram, applications.

UNIT V SPECIAL TECHNIQUES 9

Near field imaging of biological structures, in-vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Leon Goldman, M.D., & R.James Rockwell,	Lasers in Medicine	Gordon and Breach, Science	1975

2	Abraham Katzir	Lasers and Optical Fibers in Medicine	Academic Press Edition	1998

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Tuan Vo Dirh	Biomedical Photonics – Handbook	CRC Press, Bocaraton	2003
2	Glasser, O.,	Medical Physics -- Vol 1, 2, 3	Adam Hilgar Brustol Inc	1987
3	G.David Baxter	Therapeutic Lasers – Theory and practice	Churchill Livingstone Publications	2001

18BEBME7E03 PATIENT AND DEVICES SAFETY 3 0 0 3 100

The goal of this course is for students

- To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care
- To Understand hospital safety.
- To be familiar with electrical & fire safety.
- To infer the knowledge of regulatory requirement for health care.
- To be exposed to standardization of quality medical care in hospitals
- To explain the assessing quality health care

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

- Create coding for different convolution and correlation techniques.
- Develop preamplifiers and amplifiers for various bio signal recordings.
- Measure various non-electrical parameters using suitable sensors/transducers
- Perform biosignal Acquisition
- Analyse ECG signal
- Understand about SNR improvement

UNIT I STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS 9

Define Quality- Need for Standardization & Quality Management, TQM in Health care organization- Quality assurance methods, Q A in (Medical Imaging & Nuclear medicine) Diagnostic services – Classification of equipments

UNIT II REGULATORY REQUIREMENT FOR HEALTH CARE 9

FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

UNIT III HOSPITAL SAFETY 9

Security & Safety of Hospital -Property, Staff & Patients, Radiation safety, Safety precautions, hazardous effects of radiation, allowed levels of radiation, ICRP regulations for radiation safety, Disposal of Biological waste.

UNIT IV ELECTRICAL & FIRE SAFETY 9

Sources of shocks, macro & micro shocks -Hazards, monitoring and interrupting the Operation from leakage current- Elements of fire, causes of fire , Action to be taken in case of fire in a Hospital.

UNIT V ASSESSING QUALITY HEALTH CARE 9

Patient Safety Organization- Governmental & Independent, Measuring Quality care – Evaluation of hospital services – six sigma way, Quality Assurance in Hospitals Sop's – Patient Orientation for Total Patient Satisfaction. 5S techniques.

Total : 45

REFERENCES

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Cesar A. Cacere & Albert Zana	The Practice of Clinical Engg.	Academic press, New York	1977
2	Webster J.G and Albert M.Cook	Clinical Engg, Principles & Practices, Prentice Hall Inc.,	Engle wood Cliffs, New Jersy	1979
3	B.M.Sakharkar	Principles of Hospital administration and Planning	JAYPEE Brothers, Medical Publishers	-

18BEBME7E04 RADIOLOGICAL EQUIPMENTS 3 0 0 3 100

OBJECTIVES:

- To understand generation of x-rays and its uses in imaging.
- To learn different types of radio diagnostic techniques.
- To know techniques used for visualizing different sections of the body.
- To infer radiation therapy methodologies and the radiation safety.
- To be familiar with electrical & fire safety.
- Know different diagnostic and therapeautic equipments

INTENDED OUTCOMES:

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

- Make the students aware of the role of medical x-ray equipment.
- Explain the different radio diagnostic and therapeutic techniques.
- Analyse the computed tomography Principles and applications.
- Use the MRI methods in appropriate situations.
- Apply nuclear medicine system in different areas of medicine.
- Perceive the standardization of quality radiation therapy and radiation safety in hospitals.

UNIT I MEDICAL X-RAY EQUIPMENT 9

Nature of X-rays- X-Ray absorption – Tissue contrast, X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography, Digital subtraction Angiography, Mammography.

UNIT II COMPUTED TOMOGRAPHY 9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.

UNIT III MAGNETIC RESONANCE IMAGING 9

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR MEDICINE SYSTEM 9

Radio Isotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera- Principle of operation, collimator, photo multiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT V RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Steve Webb	The Physics of Medical Imaging	Adam Hilger, Philadelpia	1988
2	R.Hendee and Russell Ritenour	Medical Imaging Physics	Fourth Edition William, Wiley-Liss,	2002

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Gopal B. Saha	Physics and Radiobiology of Nuclear Medicine	Third edition Springer	2006
2	B.H.Brown, PV Lawford, R H Small	Medical physics and biomedical Engineering	CRC Press	1999
3	Myer Kutz,	Standard handbook of Biomedical Engineering and design	McGraw Hill	2003

FOR SEMESTER VIII (ELECTIVE-VI & VII)

18BEBME8E01 BIOLOGICAL SPECTROSCOPY 3 0 0 3 100

COURSE OBJECTIVE

- To develop the skills of students in the area of Biological spectroscopy.
- To learn various aspects of mass spectroscopy
- To Understand NMR Spectroscopy
- To Know various diffraction methods
- To Learn about Polarized light
- To understand optical rotation

COURSE OUTCOMES:

At the end of the course, the student would have learnt about

- various aspects of mass spectroscopy
- Understand about magnetic resonance imaging.
- Application of mass spectrometry
- X-ray diffraction.
- Familiarise optical rotation
- various kinds spectroscopic techniques to study biological system.

UNIT I OPTICAL ROTATORY DISPERSION 5

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional NMR spectroscopy – determination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT III MASS SPECTROMETRY 10

Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass sepctrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION 10

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – bragg reflection – unit cell – phase problem – anomalous diffraction – detemination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS 10

Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

Total : 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Campbell I.D and Dwek R.A	Biological Spectroscopy	Benjamin Cummins and	1986
2	Atkins P.W	Physical Chemistry	Oxford IV Edition	1990

18BEBME8E02 ROBOTICS IN MEDICINE 3 0 0 3 100

COURSE OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.
- Use Robots in different applications

COURSE OUTCOMES:

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

- Explain various kinds robotics techniques, vision, planning and applications.
- Outline the basic concept of robotics
- Identify and discuss the Robot Vision
- Describe about manipulators and kinematics.
- Demonstrate Task level programming
- Discuss the applications of robotic systems in medical field.

UNIT I BASIC CONCEPTS (9)

Definition and origin of robotics–different types of robotics–various generations of robots– degrees of freedom–Asimov's laws of robotics–dynamic stabilization of robots.

UNITII POWER SOURCESAND SENSORS (9)

Hydraulic, pneumatic and electric drives–determination of HP of motor and gear ingratio–variable speed arrangements–path determination – micro machines in robotics– machine vision – ranging– laser–acoustic –magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS (9)

Construction of manipulators– manipulator dynamics and force control –electronic and pneumatic manipulator control circuits–end effectors–U various types of grippers –design considerations.

UNIT IV KINEMATICSAND PATH PLANNING (9)

Solution of inverse kinematics problem–multiple solution jacobian work envelop–hill Climbing Techniques– robot programming languages

UNIT V CASE STUDIES (9)

Multiple robots–machine interface–robots in manufacturing and non-manufacturing applications– robot cell design–selection of robot.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Mikell P.Weiss G.M.,Nagel R.N., Odraj N.G,	Industrial Robotics	McGraw-Hill Singapore	1996
2	Ghosh	Control in Robotics and Automation: Sensor Based Integration	Allied Publishers, Chennai	1998

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Deb.S.R	Robotics Technology and flexible Automation	John Wiley, USA	1992
2	Klafter R.D., Chimielewski T.A., Negin M	Robotic Engineering– An integrated approach	Prentice Hall of India, New Delhi	1994
3	McKerrow P.J	Introduction to Robotics	Addison Wesley, USA,	1991
4	Issac Asimov	Robot	Ballantine Books, NewYork	1986
5	Barry Leatham- Jones	Elements of industrial Robotics	PITMAN Publishing	1987
6	Mikell P.Groover, Mitchell Weiss, Roger N. Nagel Nicholas G. Odrey	Industrial Robotics Technology, Programming and Applications	McGraw Hill Book Company	1986
7	Fu K.S. Gonzaleaz R.C. and Lee C.S.G	Robotics Control Sensing, Vision and Intelligence	McGraw Hill International Editions	1987

18BEBME8E03 NANOTECHNOLOGY IN MEDICINE 3003 100

COURSE OBJECTIVE:

- To study and gain the knowledge of Nanotechnology in the field of medicine.
- To study and gain the knowledge of Cellular Nano machines and the Building Blocks of Life
- Know the Importance of various nano materials in health and medicine.
- To gain the knowledge of Molecular therapy
- To study Stem cell therapy,
- .Application of nanotechnology in health monitoring systems

COURSE OUTCOMES:

After learning the course the students should be able to understand:

1. Applications of nanotechnology health care and medicine.
2. Cellular Nano machines and the Building Blocks of Life
3. Importance of nanomaterials in drug delivery.
4. Application of nanomaterials and nanosystems in Medical Diagnostics and Therapeutics.
5. Know Application of nanotechnology in health monitoring systems.
6. Familiarise Cellular Nano machines

UNIT I INTRODUCTION (9)

Cellular Nano machines and the Building Blocks of Life, A New Generation of Nano tools, Importance of various nano materials in health and medicine.

UNIT II NANOPARTICLES FOR DIAGNOSTICS (9)

Nanoparticles in Medical Diagnostics and Therapeutics, Targeted drug delivery, Magnetic Nanoparticles as Contrast Agents for Medical Diagnosis, Liposome based delivery, Bio Inspired Nanomaterials for a New Generation of Medicine.

UNIT III THERAPEUTIC NANO DEVICES (9)

Definition and scope, Synthetic Approaches: top-down versus bottom-up Approaches for Nanotherapeutic Device Components, Applications for Nano therapeutic Devices.

UNIT IV NANOSYSTEMS FOR HEALTHCARE MONITORING – I (9)

Single-Molecule Detection Techniques for Monitoring Cellular Activity at the Nano scale Level, Nano probes, Integrated Cantilever-Based Biosensors for the Detection of Chemical and Biological Entities.

UNIT V NANOSYSTEMS FOR HEALTHCARE MONITORING – II (9)

Nano pore Methods for DNA Detection and Sequencing, Nano tube Based Membrane Systems, micro/nano fluidic systems for bio-object sorting, single chip electrophoresis system.

