BE

CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus
2017-2018

BIOMETRICAL ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established under section 3 of UGC Act, 1956)
Pollachi Main Road, Eachanari (Post), Coimbatore- 641021, Tamil Nadu, India
Phone: 0422 – 2980011 – 15  Fax No: 0422 – 2980022-23
Email: info@karpagam.com Web: www.kahedu.edu.in
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.

INTENDED OUTCOMES:

Students undergoing this course will be able to

- Use English language for communication: verbal & non–verbal.
- Enrich comprehension and acquisition of speaking & writing ability.
- Gain confidence in using English language in real life situations.
- Improve word power: lexical, grammatical and communication competence.

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)


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)

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)


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:

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<tr>
<th>S. NO.</th>
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<th>YEAR OF PUBLICATION</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Sangeeta Sharma, Meenakshi Raman</td>
<td>Technical Communication: Principles And Practice 2nd Edition</td>
<td>OUP, New Delhi.</td>
<td>2015</td>
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<tr>
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<tr>
<td><a href="http://www.learnerstv.com">www.learnerstv.com</a></td>
<td>Listening/ Speaking/ Presentation</td>
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<tr>
<td><a href="http://www.usingenglish.com">www.usingenglish.com</a></td>
<td>Writing/ Grammar</td>
</tr>
<tr>
<td><a href="http://www.englishclub.com">www.englishclub.com</a></td>
<td>Vocabulary Enrichment/ Speaking</td>
</tr>
<tr>
<td><a href="http://www.ispeakyouspeak.blogspot.com">www.ispeakyouspeak.blogspot.com</a></td>
<td>Vocabulary Enrichment/ Speaking</td>
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<tr>
<td><a href="http://www.teachertube.com">www.teachertube.com</a></td>
<td>Writing Technically</td>
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</tbody>
</table>
OBJECTIVES:

- To develop analytical skills for solving different engineering problems.
- To understand the concepts of Matrices and vector differentiation.
- To solve problems by applying Differential Calculus and Differential equations.

INTENDED OUTCOMES:

The student will be able to

- apply advanced matrix knowledge to Engineering problems.
- improve their ability in solving geometrical applications of differential calculus problems
- improve their ability in vector differentiation.

UNIT I MATRICES (12)

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)

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
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## WEBSITES:

1. [www.efunda.com](http://www.efunda.com)
2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
OBJECTIVE:
- To enhance the fundamental knowledge in Physics and its applications relevant to various branches of Engineering and Technology

INTENDED OUTCOME:
1. The students will have the knowledge on the basics of physics related to properties of matter, fiber optics, quantum, crystal physics and that knowledge will be used by them in different engineering and technological applications

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


UNIT II LASER AND FIBER OPTICS (9)

Introduction – emission and absorption process- Einstein’s coefficients derivation. Types of LASER - CO₂, 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)


Total- 45
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<tr>
<td>1</td>
<td>Ganesan.S and Baskar.T</td>
<td>Engineering Physics I</td>
<td>GEMS Publisher, Coimbatore-641 001</td>
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<td>Serway and Jewett</td>
<td>Physics for Scientists and Engineers with Modern Physics</td>
<td>Thomson Brooks/Cole, Indian reprint, New Delhi</td>
<td>2010</td>
</tr>
<tr>
<td>5</td>
<td>P. Khare, A. Swarup</td>
<td>Engineering Physics: Fundamentals and Modern Applications</td>
<td>Jones &amp; Bartlett Learning</td>
<td>2009</td>
</tr>
</tbody>
</table>

## WEBSITES:

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

- To understand about the water technology.
- To get the information on electrochemical cells, batteries, fuels and combustion.
- To study about the corrosion and protective coatings.
- To gain knowledge on adsorption phenomena.

INTENDED OUTCOME:

1. This course will create an impact on the students and make them to realize the modern utility on electrochemical cells, batteries, fuels and combustion process, corrosion and adsorption methods.

UNIT I  WATER TECHNOLOGY  (9)

UNIT II  ELECTROCHEMISTRY AND STORAGE DEVICES  (9)

UNIT III  FUELS AND COMBUSTION  (9)

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

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

Total: 45

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WEBSITES:

OBJECTIVES:
- To give exposure on the basics of Biomedical engineering to the students.
- To have a basic knowledge on medical devices and equipment

INTENDED OUTCOMES:
At the end of the course,
- The students will be able to understand the basics of Bioinstrumentation
- The students will be exposed to the ethics for Biomedical 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)

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.