Total : 45

TEXT BOOK:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Tuan Vo-Dinh	Nanotechnology in Biology and Medicine: Methods, Devices and Applications	CRC press	2006

REFERENCE BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Chala Kumar	Bio functionalization of nanomaterials	Wiley	2005
2	Charles Pooles, Frank J. Ownes	Introduction to Nanotechnology	Wiley	2003
3	Bharat Bhushan	Handbook of Nanotechnology	Springer	2003

18BEBME8E04 TISSUE ENGINEERING 3 0 0 3 100

COURSE COBJECTIVES:

To enable the students

- To learn the fundamentals of tissue engineering and tissue repairing
- To acquire knowledge on clinical applications of tissue engineering
- To understand the basic concept behind tissue engineering focusing on the stem cells, biomaterials and its applications
- Overall exposure to the role of tissue engineering and stem cell therapy in organogenesis
- Ability to understand the components of the tissue architecture
- To learn the fundamentals of tissue engineering and tissue repairing

COURSE OUTCOMES:

Upon completion of this course, the students would get

- Ability to understand the components of the tissue architecture
- Opportunity to get familiarized with the stem cell characteristics and their relevance in medicine
- Awareness about the properties and broad applications of biomaterials
- Overall exposure to the role of tissue engineering and stem cell therapy in organogenesis
- To learn the fundamentals of tissue engineering and tissue repairing
- To acquire knowledge on clinical applications of tissue engineering

UNIT I INTRODUCTION (9)

Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics, cells as therapeutic agents, cell numbers and growth rates, measurement of cell characteristics morphology, number viability, motility and functions. Measurement of tissue characteristics, appearance, cellular component, ECM component, mechanical measurements and physical properties.

UNIT II TISSUE ARCHITECTURE (9)

Tissue types and Tissue components, Tissue repair, Engineering wound healing and sequence of events. Basic wound healing Applications of growth factors: VEGF/angiogenesis, Basicproperties, Cell-Matrix & Cell-Cell Interactions, telomeres and Selfrenewal, Control of cell migration in tissue engineering.

UNIT III BIOMATERIALS (9)

Biomaterials: Properties of biomaterials, Surface, bulk, mechanical and biological properties. Scaffolds & tissue engineering, Types of biomaterials, biological and synthetic materials, Biopolymers, Applications of biomaterials, Modifications of Biomaterials, Role of Nanotechnology.

UNIT IV BASIC BIOLOGY OF STEM CELLS (9)

Stem Cells: Introduction, hematopoietic differentiation pathway Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers, FACS

analysis, Differentiation, Stem cell systems- Liver, neuronal stem cells, Types & sources of stem cell with characteristics: embryonic, adult, haematopoetic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells induced pleuripotent stem cells.

UNIT V CLINICAL APPLICATIONS (9)

Stem cell therapy, Molecular therapy, In vitro organogenesis, Neurodegenrative diseases, spinal cord injury, heart disease, diabetes, burns and skin ulcers, muscular dystrophy, orthopedic applications, Stem cells and Gene therapy Physiological models, tissue engineered therapies, product characterization, components, safety, efficacy. Preservation –freezing and drying. Patent protection and regulation of tissue engineered products, sethical issues.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Bernhard O.Palsson, Sangeeta N.Bhatia	Tissue Engineering	Pearson Publishers	2009
2	Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P.	Fundamentals of Tissue Engineering and Regenerative Medicine	-	2009

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Bernard N. Kennedy (editor)	Stem cell transplantation, tissue engineering, and cancer applications	New York: Nova Science Publishers	2008
2	Raphael Gorodetsky, Richard Schäfer	Stem cell based tissue repair	Cambridge: RSC publishing	2011
3	R. Lanza, I. Weissman, J. Thomson, and R. Pedersen	Volume 1-Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells	Academic Press	2004
4	R. Lanza, J. Gearhart etal (Eds)	Essential of Stem Cell Biology	Elsevier Academic press	2006
5	J. J. Mao, G. Vunjak-Novakovic et al (Eds)	Translational Approaches In Tissue Engineering & Regenrative Medicine	Artech House, INC Publications	2008
6	Naggy N. Habib, M.Y. Levicar, , L. G. Jiao,.and N. Fisk	Stem Cell Repair and Regeneration	Imperial College Press	2007

18BEBME8E05 SPEECH PROCESSING 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce speech production and related parameters of speech.
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.
- To introduce the models of speech production and acoustic phonetics
- . To teach time and frequency domain techniques for estimating speech parameters
- To teach predictive techniques for speech coding

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different speech synthesis techniques.
- .Analyze application of speech processing in speech compression, speech recognition, and speech synthesis

UNIT I BASIC CONCEPTS 9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II SPEECH ANALYSIS 9

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING 9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Lawrence Rabiner and Biing-Hwang Juang	Fundamentals of Speech Recognition	Pearson Education	2003
2	Daniel Jurafsky and James H Martin	Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition	Pearson Education	2002
3	Frederick Jelinek	Statistical Methods of Speech Recognition	MIT Press	1997

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Steven W. Smith	The Scientist and Engineer"s Guide to Digital Signal Processing	California Technical Publishing	1997
2	Thomas F Quatier	Discrete-Time Speech Signal Processing – Principles and Practice	Pearson Education	2004
3	Claudio Becchetti and Lucio Prina Ricotti	Speech Recognition	John Wiley and Sons	1999
4	Ben Gold and Nelson Morgan	Speech and audio signal processing, Processing and Perception of Speech and Music	Wiley- India Edition	2006

18BEBME8E06 RAPID PROTOTYPING 3 0 0 3 100

OBJECTIVE:

- Generating a good understanding of RP history, its development and applications.
- To expose the students to different types of Rapid prototyping processes,
- Materials used in RP systems and reverse engineering.
- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields
- Understand Selective Laser Sintering
- Know Direct shell production casting

OUTCOME:

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields
- Generating a good understanding of RP history, its development and applications.
- To expose the students to different types of Rapid prototyping processes,
- Materials used in RP systems and reverse engineering.
- Familiarise Laser Engineered Net Shaping (LENS).
- Know medical data processing

UNIT I INTRODUCTION 9

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 9

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS 9

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS 9

Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING and NEW TECHNOLOGIES 9

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications – Case study.

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Rafiq I. Noorani	Rapid Prototyping – Principles and	Wiley & Sons	2006
2	Chua C.K, Leong K.F and Lim C.S	Rapid Prototyping: Principles and Applications	second edition, World Scientific	2003

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	N.HOPKINSON, R.J.M, HAUGE, P M, DICKENS	Rapid Manufacturing – An Industrial revolution for the digital age	Wiley	2006
2	IAN GIBSON	Advanced Manufacturing Technology for Medical	Wiley	2006
3	Paul F.Jacobs	Rapid Prototyping and Manufacturing, "Fundamentals of Stereo lithography	McGraw Hill	1993
4	D.T.Pham and S.S. Dimov	Rapid Manufacturing	Springer Verlog	2001

18BEBME8E07 BIO MEMS 3 0 0 3 100

COURSE OBJECTIVES:

The student should be made to:

- Learn various MEMS fabrication techniques.
- Understand different types of sensors and actuators and their principles of operation at the micro scale level.
- Know the application of MEMS in different field of medicine.
- Discuss various MEMS fabrication techniques.
- Explain different types of sensors and actuators and their principles of operation at the micro Scale level.
- Apply MEMS in different field of medicine.

COURSE OUTCOMES:

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

- Discuss various MEMS fabrication techniques.
- Explain different types of sensors and actuators and their principles of operation at the micro Scale level.
- Apply MEMS in different field of medicine.
- Learn various MEMS fabrication techniques.
- Understand different types of sensors and actuators and their principles of operation at the micro scale level.
- Know the application of MEMS in different field of medicine.

UNIT I MEMS MATERIALS AND FABRICATION 9

Typical MEMs and Microsystems, materials for MEMS - active substrate materials-Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachining photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT II MECHANICAL AND THERMAL SENSORS AND ACTUATORS 9

Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – microplates, strain, pressure and flow measurements, Thermal sensors and actuators-actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys-Inertia sensor, flow sensor

UNIT III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS 9

Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV MICROFLUIDIC SYSTEMS 9

Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in microconduits, in submicrometer and nanoscale. Microscale

fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers

UNIT V APPLICATIONS OF BIOMEMS 9

CAD for MEMs, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR),DNA sensor, MEMS based drug delivery

Total : 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Tai Ran Hsu	MEMS and Microsystems Design and Manufacture	Tata McGraw Hill Publishing Company, New Delhi	2002
2	Wanjun Wang, Stephen A.Soper	BioMEMs: Technologies and Applications	CRC Press, New York	2007

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Marc J. Madou	Fundamentals of Microfabrication: the Science of Miniaturization	CRC Press	2002
2	Nadim Maluf, Kirt Williams	An introduction to Microelectro Mechancial Systems Engineering	Second Edition, Artech House Inc, MA,	2004
3	Chang Liu,	Foundations of MEMS	Pearson Education International, New Jersey, USA	2006
4	Nitaigour Premchand Mahalik	MEMS	Tata McGraw Hill Publishing Company, New Delhi	2007

18BEBME8E08 INTELLECTUAL PROPERTY RIGHTS 3003 100

OBJECTIVES:

The student should be made to:

- Learn how to value intangible assets, taking into account their commercial potential and legal status.
- Explore the legal & business issues surrounding marketing of new products related to technology.
- Review an intellectual property portfolio and comprehend the extent of their protection.
- Develop a business plan that advances the value of their intellectual property portfolio
- Develop a strategy of marketing their intellectual property and understand some negotiation basics.
- Explain some of the limits of their intellectual property rights and comprehend some basic legal pitfalls.

OUTCOMES:

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

- Review an intellectual property portfolio and comprehend the extent of their protection.
- Develop a business plan that advances the value of their intellectual property portfolio
- Learn how to value intangible assets, taking into account their commercial potential and legal status.
- Explore the legal & business issues surrounding marketing of new products related to technology.
- Develop a strategy of marketing their intellectual property and understand some negotiation basics.
- Explain some of the limits of their intellectual property rights and comprehend some basic legal pitfalls.

UNIT I INTRODUCTION 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i) Movable Property (ii) Immovable Property and (iii) Intellectual Property.