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<tbody>
<tr>
<td>1</td>
<td>Enderle, John D., Bronzino, Joseph D., Blanchard, Susan M</td>
<td>Introduction to Biomedical Engineering</td>
<td>Elsevier Inc</td>
<td>2nd edition, 2005</td>
</tr>
<tr>
<td>3</td>
<td>Daniel A Vallero</td>
<td>Biomedical ethics for Engineers</td>
<td>Elsevier publication</td>
<td>1st edition, 2007</td>
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<td>1</td>
<td>Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer</td>
<td>Biomedical Instrumentation and Measurement</td>
<td>Prentice Hall of India, New Delhi</td>
<td>2nd edition 2002</td>
</tr>
</tbody>
</table>
OBJECTIVES

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of various Electrical Machines.
3. To know about various measuring instruments.
4. To understand the basic concepts in semiconductor devices and digital electronics.

INTENDED OUTCOMES

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.

UNIT I ELECTRIC CIRCUITS & MEASUREMENTS 9

UNIT II ELECTRICAL MACHINES 9

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

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

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<tr>
<td>2</td>
<td>Sedha R.S</td>
<td>Applied Electronics</td>
<td>S. Chand &amp; Co</td>
<td>2006</td>
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<tr>
<td>4</td>
<td>Premkumar N</td>
<td>Basic Electrical Engineering</td>
<td>Anuradha Publishers</td>
<td>2003</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- To develop basic laboratory skills and demonstrating the application of physical principles.

INTENDED OUTCOME:

1. The students will have the knowledge on Physics practical experiments and that knowledge will be used by them in different engineering and technological applications.

LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of Young’s modulus of the material – Non uniform bending (or) Uniform bending.
5. Spectrometer Dispersive power of a prism.
7. Particle size determination using Diode Laser
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
OBJECTIVE:

- To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

INTENDED OUTCOME:

- The students will be outfitted with hands-on knowledge in quantitative chemical analysis of water quality parameters and corrosion measurement.

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. Conductometric Titration using BaCl$_2$ vs Na$_2$SO$_4$.
8. pH Titration (acid & base).
9. Potentiometric Titration ($\text{Fe}^{2+} / \text{KMnO}_4$ or $\text{K}_2\text{Cr}_2\text{O}_7$).
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.
OBJECTIVE:

- 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.

INTENDED OUTCOME:

- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in ‘C’ language

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.

   Total: 45

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<tr>
<td>1</td>
<td></td>
<td>Programming</td>
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OBJECTIVES

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing national standards related to technical drawings.

OUTCOMES:

On Completion of the course the student will be able to

1. perform free hand sketching of basic geometrical constructions and multiple views of objects.
2. do orthographic projection of lines and plane surfaces.
3. draw projections and solids and development of surfaces.
4. prepare isometric and perspective sections of simple solids.
5. demonstrate computer aided drafting.

UNIT I INTRODUCTION

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 CURVES

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

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

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

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)

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
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<td>2</td>
<td>VTU</td>
<td>A Primer on Computer Aided Engineering Drawing</td>
<td>Belgaum</td>
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WEB REFERENCES

OBJECTIVE:

Yoga Education Helps To Develop The Self Discipline, Self Control, Awareness, Concentration And Higher Level Of Consciousness.

AIM : To Enable The Student To Have Physical Health And Mental Health.

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

UNIT- III

UNIT- IV

UNIT- V

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<td>1.</td>
<td>Dr.K.Chandrasekaran</td>
<td>Sound Health Through Yoga</td>
<td>PremKalyan</td>
<td>2009</td>
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<td>2.</td>
<td>B.K.S.Iyangar</td>
<td>Light On Pranayama</td>
<td>Crossroad Centuary</td>
<td>2013</td>
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<tr>
<td>3.</td>
<td>Thirumular</td>
<td>Thirumandhiram</td>
<td>Sriramakrishna Math</td>
<td>2016</td>
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</table>
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

1. 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.
2. 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.
3. Practice principles of effective business writing and document design in all written documents.
4. Build an understanding of different organizational cultures, business practices, and social norms to communicate more effectively in domestic and cross-cultural business contexts.
5. Develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.

UNIT I


UNIT II


UNIT III


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

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<td>Meenakshi Raman ; Prakash Singh</td>
<td>Business Communication</td>
<td>Oxford University Press</td>
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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://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.
OBJECTIVES:

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

INTENDED 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.