UNIT II PATENTS, COPYRIGHTS AND TRADEMARKS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III INTERNATIONAL STANDARDISATION 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV INDIAN STRATEGIES 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair

competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

Total : 45

TEXT BOOK:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Subbaram N.R	Handbook of Indian Patent Law and Practice	S. Viswanathan, Printers and Publishers Pvt. Ltd	1998

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Eli Whitney	United States Patent Number: 72X	Cotton Gin	March 14, 1794
2	Derwent IP Matters	Using the Internet for non-patent prior art searches	-	July 2000.

18BEBME8E09 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 3 0 0 3 100

COURSE OBJECTIVE

- To impart Adequate knowledge on there presentation and structures of artificial intelligence and to study in depth about the expert systems and its tools.
- To present an overview of artificial intelligence (AI) principles and approaches.
- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.
- Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.
- To impart Knowledge Representation: Predicate Logic: Unification, modus pones, resolution, and dependency directed backtracking.
- To develop understanding of Rule based Systems: Forward reasoning: Conflict resolution, backward reasoning: use of no backtrack.

LEARNING OUTCOMES:

Upon successful completion of this course student will:

- be able to design a knowledge based system,be familiar with terminology used in this topical area
- have read and analyzed important historical and current trends addressing artificial intelligence.
- To Handling uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning, and use of certainty factors.
- Learning Concept automation, genetic algorithm,
- Know Knowledge discovery in database.
- Familiarise learning by inductions, neural nets.

UNIT I AI & INTERNAL REPRESENTATION 9

The AI problem– What is AI technology– Level of the Model–Criteria for Success problems, Problem Spaces & Searches & Heuristic Search Technology Problem as a State Space Search–Production Systems– Production System Characteristics– Generate & Test– Hill Climbing –Best First Search– Constraint Satisfaction– Means End Analysis.

UNIT2 KNOWLEDGE REPRESENTATION 9

Issues in Knowledge Representation – Using Predicate Logic– Representing Simple Facts in Logic, Representing Instance & Isa Relationship–Computable Functions & I Predicates–Representing Knowledge Using Rules: Procedural Vs. Declarative Knowledge– Forward Vs. Backward Reasoning.

UNIT3 SLOT & FILLER STRUCTURES 9

Weak Slot &Filler– Semantic Nets– Frames Strong & filler Structures– Scripts– CYC-CYCL

UNIT4 EXPERT SYSTEMS 9

What are Expert Systems– Knowledge Representation in Expert Systems– Symbolic Computation–Rule based Systems

UNIT5 TOOLS FOR BUILDING EXPERT SYSTEMS 9

Using Domain Knowledge– Knowledge Acquisition– Design for Explanation–Black Board Architecture– Truth Maintenance Systems–Machine Learning– Case based Reasoning

Total : 45

TEXT/REFERENCEBOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Elaine Rich, Kevin Knight	Artifical Intelligence	2nd Edition, Tata McGraw Hill	1992
2	Peter Jackson,	Introduction to Expert Systems	3rd Edition,Addison Wesley,1st Indian Reprint	2000

18BEBME8E10 NEURAL NETWORKS AND APPLICATIONS 3003 100

COURSE OBJECTIVES:

The student should be made to:

- Understand biological and statistical foundations of neural networks,
- Learn Perceptron, MLPs , SVMs, RBFN and competitive learning
- Introduce major deep learning algorithms, the problem settings,
- Neural networks applications to solve real world problems.
- Design ANN for some basic logical operations.
- Understand the concept of learning in AI and ANN based systems.

COURSE OUTCOMES:

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

- Explain the mathematical foundations of neural network models.
- Design and implement neural network systems to solve real-world problems.
- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Get the idea about how ANN can be applied in various fields of technology including bioinformatics, communication etc.
- Understand how artificial neural network arise from biological neuron.

UNIT I NEURON MODEL NETWORK ARCHITECTURE 9

Neuron model – single input neuron –activation function – multiple input neuron neural networks viewed as directed graphs -feedback - network architectures – knowledge representation – linear and non- linear separable problem(XOR)

UNIT II LEARNING PROCESS 9

Error – correction learning – memory based learning - Hebbian learning-competitive learning-Boltzmann learning-credit assignment problem-supervised and unsupervised learning-adaptation statistical learning theory.

UNIT III PERCEPTRONS 9

Single layer perceptron-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Learning curve-Annealing Technique-perception convergence theorem- Relationship between perceptron and Baye's classifier-Back propagation algorithm- Network pruning techniques-supervised learning viewed as an optimization problem convolutional network. Application to Adaptive Prediction and character recognition.

UNIT IV ATTRACTOR NEURAL NETWORK AND ART 9

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-Leaning lawL1-L2- Leaning law L2-L1-ART algorithm-ARTMAP

UNIT V PRINCIPAL COMPONENT ANALYSIS AND SELF ORGANIZATION 9

Principle of self organization-Principle Component analysis-Adaptive PCA using Lateral inhibition-Two classes of PCA algorithm-Two basic feature- mapping model-self organizing map-SOM Algorithm properties of the feature map-LVQ-Hierarchical vector Quantization. Applications of self-organizing maps: The Neural Phonetic Typewriter- Learning Ballistic Arm Movements

TOTAL: 45

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Freeman J.A., Skapura D.M	Neural Networks, Algorithms, Applications, and Programming Techniques	Addition Wesley	2005
2	Laurene Fausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/ Prentice Hall	-

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Simon Haykin	Neural Networks and Learning Machines	3rd Edition-Pearson/ Prentice Hall	2009
2	Robert J Schalkoff	Artificial Neural Networks	McGraw Hill	1997

LIST OF OPEN ELECTIVES OFFERED BY
SCIENCE AND HUMANITIES DEPARTMENT

18BESHOE01 PROBABILITY AND RANDOM PROCESS 3 0 0 3 100

COURSE OBJECTIVES:

- To gain knowledge inmeasures of central tendency.
- To provide necessary basic concepts in probability and random processes.
- 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.

COURSE OUTCOMES:

- Learners acquire skills in handling situations involving more than one random variable and functions of random variables.
- The students will have an exposure of various distribution functions, correlation and spectral densities.
- To understand the significance of linear systems with random inputs.
- Apply the concept random processes in engineering disciplines.
- Understand and 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.

UNIT I MEASURES OF CENTRAL TENDENCY AND PROBABILITY (9)

Measures of central tendency – Mean, Median, Mode - Standard DeviationProbability – Random variable - Axioms of probability - Conditional probability – Total probability – Baye's theorem.

UNIT II STANDARD DISTRIBUTIONS (9)

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – *Chebyshev's inequality*.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES (9)

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNIT IV CLASSIFICATION OF RANDOM PROCESS (9)

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

UNIT V CORRELATION AND SPECTRAL DENSITIES (9)

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Total: 45

TEXTBOOK:

S.NO.		Author(s) Name	Title of the book	Publisher	Year of publicatio
1		Peebles Jr, P. Z	Probability Random Variables and Random Signal	Tata McGraw-Hill Pubishers, New Delhi.	2002

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Ross, S	A first Course in Probability	Pearson Education, New Delhi (Chap 2 to 8)	2012
2	Gupta, S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics	Chand and Sons, New Delhi.	2014
3	Veerarajan,T.	Probabilitiy, Statistics and Random process	Tata McGraw-Hill Education pvt. Ltd., New Delhi	2008
4	Henry Stark and John W. Woods	Probability and Random Processes with Applications to Signal Processing	Pearson Education, Third edition, Delhi	2002

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld.Wolfram.com

18BESHOE02 FUZZY MATHEMATICS 3 0 0 3 100

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 understand the concepts of Probability Measures vs Possibility Measures

COURSE OUTCOME:

- To gain the main subject of fuzzy sets.
- To understand the concept of fuzziness involved in various systems and fuzzy set theory.
- To gain the methods of fuzzy logic.
- To comprehend the concepts of fuzzy relations.
- To 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 (9)

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 (9)

Operations on Fuzzy Sets Operations on [0, 1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS (9)

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 (9)

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V FUZZY INFERENCE (9)

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Total: 45

TEXTBOOK:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	George J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic: Theory and Applications	Prentice Hall of India, New Delhi.	2003

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Zimmermann H.J.	Fuzzy Set Theory and its Applications	Kluwer Academic publishers, USA.	2001
2	Michal Baczynski and BalasubramaniamJayaram	Fuzzy Implications	Springer-Verlag publishers, Heidelberg	2008
3	Kevin M Passino and Stephen Yurkovich	Fuzzy Control	Addison Wesley Longman publishers, USA	1998

WEBSITES:

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm

18BESHOE03 LINEAR ALGEBRA 3 0 0 3 100

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 understand the importance of Linear Algebra and its applications in branches of Mathematics

COURSE OUTCOMES:

The student will be able to

- To explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- To describe the fundamental concepts of Eigen values and Eigen vectors by using Power method.
- To apply the fundamental concepts in their respective engineering fields
- To visualize linear transformations as matrix form
- To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
- To articulate the importance of Linear Algebra and its applications in branches of Mathematics

UNIT I VECTOR SPACES (9)

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 (9)

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS (9)

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 (9)

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 (9)

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

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	ShahnazBathul	Text book of Engineering Mathematics (Special Functions and Complex Variables)	PHI Publications, New Delhi.	2009

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
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

WEBSITES:

1. www.sosmath.com
2. www.nptel.ac.in
3. www.mathworld.wolfram.com

18BESHOE04 ENGINEERING ACOUSTICS 3 0 0 3 100

COURSE OBJECTIVES:

- 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 introduce the applications of Engineering acoustics

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 9

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 of images.

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES 9

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation 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 9

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 9

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 **9**

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

Total: 45

TEXTBOOK:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	LawerenceE.Kinsler, Austin R.Frey,	Fundamentals of Acoustics	John Wiley & Sons	2000

REFERENCE:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	F. AltonEverest & Ken Pohlmann	Master Handbook of Acoustics	McGraw Hill Professional	2014

WEBSITES:

1. www.acousticalsociety.org
2. www.acoustics-engineering.com
3. www.nptel.ac.in
4. www. ocw.mit.edu

18BESHOE05 SOLID WASTE MANAGEMENT 3 0 0 3 100

Course Objectives:

- To make the students conversant with basics of Solid waste sand 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 understand the chemical principles in field of engineering and technology

Course Outcome:

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

UNIT I SOLID WASTE 9

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 9

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 9

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 9

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 9

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.

Total: 45

TEXTBOOK:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	Dara.S.S,Mishra.D.D	A Text book of Environmental Chemistry and Pollution Control	S.Chand and Company Ltd., New Delhi.	2011

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	Naomi B. Klinghoffer and Marco J. Castaldi	Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy)	Woodhead Publishing Ltd., Cambridge, UK	2013
2	Frank Kreith, George Tchobanoglous	Hand Book of Solid Waste Management- 2nd edition	McGraw Hill Publishing Ltd., Newyork	2002
3	Shah, L Kanti	Basics of Solid & Hazardous Waste Management Technology	Prentice Hall (P) Ltd., New Delhi.	1999

WEBSITES:

1. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
3. www.alternative-energy-news.info/technology/garbage-energy/
4. nzic.org.nz/Chem Processes/environment/

18BESHOE06 GREEN CHEMISTRY 30 03 100

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 understand the chemical principles in in field of engineering and technology

COURSE OUTCOMES:

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

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES 9

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 9

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 9

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 9

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 9

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.

Total: 45

TEXTBOOKS:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
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

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	Dr. SunitaRatan	A Textbook of Engineering Chemistry	S.K. Kataria and Sons., New Delhi.	2012
2	MukeshDoble. Ken Rollins, Anil Kumar	Green Chemistry and Engineering, 1st edition	Academic Press, Elesevier., New Delhi.	2007
3	Desai K. R.	Green Chemistry	Himalaya Publishing House, Mumbai.	2005
4	Matlack A. S.	Introduction to Green Chemistry	Marcel Dekker: New York	2001

WEBSITES:

1. http://www.organic-chemistry.org/topics/green-chemistry.shtm
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
4. http://www.epa.gov/research/greenchemistry/
5. http://www.amazon.in/Green-Chemistry-Catalysis

18BESHOE07 APPLIED ELECTROCHEMISTRY L T P C

30 03

COURSE 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 impart knowledge on basic principles of solar cells and its applications
- To understand about electrochemical material science

COURSE INTENDED OUTCOME:

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

UNIT I METAL FINISHING 9

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 9

Electropolymerization- 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 9

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 9

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries, Lithium ion 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 9

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.

Total: 45

TEXTBOOKS:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
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

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	M. Barak	Electrochemical Power Sources	I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.	1997
2	Bruno Scrosati	Applications of Electroactive Polymers	Chapman & Hall, London	1993
3	K.L. Chopra and I. Kaur	Thin Film Devices and their Application	Plenum Press, New York.	1983
4	M.M.Baizer	Organic Electrochemistry	Dekker Inc. New York	1983

WEBSITES:

1. http://www.anoplate.com/finishes/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
3. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

18BESHOE08 INDUSTRIAL CHEMISTRY L T P C

30 03

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 understand the chemical principles in in field of engineering and technology

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)
- Identify 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 9

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 9

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 9

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 9

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 9

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

Total: 45

TEXTBOOKS:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	Harikrishan	Industrial Chemistry	Goel Publishing House, Meerut.	2014
2	B.K. Sharma	Industrial Chemistry	Goel Publishing House, Meerut.	2000

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	B.N.Chakrabarty	Industrial Chemistry	Oxford and IBH Publishing CO. New Delhi.	1998
2	James A. Kent	Hand Book of Industrial Chemistry, 9th edition	Van Nostrand Reinhold, New	1992
3	R.N. Sherve	Chemical Process Industries	McGraw-Hill, Kugakuisha Ltd., Tokyo.	1984
4	S.D. Shukla and G.N. Pandy	A Text book of Chemical Technology	Vikas Publishing House (P) Ltd, New Delhi	1979

WEBSITES:

1. http://en.wikipedia.org/wiki/Cement
2. http://www.hon.ch/HONselect/Selection/D01.html
3. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
4. http://toxics.usgs.gov/topics/agchemicals.html

18BESHOE09 ENGLISH FOR TECHNOCRATS L T P C

1 4 0 3

PURPOSE:

It provides techniques of writing and also trains the students to write without their influence of mother tongue. In addition to honing their skills as professional writers, students will develop technical vocabularies that will aid writing research articles and discussing articles produces by their peers.

COURSE OBJECTIVE:

- Develop abilities to write technically and expressively.
- Recognize writing as a constructive, meaningful process.
- Practise using reading strategies for effective writing.
- To develop communication skills
- Understand grammar and usage of various phrases and idioms
- Construct simple sentences, correct common grammatical errors in written English

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.
- Read and review technical papers
- Write technical papers by their own
- face technical interviews with confidence

UNIT I BASICS OF WRITING 9

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 9

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 9

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.

UNIT IV THE ART OF CONDENSATION AND TECHNICAL PROPOSALS 9

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 9

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.

Total: 45

TEXTBOOK:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	V.N. Arora & Lakshmi	Improve Your Writing: Revised First Edition	OUP	2014

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1	Crème, P. and M. Lea.	Writing at University: A guide for students.	OUP	2003
2	Graham King	Collins Improve Your Writing	Collins; First edition	2009
3	David Morley	The Cambridge Intro. To Creative Writing	Cambridge	2008

WEBSITES:

1. http://www.stevepavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/
2. http://www.nyu.edu/classes/keefer/brain/net2.html
3. https://www.udemy.com/technical-writing-and-editing/
4. http://techwhirl.com/what-is-technical-writing/

LIST OF OPEN ELECTIVES OFFERED BY
COMPUTER SCIENCE ENGINEERING DEPARTMENT

		L	T	P	C
18BECSOE01	**INTERNET PROGRAMMING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE:

- 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 study the way that exceptions are detected and handled in the Java programming language
- To write working Java code that demonstrates multiple threads of execution
- To understand about various Internet applications

COURSE OUTCOME

- Know Java programming language and explore its current strengths and Weaknesses
- Learn about object-oriented concepts
- Learn Java code to demonstrate the use of applets for client side programming
- To study the way that exceptions are detected and handled in the Java programming language
- know Java code that demonstrates multiple threads of execution
- To understand about various Internet applications

UNIT I INTRODUCTION 9

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 Sub netting and addressing- Classful and Classless Addressing, Sub netting

UNIT II HTML 9

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. 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 9

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 9

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 9

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.

Total: 45

TEXTBOOKS:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Paul Deitel, Harvey Deitel and Abby Deitel	Internet and World Wide Web-How to Program 5thEdition	Dorling Kindersley pvt Ltd	2011
2.	N.P. Gopalan and J. Akilandeswari	Web Technology: A Developer's Perspective	PHI Learning	2013

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Rahul Banerjee	Internetworking Technologies, An Engineering Perspective	PHI Learning, Delhi	2011
2.	Robert W. Sebesta	Programming the World Wide Web	Pearson Education	2016

18BECSOE02 **MULTIMEDIA AND ANIMATION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To study the graphics techniques and algorithms
- To study the multimedia concepts and various I/O technologies.
- To enable the students to develop their creativity
- To impart the fundamental concepts of Computer Animation and Multimedia.
- To understand Techniques of Animation
- Learn about different 3D Animation

COURSE OUTCOMES:

After the course the student will be able to:

- Get Familiarised With Animation
- Types Of 3D Animation
- Know about motion caption
- Work With The Timeline And Tween-Based Animation
- Learn about 3D Animation
- Master the techniques of computer animation and multimedia

UNIT I INTRODUCTION **9**

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 **9**

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 **9**

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 **9**

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software.

UNIT V CONCEPT DEVELOPMENT **9**

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

Total: 45

TEXTBOOK:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Malay K. Pakhira	Computer Graphics, Multimedia and Animation	PHI Learning PVT Ltd	2010

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Ranjan Parekh	Principles of Multimedia	TMH	2007
2.	Ashok Banerji, Ananda Mohan Ghosh	Multimedia Technologies	McGraw Hill Publication	2010
3.	Pankaj Dhaka	Encyclopedia of Multimedia and Animations	Anmol Publications	2011

18BECSOE03 PC HARDWARE AND TROUBLE SHOOTING L T P C

3 0 0 3

COURSE OBJECTIVES:

- Assemble/setup and upgrade personal computer systems
- Perform installation, configuration, and upgrading of microcomputer hardware and software.
- Install/connect associated peripherals.
- Diagnose and troubleshoot microcomputer systems hardware and software, peripheral equipment.
- Know Multitasking and Multiprogramming
- Familiarise Various Types of faults

COURSE OUTCOMES

After the course student will be able to:

- Familiarise Special Peripherals.
- Know Computer Organization
- Know about Memory Space
- Familiarise Motherboard Logic
- Know Programmable LSI's
- Know about Data Recovery.

UNIT I INTRODUCTION 9

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 9

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 9

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 9

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 9

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.

Total: 45

TEXTBOOK:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	B. Govindarajalu	IBM PC Clones Hardware, Troubleshooting and Maintenance	TMH	2002

REFERENCES:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Peter Abel, NiyazNizamuddin	IMB PC Assembly Language and Programming	Pearson Education	2007
2.	Scott Mueller	Repairing PC's	PHI	1992

18BECSOE04 JAVA PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- 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.
- 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
- To understand Object oriented programming concepts

COURSE OUTCOMES:

After the course student will be able to:

- Familiar with programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java and work with 2D shapes
- Be familiar with Arrays – Strings - Packages
- Have the ability to write a computer program to solve specified problems.
- Work on Java SDK environment to create, debug and run simple Java programs
- To understand abstract classes

UNIT I INTRODUCTION TO JAVA 9

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 9

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNIT III I/O STREAMS 9

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 9

Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging

UNIT V THREADS 9

Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

Total: 45

TEXTBOOK:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Cay S. Horstmann and Gary Cornell	Core Java: Volume I - Fundamentals	Sun Microsystems Press	2008

REFERENCES:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	K. Arnold and J. Gosling	The JAVA programming language Third edition	Pearson Education	2009
2.	Timothy Budd	Understanding Object-oriented programming with Java Updated Edition	Pearson Education	2002
3.	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

LIST OF OPEN ELECTIVES OFFERED BY
ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

18BEEEOE01 ELECTRIC HYBRID VEHICLES L T P C 3 0 0 3

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 know the concept of electric hybrid vehicle
- Understand the various energy storage schemes
- Know about the various fuel efficiency schemes

COURSE OUTCOMES:

- At the end of the course the student will be understand the concept of electric hybrid vehicle and its energy storage schemes.
- Battery based energy storage and its analysis,
- Familiarise Fuel Cell based energy storage and its analysis
- Super Capacitor based energy storage and its analysis,
- Understand Flywheel based energy storage and its analysis,
- Know Hybridization of different energy storage devices.