UNIT-1 LSRW SKILLS & GRAMMAR

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


UNIT-II LSRW SKILLS & GRAMMAR

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

UNIT – III  LSRW SKILLS & GRAMMAR

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


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:

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Sangeeta Sharma, Meenakshi Raman</td>
<td>Technical Communication: Principles And Practice 2nd Edition</td>
<td>OUP, New Delhi.</td>
<td>2015</td>
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### WEBSITES:

- [www.learnerstv.com](http://www.learnerstv.com) – Listening/ Speaking/ Presentation
- [www.usingenglish.com](http://www.usingenglish.com) – Writing/ Grammar
- [www.englishclub.com](http://www.englishclub.com) – Vocabulary Enrichment/ Speaking
- [www.ispeakyouspeak.blogspot.com](http://www.ispeakyouspeak.blogspot.com) – Vocabulary Enrichment/ Speaking
- [www.teachertube.com](http://www.teachertube.com) – Writing Technically
OBJECTIVES:

1. To have knowledge in integral calculus and Vector calculus
2. To expose the concept of Analytical function and Complex integration.

INTENDED OUTCOMES:

The student will be able to

1. Solve problems in Fluid Dynamics, Theory of Elasticity, Heat and Mass Transfer etc.
2. Find the areas and volumes using Multiple Integrals
3. Improve their ability in Vector calculus
4. Expose to the concept of Analytical function.
5. Apply Complex integration in their Engineering problems

UNIT I INTEGRAL CALCULUS

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

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

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

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

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:

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### WEBSITES:

1. www.efunda.com  
2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)  
3. [www.sosmath.com/diffeq/laplace/basic/basic.html](http://www.sosmath.com/diffeq/laplace/basic/basic.html)  
4. [www.mathworld.wolfram.com](http://www.mathworld.wolfram.com)
OBJECTIVES:

- To give a comprehensive insight into natural resources, 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.

INTENDED OUTCOME:

- Students will prepare themselves to go ecofriendly and help preserving the nature and environment.

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


Total: 45

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<td>1.</td>
<td>Dr. Ravikrishnan, A</td>
<td>Environmental Science</td>
<td>Sri Krishna Hi tech Publishing Company Private Ltd., Chennai</td>
<td>2012</td>
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WEBSITES:

2. http://nptel.ac.in/courses.php?disciplineId=120
OBJECTIVES:

- To give a comprehensive insight into natural resources, 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.

INTENDED OUTCOME:

1. Students will prepare themselves to go ecofriendly and help preserving the nature and environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

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.

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UNIT V SOCIAL ISSUES AND ENVIRONMENT

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

Total: 45

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<td>2.</td>
<td>Anubha kaushik</td>
<td>Environmental Science and Engineering</td>
<td>New Age International (P) Ltd., New Delhi.</td>
<td>2010</td>
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**WEBSITES:**

2. http://nptel.ac.in/courses.php?disciplineId=120
OBJECTIVE

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

OUTCOMES:

1. Ability to fabricate carpentry components and pipe connections including plumbing works.
2. Ability to use welding equipments to join the structures.
3. 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. Carpentry 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), capacitores 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

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<tr>
<td>1</td>
<td>Jeyachandran, K. and Balasubramanian, S</td>
<td>A Premier on Engineering Practices Laboratory</td>
<td>Anuradha Publications, Kumbakonam</td>
<td>2007</td>
</tr>
</tbody>
</table>
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

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.

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.
BUSINESS PLAN

COURSE OBJECTIVE:
Any business has to be developed from scratch. As entrepreneur one should learn various avenues of promoting the given business along with ethics which is other side of the coin. This course is meant to inculcate to develop a business plan connected with ethics.

LEARNING OBJECTIVE:
To explain relevance of Ethics while taking business decisions.

UNIT I

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

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<td>Rhonda Abrams</td>
<td>The Successful business Plan Secret S Strategies</td>
<td>Prentice Hall</td>
<td>-</td>
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<tr>
<td>2</td>
<td>Rhonda Abrams</td>
<td>The business plan in a day</td>
<td>Prentice Hall</td>
<td>-</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- 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

INTENDED OUTCOMES:

1. Be able to solve problems in different environments and develop critical thinking
2. Be able to build and solve Transportation Models, Assignment Models, integer programming and Nonlinear programming

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

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<tr>
<td>4</td>
<td>Kanti Swarup, Manmohan, Gupta</td>
<td>Operations Research</td>
<td>Sultan Chand &amp; Sons, New Delhi.</td>
<td>2010</td>
</tr>
</tbody>
</table>

# WEBSITES:

1. [www.mathworld](http://www.mathworld). Wolfram.com
2. [www.mit.edu](http://www.mit.edu)
3. [www.nptel.com](http://www.nptel.com)
OBJECTIVES:

1. To develop analytical skills for solving engineering problems
2. To make the students to study about linear algebra and some useful special functions.