UNIT I INTRODUCTION 9

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 9

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 9

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 Motr drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

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 9

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.

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Iqbal Hussein	Electric and Hybrid Vehicles: Design Fundamentals	CRC Press – 2nd edition	2010

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	Standardsmedia – 2nd edition	2009
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley – 2nd edition	2012

18BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING L T P C
3 0 0 3

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 know the concept of electric hybrid vehicle
- Understand the various energy storage schemes
- Know about the various fuel efficiency schemes

COURSE OUTCOMES:

At the end of the course the student will be

- understand the concept of electric hybrid vehicle and its energy storage schemes.
- Battery based energy storage and its analysis,
- Familiarise Fuel Cell based energy storage and its analysis
- Super Capacitor based energy storage and its analysis,
- Understand Flywheel based energy storage and its analysis,
- Know Hybridization of different energy storage devices.

UNIT I ENERGY MANAGEMENT 9

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 9

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 9

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 9

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 **9**

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.

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Murphy W.R. and G.Mckay Butter worth	Energy Management	Heinemann Publications	2007

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	John.C.Andreas	Energy Efficient Electric Motors	Marcel Dekker Inc Ltd – 3rd edition	2005
2	W.C.Turner Steve Doty	Energy Management Handbook	Lulu Enterprises, Inc. - 8th Edition Volume II	2013

18BEEEOE03 PROGRAMMABLE LOGIC CONTROLLER L T P C
3 0 0 3

Course Objectives

- To understand the basic principles of PLC systems.
- To gain the knowledge about data handling functions.
- To gain the knowledge of storage techniques in PLC
- To acquire the knowledge about how to handle the data and functions
- To study about flow charts of ladder and spray process system
- To understand the principles of PID.

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.
- To acquire the knowledge of storage techniques in PLC
- Students know how to handle the data and functions
- Students known about advanced controller in PLC applications
- Students gather real time industrial application of PLC
- Students gathered and evaluate the flow charts of ladder and spray process system

UNIT I INTRODUCTION 9

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 9

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 9

PLC Registers: Digital logic gates programming 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 9

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 9

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

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	JR Hackworth and F.D Hackworth – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	2004
2	W.Bolton	Programmable Logic controller	Elsevier Newnes Publications, 5th Edition	2009

WEBSITE:

1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,- Introduction to programmable Logic controller.

18BEEEOE04 RENEWABLE ENERGY RESOURCES L T P C

3 0 0 3

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 study about solar energy collectors and its storages
- To study about the inter connected system in wind power
- 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
- Students gathered the real time inter connected system modelling in wind power

UNIT I INTRODUCTION 9

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 9

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 9

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 9

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 9

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
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

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Rao.S. &Parulekar	Energy Technology	Khanna publishers, Eleventh Reprint	2013
2	Godfrey Boyl	Renewable Energy: Power sustainable future	Oxford University Press, Third edition	2012
3	John W Twidell and Anthony D Weir	Renewable Energy Resources	Taylor and Francis – 3rd edition	2015

WEBSITES:

1. www.energycentral.com
2. www.catelelectricpowerinfo.com

LIST OF OPEN ELECTIVES OFFERED BY ELECTRONICS AND COMMUNICATION ENGINEERING

18BEECOE01 REAL TIME EMBEDDED SYSTEMS L T P C 100
3 0 0 3

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 9

Introduction- Embedded systems description, definition, design considerations &requirements-Overview of Embedded SystemArchitecture (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 9

Introduction–AdvantageandDisadvantageofUsingRTOS–Multitasking–Tasks-RealTimeKernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- ReentrantFunctions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion–Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- TaskManagement– Memory Management-Time Management–Clock Ticks.

UNIT-III TASK MANAGEMENT 9

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–StackChecking–Task'sPriority–SuspendingTask–ResumingTask.TimeManagement: Delaying aTask–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 9

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. MessageMailbox 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 9

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 andRescheduling –Analyze the Multichannel ADC with help ofμ C/OS-II.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	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

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	K.V.K.K.Prasad	Embedded Real-Time Systems: Concepts, Design & Programming	Dream Tech Press	2005
2	Sriram V Iyer, Pankaj Gupta	Embedded Real Time Systems Programming	Tata McGraw Hill	2004

18BEECOE02 CONSUMER ELECTRONICS L T P C 100

3 0 0 3

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 9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNITII TELEVISION STANDARDS AND SYSTEMS 9

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.

UNITIII OPTICAL RECORDING AND REPRODUCTION 9

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.

UNITIV TELECOMMUNICATION SYSTEMS 9

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.

UNITV HOME APPLIANCES 9

Basic principle and block diagram of microwave oven; washing machine hardware and software; Components of air conditioning and refrigeration systems.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	S.P. Bali	Consumer Electronics	PearsonEducation	2007
2	J.S.Chitode	Consumer Electronics	Technical Publications	2007

REFERENCE:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Philip Hoff,Philip Herbert Hoff.	Consumer Electronics for Engineers.	Cambridge University Press	1998

18BEECOE03 NEURAL NETWORKS AND ITS APPLICATIONS L T P C 100

3 0 0 3

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

UNIT I INTRODUCTION TONEURAL NETWORKS 9

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 9

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION 9

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 9

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 9

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.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	SimonHaykin	Neural Networks and Learning Machines	Pearson/Prentice Hall 3rd Edition	2009
2	SatishKumar	Neural Networks: A Classroom Approach	TMH	2008

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Rajasekaran.S, VijayalakshmiPai. G.A	Neural Networks, Fuzzy Logic and Genetic Algorithms,	PHI, New Delhi.	2003
2	LaureneFausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/PrenticeHall	1994
3	Wasserman P.D	Neural Computing Theory & Practice	Van Nortrand Reinhold	1989
4	Freeman J.A., S kapura D.M	Neuralnetworks, algorithms, applications, and programming techniques.	AdditionWesley	2005

18BEECOE04 FUZZY LOGIC AND ITS APPLICATIONS L T P C 100

3 0 0 3

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

UNITI **9**

Basics of Fuzzy Logic: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II **9**

Theory of Approximate Reasoning: Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III **9**

Fuzzy Knowledge Based Controllers (Fkbc): 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 **9**

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 **9**

Fuzzy based systems: Simple applications of FKBC-washing machines-traffic regulations-lift control-fuzzy in medical Applications-Introduction to ANFIS.

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
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

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Timothy J. Ross	Fuzzy Logic with Engineering Applications	McGraw Hill	1997
2	George. J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic	Prentice Hall, USA	1995

LIST OF OPEN ELECTIVES OFFERED BY BIO TECHNOLOGY DEPARTMENT

18BTBTOE01 **BIOREACTOR DESIGN** **L T P C**
3003

COURSE OBJECTIVES:

- To understand the basic design of bioreactors
- To understand the principle of heat transfer inside a bioreactor
- Design of various reactors
- Study various mass transfer equipments
- Learn about cylindrical storage tnks and various applications
- Design of plate and frame filters

COURSE OUTCOMES:

After completion of this course students will be able to

- Design bioreactors for various operations.
- Select the appropriate separation equipment based on the nature of the product.
- Familiarise mass transfer equipments
- Work with cylindrical storage tanks and know various applications
- Design of plate and frame filters in reactors
- Know various separation equipments

UNIT I ENGINEERING PROPERTIES AND STORAGE TANK **9**

Introductiontovariousmechanicalpropertiesofmaterialtobeusedmaterialofconstruction, designofcylindricalstoragetank.

UNIT II REACTOR DESIGN **9**

DesignofAirliftfermentor,BubblecolumnreactorandContinuousstirredtankreactor.

UNIT III HEAT TRANSFER EQUIPMENTS **9**

DesignofShellandtubeHeatexchanger,Doublepipeheatexchanger,longtube verticalevaporatorandforcedcirculation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS **9**

DesignofBollmannextractor,fractionatingcolumn,packedtowerandspraytrayabsorber

UNIT V SEPARATIONEQUIPMENTS **9**

Designof plate andframefilter press,leaffilter,rotarydrumfilter,discbowlcentrifuge, rotary drumdrierandSwenson–walkercrystallizer.

Total:45

TEXTBOOKS:

S.NO.	Author(s)Name	Titleofthebook	Publisher	YearofPublicatio
1	James Edwin Bailey, DavidF.Ollis	Biochemical Engineering Fundamentals	McGraw-Hill	2007
2	DonW.Green,RobertH.Perry	Chemical Engineer Handbook	The McGraw-HillCompanies, Inc.	2008

REFERENCE:

S.NO	Author(s)Name	Titleofthebook	Publisher	Year of Publications
1	Pauline.M.Doran	BioprocessEngineering Principles	Academic Press	2013

18BTBTOE02 FOOD PROCESSING AND PRESERVATION L T P C

3003

OBJECTIVES:

- To understand the importance of food processing
- To make the students learn the various processing and preservation techniques.
- Understand various Pasteurization and Freezing techniques
- Learn about Infrared radiation processing-
- Concepts ande quipment used. In various food processing methods
- Learn about preservation of fruits and vegetables

INTENDED OUTCOMES:

The students are exposed to

- Properties off Food material.
- Various methods used for preserving Fruits and vegetables
- Learn about chemical preservation
- Know food preservation by cooling methods
- Learn about Food irradiation
- Understand fermentation techniques

UNIT I SCOPE AND IMPORTANCE OF FOOD PROCESSING 9

Properties of food- Physical, thermal, mechanical, sensory.Raw material Preparation - Cleaning,sorting,grading,peeling.

UNIT II PROCESSING METHODS 9

Heating- Blanching and Pasteurization.Freezing- Dehydration- canning- additives- fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- microwave processingandasepticprocessing–Infraredradiationprocessing- Conceptsandequipmentused.

UNIT III FOOD CONVERSION OPERATIONS 9

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation-filtration-equipmentandapplication.

UNITIV FOODPRESERVATION BY COOLING 9

Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Wateractivity, methods tocontrolwateractivity.

UNITV PRESERVATIONMETHODSFORFRUITSANDVEGETABLES 9

Preprocessing 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.

Total: 45

TEXTBOOKS:

S.NO	Author(s)Name	Titleofthebook	Publisher	Year of Publication
1	R.PaulSingh, DennisR.Heldman	Introduction to food engineering.	Academic Press	2001
2	P.Fellows.	FoodProcessing Technology, Principles and practice.	Woodhead Publishing Ltd	2000
3	MirceaEnachescuDauthy	Fruit and Vegetable Processing	FAOagricultural services bulletin no.119	1995

REFERENCES:

S.NO	Author(s)Name	Titleofthebook	Publisher	Yearof Publications
1	M.A. Rao, Syed S.H. Rizvi,AshimK.Datta	Engineering properties Offoods	CRCPress	2005
2	B.Sivasankar	Food processing and preservation	PHILearning Pvt. Ltd	2002

18BTBTOE03 BASIC BIOINFORMATICS L T P C 3 0 0 3

COURSE OBJECTIVES:

- To enable the students to get aware of available tools and data bases for performing research in bioinformatics.
- To provide the thorough understanding of protein structure in detail.
- bioinformatics at a level appropriate for biology majors having completed the lower-division core, and for chemistry, computer science, and math majors with an interest in biology.
- the chemical principles that underlie biochemistry, molecular biology and genomics,
- the design and implementation of relational databases
- the construction of predictive mathematical models of biological systems.

COURSE OUTCOMES:

At the end of the course,

- The students will understand the importance of Bioinformatics in various sectors.
- The students will be exposed to biological database management and microarray technology.
- Understand advanced methods in computational biology
- Be capable of using critical thinking and research methods in Bioinformatics to understand computational and experimental data
- Demonstrate the ability to produce and present original research in Bioinformatics.
- preparation for and presentations at scientific meetings, and graduate seminars, student seminars, and qualifying examinations.

UNIT I OVERVIEW OF BIOINFORMATICS 9

Thescopeofbioinformatics; bioinformatics&theinternet;usefulbioinformatics sites.Data acquisition:sequencingDNA,RNA&proteins;determination ofproteinstructure;gene&protein expression data;proteininteractiondata. Databases–contents,structure&annotation:fileformats; annotatedsequencedatabases;miscellaneousdatabases.

UNITII RETRIEVALOFBIOLOGICALDATA 9

DataretrievalwithEntrez&DBGET/LinkDB;dataretrievalwithSRS(sequence retrieval system).Searching sequencedatabasesbysequencesimilaritycriteria:sequencesimilarity searches;aminoacidsubstitution matrices;databasesearches,FASTA&BLAST;sequence filters;iterativedatabasesearches&PSI-BLAST.Multiple-sequence alignment,gene&protein families:multiple-sequence alignment&family relationships;proteinfamilies&pattern databases;proteindomainfamilies.

UNITIII PHYLOGENETICS 9

Phylogenetics, cladistics &ontology; building phylogenetic trees; evolution of macromolecularsequences.Sequenceannotation:principlesofgenomeannotation;annotationtools &resources.

UNITIV STRUCTURALBIOINFORMATICS 9

Conceptualmodelsofproteinstructure;therelationshipofproteinthree-dimensional structureto proteinfunction;theevolutionofproteinstructure&function;obtaining, viewing&analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure:CATH&SCOP;introduction toproteinstructureprediction;structurepredictionby comparativemodeling;secondary structureprediction;advancedproteinstructureprediction& predictionstrategies.

UNITV MICROARRAYDATAANALYSIS 9

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics &drug discovery; pharmainformaticsresources.Basicprinciplesof computinginbioinformatics:running computer software; computer operating systems;softwaredownloading &installation;database management.

Total: 45

TEXTBOOKS:

S.NO.	Author (s) Name	Titleof thebook	Publisher	Year of Publication
1	Dan E. Krane, Michael Rayme	Fundamental Concepts ofBioinformatics	Pearsoneducation	2004
2	Andreas D. Baxevanis, F. Francis Ouellette	Bioinformatics: A PracticalGuidetotheAnalysisof Genes andProteins	Wiley-Interscience	2004
3	David W. Mount	SequenceandGenomeAnalysis	ColdSpringHarbor Laboratory	2004
4	Jonathan Pevsner	Bioinformatics and FunctionalGenomics	Wiley-Liss	2003

REFERENCEBOOK:

S.NO.	Author (s) Nam	Titleof thebook	Publisher	Year of Publication
1	Michael J. Korenberg	Microarray Data Analysis: MethodsandApplications	Springer Science & BusinessMedia	2007

18BTBTOE04 FUNDAMENTALS OF NANOBIOTECHNOLOGY L T P C 3003

COURSE OBJECTIVES:

- To develop skills of the students in the field of nano biotechnology and its applications in various fields.
- The course will serve as an effective course to understand Socio-economic issues of Nanobiotechnology.
- Scope of nanaoparticles in biomedical field
- Ethical issues working with nanoparticles
- Learn about nanosurgical devices
- BenefitsandchallengesinMolecularmanufacturing:

COURSE OUTCOMES:

At the end of the course,

- The students will be able to identify the potential areas where nanoparticles can be utilized.
- The students will be exposed to the ethical issues regarding the use of nanoparticles.
- Learn Techniques to Synthesize Nanoparticles
- Learn about nanosurgical devices
- Familiarise MEMS/NEMS
- Know about various lithographic techniques

UNITI INTRODUCTION (9)

Introduction, ScopeandOverview,Lengthscales,Importance ofNanoscaleandTechnology, HistoryofNanotechnology, FutureofNanotechnology:NanoTechnologyRevolution,Silicon basedTechnology,BenefitsandchallengesinMolecularmanufacturing: TheMolecular assemblerconcept,Controversiesandconfusions,Understanding advancedcapabilities, NanotechnologyinDifferent,Fields:Nanobiotechnology,Materials,Medicine,Dentalcare.

UNITII NANOPARTICLES (9)

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, CharacterizationofNanoparticles, Applications,ToxiceffectsofNanomaterials, Significance ofNanoparticlesNanofabrications-MEMS/NEMS,Atomic ForceMicroscopy,Selfassembled monolayers/Dip-penNanolithography, SoftLithography, PDMSMolding,NanoParticles, Nanowires andNanotubes.

UNITIII APPLICATIONS (9)

Nanomedicine,NanobiocensorandNanofludics.Nanocrystals inbiological detection, ElectrochemicalDNAsensors and IntegratedNanolitersystems.Nano-Biodevicesand Systems.Fabricationof Novel Biomaterialsthrough molecularself assembly- Small scale systemsforinvivodrugdelivery- Futurenanomachine.

UNITIV NANOBIOTECHNOLOGY (9)

Clinicalapplicationsofnanodevices.Artificialneurons.Real-timenanosensors-Applicationsin cancerbiology.Nanomedicine.Syntheticretinyl chipsbasedonbacteriorhodopsins.High throughputDNAsequencingwithnanocarbontubules.Nanosurgicaldevices.

UNITV ETHICALISSUESINNANOTECHNOLOGY (9)

Introduction,Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, NanomedicineAppliedinNonmedicalContexts,SocialIssues RelatingtoNanomedicine. SocialandEthicalIssues,EconomicImpacts,OtherIssues, Nanotechnologyand FutureSocio-economicchallenges.

Total: 45

TEXTBOOKS:

S.NO.	Author (s) Name	Titleof thebook	Publisher	Year of Publication
1	Niemeyer,C.M. andMirkin,C.A	Nanobiotechnology:Con cepts, Applicationsand	Wiley-VCH	2004
2	Goodsell,D.S.	Bionanotechnology	JohnWiley andSons, Inc	2004

REFERENCES:

S.No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shoseyov,O. and Levy,I	Nanobiotechnology: BioinspiredDevicesand Materialsof theFuture	Humana Press	2007
2	Bhushan,B.	SpringerHandbookof Nanotechnology	Springer-VerlagBerlin Heidelberg	2004
3	FreitasJrR.A	Nanomedicine	Landes Biosciences	2004
4	Kohler,M.and Fritzsche,W.	Nanotechnology–An IntroductiontoNanostructuring Techniques	Wiley-VCH	2004

LIST OF OPEN ELECTIVES OFFERED BY MECHANICAL ENGINEERING DEPARTMENT

18BEMEOE01 COMPUTER AIDED DESIGN L T P C
3 0 0 3

Course Objective

- To apply basic concepts to develop construction (drawing) techniques.
- To ability to manipulate drawings through editing and plotting techniques.
- To understand geometric construction and Produce template drawings.
- To understand and demonstrate dimensioning concepts and techniques.
- To understand Section and Auxiliary Views.
- To become familiar with Solid Modelling concepts and techniques.

Course Outcome

- Apply basic concepts to develop construction (drawing) techniques.
- Ability to manipulate drawings through editing and plotting techniques.
- Understand geometric construction and Produce template drawings.
- Understand and demonstrate dimensioning concepts and techniques
- Understand Section and Auxiliary Views
- Become familiar with Solid Modelling concepts and techniques.

UNIT I OVERVIEW OF CAD SYSTEMS 9

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 9

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 transpformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING 9

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 9

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 9

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Vera B Anand	Computer Graphics and Geometric Modeling for Engineers	John Wiley & Sons, New York	2000
2	Radhakrishnan P and Subramanyan S	CAD/CAM/CIM	New Age International Pvt. Ltd	2004

REFERENCES:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Radhakrishnan P and Kothandaraman C P	Computer Graphics and Design	DhanpatRai& Sons, New Delhi	2002
2	Ibrahim Zeid	CAD/CAM Theory and Practice	McGraw Hill Inc., New York	2003
3	Barry Hawhes	The CAD/CAM Process	Pitman Publishing, London	1998
4	William M Newman and Robert Sproul	Principles of Interactive Computer Graphics	McGraw Hill Inc., New York	1994
5	Sadhu Singh	Computer-Aided Design and Manufacturing	Khanna Publishers, New Delhi	1998
6	Rao S S	Optimisaiton Techniques	Wiley Eastern, New Delhi	2003

18BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT L T P C
3 0 0 3

Course Objective

- To recognize and evaluate occupational safety and health hazards in the workplace.
- To determine appropriate hazard controls following the hierarchy of controls.
- To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- To prevent or mitigate harm or damage to people, property, or the environment.