INTENDED OUTCOMES:

1. Be able to acquire basic knowledge on vector spaces and linear transformations.
2. Be able to build and solve the special functions.

UNIT I VECTOR SPACES (12)
General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space.

UNIT II LINEAR TRANSFORMATIONS (12)
Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Eigen values and Eigen vectors - Similarity, Diagonalization.

UNIT III INNER PRODUCT SPACES (12)
The Dot Product on $\mathbb{R}^n$ and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application: Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

UNIT IV HYPERBOLIC FUNCTIONS, BETA AND GAMMA FUNCTIONS (12)
Hyperbolic Functions: Hyperbolic functions and Inverse Hyperbolic functions – Identities – Real and imaginary parts – solving problems using hyperbolic functions.

UNIT V BESSEL FUNCTIONS (12)
Bessel Functions – Preliminaries – Definitions – Bessel Differential Equation – Differential recurrence relations – the pure recurrence relation – A generating function – Bessel’s integral – Index half and odd integer.

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<td>3</td>
<td>Jim Defranza, Daniel Gagliardi</td>
<td>Introduction to Linear Algebra with Application</td>
<td>Tata McGraw-Hill, New Delhi.</td>
<td>2008</td>
</tr>
</tbody>
</table>

WEBSITES:

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

- 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

INTENDED OUTCOMES:

- 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.

UNIT-I  NUMBER SYSTEMS AND BOOLEAN ALGEBRA  (12)

UNIT-II  LOGIC GATES AND COMBINATIONAL CIRCUITS  (12)

UNIT-III  SEQUENTIAL CIRCUIT  (12)

UNIT-IV  ASYNCHRONOUS SEQUENTIAL CIRCUITS  (12)
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<td>2</td>
<td>John M. Yarbrough</td>
<td>Digital Logic Applications and Design</td>
<td>Thomson- Vikas publishing house, New Delhi</td>
<td>2002</td>
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<td>Thomas L. Floyd</td>
<td>Digital Fundamentals</td>
<td>Pearson Education, New Delhi</td>
<td>2003</td>
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</table>

WEBSITES:

http://www.allaboutcircuits.com/vol_2/chpt_9/2.html
OBJECTIVE
To develop programming skill and to solve engineering related problems using C++, Object Oriented Programming (OOP) and Data Structure Concepts.

INDENTED OUTCOME
Understanding the concepts of C++, OOPs and Data structures and its applications

UNIT – I INTRODUCTION TO DATA STRUCTURES

UNIT – II LINKED LISTS

UNIT – III OBJECTS ORIENTED PROGRAMMING

UNIT – IV OBJECTS AND CLASSES

UNIT – V OPERATOR OVERLOADING

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<td>2</td>
<td>Liberty &amp; Keogh</td>
<td>C++: An introduction to programming</td>
<td>Prentice Hall of India Pvt., Ltd., New Delhi</td>
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<td>1</td>
<td>Bjarne Stroustrup</td>
<td>The C++ Programming Language</td>
<td>Addison Wesley by publication, New York</td>
<td>1994</td>
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<tr>
<td>2</td>
<td>Jean – Paul Tremblay and Paul G.Sorenson</td>
<td>An Introduction to Data Structures with Applications</td>
<td>Tata McGraw Hill</td>
<td>1998</td>
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OBJECTIVES

- 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

INTENDED OUTCOMES

- Understand the fundamental concepts
- Logically analyze any electronic circuit
- Apply the logic in any application

UNIT I SEMICONDUCTOR DIODES AND SPECIAL PURPOSE DIODES (10)