Course Outcome

- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- Prevent or mitigate harm or damage to people, property, or the environment

UNIT I INTRODUCTION TO LOGISTICS 9

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II PHASES OF SUPPLY CHAIN 9

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS 9

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

UNIT IV SUPPLY CHAIN ACTIVITIES 9

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V SCM ORGANISATION AND INFORMATION SYSTEM 9

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERP Software's

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shari.P.B and Lassen.T.S	Managing the global supply chain	Viva books, New Delhi	2000
2	Ayers.J.B	Hand book of supply chain management	The St. Lencie press	2000

REFERENCES:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nicolas.J.N	Competitive manufacturing management - continuous improvement, Lean production, customer focused quality	McGrawHill, New York	1998
2	Steudel.H.J and Desruelle.P	Manufacturing in the nineteen - How to become a mean, lean and world class competitor	Van No strand Reinhold, New York	1992

18BEMEOE03 TRANSPORT PHENOMENA L T P C
3 0 0 3

Course Objective

- To generalized equations for mass, momentum and heat.
- To understand the concepts of Reynolds and Gauss theorems.
- To learn combined diffusive and convective transport.
- To apply Film- and penetration models for mass and heat transfer.
- To apply Stefan-Maxwells equations for multi-component diffusion.
- To Solve the given set of equations either analytically or numerically.

Course Outcome

- Generalized equations for mass, momentum and heat.
- Understand the concepts of Reynolds and Gauss theorems.
- Learn combined diffusive and convective transport.
- Apply Film- and penetration models for mass and heat transfer.
- Apply Stefan-Maxwells equations for multi-component diffusion.
- Solve the given set of equations either analytically or numerically.

UNIT I INTRODUCTION AND BASIC CONCEPTS 9

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 9

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT 9

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 9

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 **9**

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

Total: 45

REFERENCE:

S. NO	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Geankoplis, C. J	Transport Processes and Separation Processes Principles	Prentice Hall	2003

WEB REFERENCE:

1. https://laulima.hawaii.edu/portal

18BEMEOE04 INTRODUCTION TO BIOMECHANICS L T P C 3 0 0 3

Course Objective

- To describe the principles of the study of human movement.
- To describe the range of factors that influence the initiation, production and control of human movement.
- To identify the body's lever systems and their relationship to basic joint movement and classification.
- To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- To relate the different body systems necessary for human movement to occur.

Course Outcome

- Describe the principles of the study of human movement.
- Describe the range of factors that influence the initiation, production and control of human movement.
- Identify the body's lever systems and their relationship to basic joint movement and classification.
- Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- Relate the different body systems necessary for human movement to occur.

UNIT I INTRODUCTION 9

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 9

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application ofBiomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY 9

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 9

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 9

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

Total: 45

REFERENCES:

S. NO	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Duane Knudson	Fundamentals of Biomechanics	Springer Science+ Business Media, LLC	2007
2	C. Ross Ethier Craig A. Simmons	Introductory Biomechanics	Cambridge University Press	2007

LIST OF OPEN ELECTIVES OFFERED BY AEROSPACE ENGINEERING DEPARTMENT

18BTAROE01 NON-DESTRUCTIVE TESTING L T P C
3 0 0 3

Course Objectives:

- To provide knowledge on the basic principles of NDT.
- To develop a basic knowledge about various NDT techniques.
- To learn the different NDT process parameters.
- To familiarise with internal flaws.
- To provide knowledge on common defects in manufacturing process
- To provide knowledge on standards and specifications

Course Outcomes:

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

- Understand the basic principles of various NDT methods, fundamentals, importance of NDT
- Explain the appropriate NDT technique as per requirement.
- Knowledge to set various process parameters and control the NDT process for the desired output parameters.
- The student shall be able to find the internal flaws in the material by NDT and take measures to eliminate them.
- Ability to solve various problems encountered like leakage, cracks, blowholes etc with the manufacturing process by analyzing the data.
- Describe the standards and specifications related to non-destructive testing technology.

UNIT I INTRODUCTION 9

Properties of Materials – Characteristics of Ferrous, Non-ferrous and Alloys.Destructive testing and Non-destructive testing – Classification – Uses and applications. Codes, Standards and Specifications(ASME, ASTM, AWS etc.).

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION 9

Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - An Illustration of Penetrant Testing, Advantages of Penetrant Testing, Disadvantages of Penetrant Testing. Introduction to Magnetic Particle Inspection - An Illustration of Magnetic Particle Inspection, Advantages of Magnetic Particle Crack Detection, Disadvantages of Magnetic Particle Crack Detection

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION 9

Introduction to Ultrasonic Flaw Detection ,An Illustration of Ultrasonic Flaw Detection , Advantages of Ultrasonic Flaw Detection, Disadvantages of Ultrasonic Flaw Detection, Principle of Radiography Inspection, Radiation sources, Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety.

UNIT IV EDDY CURRENT AND ELECTRO-MAGNETIC METHODS 9

Introduction to Eddy Current Testing. An Illustration of Eddy Current Testing Equipment , Advantages of Eddy Current Testing, Disadvantages of Eddy Current Testing

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS 9

Inspection of Raw Products, Inspection For In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Aircraft Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

Total: 45

TEXTBOOKS:

S.NO.	Author(s)	Title of the book	Publisher	Year of publication
1.	Louis Cartz	Nondestructive Testing	ASM International, Almere, Netherland	1995
2.	Paul E. Mix	Introduction to Nondestructive Testing	John Wiley &Sons,Newyork.	2005

REFERENCES:

S.NO.	Author(s)	Title of the book	Publisher	Year of publication
1.	Baldev Raj, T. Jayakumar, M. Thavasimuthu	Practical Non-destructive Testing	Wood head Publishing, Cambridge.	2007
2.	J. Blitz, G. Simpson	Ultrasonic Methods of Non-destructive Testing	Springer Science & Business Media	1996

WEB REFERENCE:

1. https://www.asnt.org/MinorSiteSections/AboutASNT/Intro-to-NDT
2. https://www.asnt.org/
3. www.bindt.org/
4. www.ndt.net/
5. www.aindt.com.au/

18BTAROE02 UNMANNED AERIAL VEHICLE SYSTEMS L T P C
3 0 0 3

Course Objectives:

- To understand the UAV system design development and integration.
- To know about avionics subsystem and analyse the performance of the sub-system
- To learn the different avionics hardware used in UAV.
- To familiarise with communication and payloads.
- To provide knowledge on UAV controls.
- To impart knowledge on development of UAV systems.

Course Outcomes:

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

- Demonstrate ability to identify and explain the complete system for UAV requirement and performance and their functions.
- Understand the UAV sub-system and input/output device & power requirement system and ability to analyze the performance of the sub-system.
- Explain the different avionics hardware used in UAV.
- Describe the communication and payloads
- Understand the concept of UAV controls
- Demonstrate the design process of UAV

UNIT I INTRODUCTION TO UAV 9

History of UAV –classification – Introduction to Unmanned Aircraft Systems--models and prototypes – System Composition-applications

UNIT II THE DESIGN OF UAV SYSTEMS 9

Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations-Characteristics of Aircraft Types-Design Standards and Regulatory Aspects-UK,USA and Europe-Design for Stealth--control surfaces-specifications.

UNIT III AVIONICS HARDWARE 9

Autopilot – AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration, and testing

UNIT IV COMMUNICATION PAYLOADS AND CONTROLS 9

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting

UNIT V THE DEVELOPMENT OF UAV SYSTEMS 9

Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing-Future Prospects and Challenges-Case Studies – Mini and Micro UAVs.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Re1 Austin	Unmanned Aircraft Systems UAV design, development and deployment	John Wiley & Sons New York	2011
2.	Jay Gundlach	Designing Unmanned Aircraft Systems	American Institute of Aeronautics and Astronautics,Reston	2014
3.	Robert C. Nelson	Flight Stability and Automatic Control	McGraw-Hill, Inc New York	2004

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Douglas M Marshall, J D Richard, K Barnhart Eric Shappee ,Barnhart Marshall Shappee	Introduction to Unmanned Aircraft Systems	Taylor & Francis Ltd, Abingdon	2011
2.	Paul G Fahlstrom, Thomas J Gleason,	Introduction to UAV Systems	UAV Systems Inc	1998
3.	Dr. Armand J. Chaput	Design of Unmanned Air Vehicle Systems	Lockheed Martin Aeronautics Company, Newjersey.	2001

WEB REFERENCE:

1. www.draganfly.com/.../introduction-to-unmanned-aerial-vehicles-uavs/ rahauav.com/Library/.../Unmanned-Air-Systems
2. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-83x spaceflight.nasa.gov/shuttle/reference/shutref/orbiter/.../plcomm.html
3. www.theuav.com/

18BTAROE03 AIR TRANSPORTATION AND AERODROME DESIGN L T P C
3 0 0 3

Course Objectives:

- Apply knowledge and skills in the aviation industry and make more effective decisions for organization.
- Provide insight into current trends and issues in civil aviation, such as aviation safety and security, law and new technology.
- Understand complexity of air transport operation and to find best solution for the issues.
- Understand Various Air transport issues
- Detail the services needed to operate the aerodrome
- Identify solutions to challenges presented regarding aerodrome design and operations

Course Outcomes:

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

- Explain the roles of the International Civil Aviation Organization and the International Air Transport Association in fostering safe and efficient air transport
- Describes national and international rules and regulations for air transportation
- Identify organizations controlling the regulatory processes in international aviation
- Describe the Various transport issues involved in handling passengers, freight of aircraft
- Demonstrate the services needed to operate the aerodrome
- Critically analyse and discuss challenges in aerodrome design and operations

UNIT I INTRODUCTION 9

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT II AIRLINE ECONOMICS 9

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

FLEET PLANNING: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT III PRINCIPLES OF AIRLINES SCHEDULING 9

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.

UNIT V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 9

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.

Total: 45

TEXTBOOKS:

S.NO.	Author(s)	Title of the book	Publisher	Year of publication
1.	Robert M. Kane	Air Transportation	Kendall Hunt Publishing Company, Dubuque	2012
2.	International Civil Aviation Organization	Aerodrome Design Manual	International Civil Aviation Organization, Montreal	2006

REFERENCES:

S.NO.	Author(s)	Title of the book	Publisher	Year of publication
1.	Wilson & Bryon	Air Transportation	English Book house. New Delhi	1998
2.	AntonínKazda, Robert E. Caves	Airport Design and Operation	Emerald Group Publishing, Illovo	2015

WEB REFERENCE:

1. www.grc.nasa.gov/WWW/k-12/airplane/
2. www.scribd.com/doc/10652418/Evolution-of-Modern-Aircraft
3. www.history.navy.mil/branches/car-toc.html
4. www.britannica.com/EBchecked/topic/.../Aircraft-configurations
5. www.brown.edu/Departments/EEB/EML/.../principles_flight.html

18BTAROE04 **AVIONICS** **L T P C**
3 0 0 3

Course Objectives:

- To impart knowledge on Avionic subsystems and its design
- To familiarize the students to understand Avionics Architecture
- To study the features of various display systems
- To give exposure to navigation and flight control systems.
- To provide an overview of air data systems.
- To acquaint the student with the concepts of auto pilot system

Course Outcomes:

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

- Enumerate the various Avionic subsystems and its design.
- Design the System architecture for various databases and explain its application in aviation.
- Identify the components and illustrate the working principles of various display systems in flight deck .
- Describe the navigation and flight control systems.
- Describe the air data systems
- Understand the concepts of auto pilot system.

UNIT I INTRODUCTION TO AVIONICS

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

UNIT II DIGITAL AVIONICS ARCHITECTURE

Avionics system architecture–8085 Architecture and 8086 Architecture -Bus Structure of 8085 Architecture and 8086 Architecture– data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

UNIT III FLIGHT DECKS AND COCKPITS

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

UNIT V AIR DATA SYSTEMS AND AUTO PILOT

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Albert Helfrick.D	Principles of Avionics	Avionics Communications Inc	2009
2.	R. P. G. Collinson	Introduction to Avionics Systems	Springer-Verlag, New York.	2011

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Ian Moir, Allan Seabridge, Malcolm Jukes	Civil Avionics Systems	John Wiley &Sons,New Jersey, USA.	2013
2.	Spitzer, C.R.	Avionics: Elements, Software and Functions	CRC Press Florida, USA.	2006
3.	Brain Kendal Spitzer, C.R.	Digital Avionics Handbook	CRC Press Florida, USA.	2014

WEB REFERENCES:

1. www.ntps.edu/courses/116-introduction-to-avionics-systems-course
2. www.ece.ucsb.edu/courses/ECE152/152A_Su11Shynk/Lec1.pdf
3. www.davi.ws/avionics/TheAvionicsHandbook_Cap_20.pdf
4. www.pbase.com/bruceleibowitz/cockpit
5. www.cranfield.ac.uk/soe/shortcourses/.../avionics-introduction.html

LIST OF OPEN ELECTIVES OFFERED BY AUTOMOBILE ENGINEERING DEPARTMENT

18BEAEOE01 AUTOMOBILE ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the 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 knowledge on the wheels, tyres and brakes of automobiles.
- To provide information on the current and future trends in automobiles.
- Identify and explain the types of steering 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.
- Identify and explain the types of suspension system.
- Classify and describe the types of wheels, tyres and brakes of automobiles.
- Discuss the current and future trends in the automobiles

UNIT I ENGINE AND FUEL FEED SYSTEMS 9

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburetor working principle, requirements of an automotive carburetor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

UNITII TRANSMISSION SYSTEMS 9

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles.Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propeller Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

UNITIII SUSPENSION SYSTEM 9

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

UNITIV BRAKES **9**

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory, Brake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

UNITV ELECTRICAL SYSTEM **9**

Principle and construction of lead acid battery. Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator. Starting System and charging system.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2003
3.	Dr.Kirpal Singh	Automobile Engineering	Standard Publishes	2011

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
2.	Crouse.W.H	Automobile Electrical Equipment", 3rd Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001

18BEAEOE02 BASICS OF TWO AND THREE WHEELERS L T P C

3 0 0 3

COURSE OBJECTIVES

- The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
- 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 systems.
- Identify and explain the types of steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.

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 systems.
- Identify and explain the types of 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.

UNIT I INTRODUCTION 9

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS 9

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburetor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION 9

Types of clutches for 2 and 3 wheelers.Design of clutch system.Gears for two and three wheelers.Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES 9

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS 9

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988.

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	M.M.Griffin.	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2.	Bruce A. Johns, David D.Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

18BEAEOE03 AUTOMOBILE MAINTENANCE L T P C

3 0 0 3

COURSE OBJECTIVE

- The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.
- 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 and suspension
- Discuss the procedure for wheel and brake maintenance.

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 and suspension
- Discuss the procedure for wheel and brake maintenance.
- Explain the fault diagnosis in the electrical and air conditioner systems

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 9

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE 9

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE 9

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE 9

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY 9

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts,

Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	John Doke	Fleet Management	McGraw Hill Co	1984
2.	James D Halderman	Advanced Engine Performance Diagnosis	Prentice Hall Publications	2011

18BEAEOE04 INTRODUCTION TO MODERN VEHICLE TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on trends in the vehicle power plants.
- To learn the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give information about motor vehicle emission and noise pollution control.
- To provide knowledge of the vehicle telematics.
- To give information about 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 describe the working of advanced suspension and braking systems.
- Apply the knowledge of motor vehicle emission and noise pollution control.
- Describe the noise control techniques
- Describe the vehicle telematics and its applications

UNIT I TRENDS IN POWER PLANTS 9

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNIT II DRIVER ASSISTANCE SYSTEMS 9

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti-spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

UNIT III SUSPENSION BRAKES AND SAFETY 9

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT IV NOISE & POLLUTION 9

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT V TELEMATICS 9

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

Total: 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	LjuboVlacic, Michael Saren and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001
2.	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems – Progress in Technology	Automotive Electronics Series,SAE, USA.	1998

REFERENCES

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	William B Riddens	"Understanding Automotive Electronics", 5th Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold,	"Understanding Automotive Electronics"	SAE	1998
3.	Robert Bosch,	"Automotive HandBook", 5th Edition	SAE	2000

LIST OF OPEN ELECTIVES OFFERED BY CIVIL ENGINEERING DEPARTMENT

18BECEOE01 HOUSING, PLAN AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE:

- Teach them introduction to housing
- Make them aware of Formulation of Housing Projects
- Impart knowledge about construction techniques and cost-effective materials
- Learn about Formulation of Housing Projects
- Understand Site analysis
- Learn about Layout design

COURSE OUTCOME

At the end of the this course the students should have learnt

- the basic terms of housing programmes,
- planning and designing of housing projects,
- Know construction techniques and
- Understand cost effective materials and
- familiarise housing finance
- Know Project appraisal techniques.

UNIT I INTRODUCTION TO HOUSING 9

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 9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
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

REFERENCES:

S.NO.	Title of the book	Year of publication
1.	Development Control Rules for Chennai Metropolitan Area,CMAM Chennai	2002
2.	UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi	2000

18BECEOE02 BUILDING SERVICES L T P C

3 0 0 3

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 Know the principle of Refrigeration and application
- To Understand Electrical system and its selection criteria

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 **9**

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 **9**

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 9

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 – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – 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 9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled 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 9

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

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	E.R.Ambrose	Heat Pumps and Electric Heating	John and Wiley and Sons, Inc., NewYork	2002
2.	Handbook for Building Engineers in Metric systems		NBC, New Delhi	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Philips Lighting in Architectural Design		McGraw-Hill, New York	2000
2.	A.F.C. Sherratt	Air-conditioning and Energy Conservation	The Architectural Press London	2005
3.	National Building Code			

18BECEOE03 MANAGEMENT OF IRRIGATION SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To enable the students for a successful career as water management professionals.
- To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
- To expose the students the need for an interdisciplinary approach in irrigation water management
- To providing a platform to work in an interdisciplinary team.
- To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
- To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

OUTCOME

At the end of this the students will be in a capacity to

- Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
- Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
- Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
- Gain insight on local and global perceptions and approaches to participatory water resource management
- Learn from successes and failures in the context of both rural and urban communities of water management.
- Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.
- Familiarise Irrigation scheduling

UNIT I IRRIGATION SYSTEM REQUIREMENTS 9

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

UNIT II IRRIGATION SCHEDULING 9

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation.

UNIT III MANAGEMENT 9

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNIT IV OPERATION **9**

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study.

UNIT V INVOLVEMENT OF STAKE HOLDERS **9**

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Dilip Kumar Majumdar	Irrigation Water Management – Principles and Practice	Prentice Hall of India Pvt. Ltd., New Delhi	2000
2.	Hand book on Irrigation Water Requirement R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi			

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Maloney, C. and Raju, K.V	Managing Irrigation TogetherPractice	Stage Publication, New Delhi, India	2000

18BECEOE04 ADVANCED CONSTRUCTION TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
- To study different methods of construction to successfully achieve the structural design with recommended specifications.
- To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
- To study of construction equipment's, and temporary works required to facilitate the construction process
- To provide a coherent development to the students for the courses in sector of Advanced construction technology.
- To present the new technology of civil Engineering and concepts related Advanced construction technology.

OUTCOMES:

- Implementation of new technology concepts which are applied in field of Advanced construction.
- Different methods of construction to successfully achieve the structural design with recommended specifications.
- Application of scientific and technological principles of planning, analysis, design and management to construction technology.
- Will gain the Knowledge of construction equipment's, and temporary works required to facilitate the construction process
- Development to the students for the courses in sector of Advanced construction technology.
- The new technology of civil Engineering and concepts related Advanced construction technology.

UNIT - I MODERN CONSTRUCTION METHODS 9

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

UNIT - II CONSTRUCTION METHODS FOR SPECIAL STRUCTURES 9

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines. Construction Methods for River Works Pipelines.

UNIT - III MODERN CONSTRUCTION EQUIPEMENTS -I **9**

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting.

UNIT - IV MODERN CONSTRUCTION EQUIPEMENTS -II **9**

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant.

UNIT - V PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES **9**

Principles and Practices of Temporary structures, Shoring, and Strutting,Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Peurifoyu , R. L., , Ledbette, W.B	Construction Planning , Equipment and Methods	McGraw Hill Co.	2000
2.	Antill J.M	PWD, Civil Engineering Construction	McGraw Hill Book Co	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Varma, M	Construction Equipment and its Planning & Applications	Metropoltian Book Co	2000
2.	Nunnaly, S.W	Construction Methods and Management	Prentice – Hall	2000
3.	Ataev, S.S	Construction Technology	MIR , Pub	2000