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
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<td>David A. Bell</td>
<td>Fundamental of electronic devices and circuits</td>
<td>Oxford press</td>
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<tr>
<td>1</td>
<td>Street Man</td>
<td>Solid State Electronic Devices'</td>
<td>Prentice Hall Of India,6th edition</td>
<td>2005</td>
</tr>
<tr>
<td>2</td>
<td>Mathur Kulshrestha and Chadha</td>
<td>Electron devices and Applications and Integrated circuits'</td>
<td>Unmesh Publications</td>
<td>2005</td>
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<td>3</td>
<td>Thomas L. Floyd</td>
<td>Electron Devices</td>
<td>Charles and Messil Publications</td>
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<td>4</td>
<td>G.K.Mithal</td>
<td>Electronic Devices and Circuits</td>
<td>Khanna Publishers</td>
<td>2013</td>
</tr>
<tr>
<td>6</td>
<td>B. Somanathan Nair</td>
<td>Electronic Devices and Applications</td>
<td>PHI,</td>
<td>2006</td>
</tr>
</tbody>
</table>
OBJECTIVES

- To study about the biochemistry of living cells, metabolism of biomolecules and the methods of investigation and diagnostic tools.

INTENDED OUTCOMES

- Understanding the concepts of biochemistry of living cells
- Understanding the concepts of metabolism of carbohydrates
- Understanding the concepts of protein biochemistry
- Understanding the concepts of biochemistry of lipids
- Understanding the concepts of investigation of metabolism.

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

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<tr>
<td>1</td>
<td>Ambiga Shanmugam</td>
<td>Fundamentals of Biochemistry for Medical Students</td>
<td>Karthick Printers, Madras</td>
<td>1997</td>
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<tbody>
<tr>
<td>2</td>
<td>Varley</td>
<td>Clinical Biochemistry</td>
<td>CBS Publications</td>
<td>1988</td>
</tr>
</tbody>
</table>
OBJECTIVE

- To provide the students a basic understanding of the structure and function of the human body.

INTENDED OUTCOMES

After completing the course the students will be able to:
1. Relate basic human body functions and life processes.
2. Name the major human body systems and relate their functions.
3. Name the major components of each system and describe briefly their anatomical locations, structures and their physiological functions.

UNIT I CELL (9)

UNIT II CARDIAC AND NERVOUS SYSTEM (9)

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)

UNIT V EYE, EAR, ENDOCRINE GLANDS (9)

Total : 45

TEXT BOOKS

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Sarada Subramanyam, K.Madhavan Kutty and H.D.Singh</td>
<td>Text Book of ‘Human Physiology’</td>
<td>S.Chand &amp; Company</td>
<td>1996</td>
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<td>2</td>
<td>Ranganathan, T.S</td>
<td>Text Book of Human Anatomy</td>
<td>S.Chand &amp;Co. Ltd., Delhi</td>
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<tbody>
<tr>
<td>2</td>
<td>J.Gibson</td>
<td>Modern Physiology and Anatomy for Nurses</td>
<td>Blackwell SC Publishing</td>
<td>1981</td>
</tr>
</tbody>
</table>
LIST OF EXPERIMENTS:

1. Characteristics of PN diode
2. Characteristics of Zener diode
3. Input and Output Characteristics of BJT
4. Drain and transfer characteristics of JFET
5. Design of Current series feedback amplifier
6. Design of RC coupled amplifier
7. Hartley Oscillator
8. Colpitt Oscillator
9. Astable Multivibrator
10. Clippers and Clampers
11. Half wave rectifier – with and without filter
12. Full wave rectifier – with and without filter

TOTAL: 45
LIST OF EXPERIMENTS:

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
5. Assay of SGOT/SGPT.
8. Separation of amino acids using thin layer chromatography.
9. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and Hemoglobin estimation.
10. Differential count of different WBCs and Blood group identification.
11. Ishihara chart for color blindness and Snellen’s chart for myopia and hyperopia – by letters reading and ophthalmoscope to view retina.
12. Weber’s and Rinnee’s test for auditory conduction.

TOTAL: 60

TOTAL: 15
OBJECTIVES:

- To introduce the concept of probability and Sampling techniques.
- To understand the fundamentals of Experimental Designs and Quality Control.

INTENDED OUTCOME:

- The students would be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

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)

UNIT – V Reliability and Quality Control (12)
Concepts of reliability – hazard functions – Reliability of series and parallel systems – control charts for measurement (X and R charts) - Control charts for attributes (p, c and np charts).

REFERENCES:

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<th>YEAR OF PUBLICATION</th>
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WEBSITES:

2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
3. [www.mathworld](http://www.mathworld)
OBJECTIVES

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To teach the theory of ADC and DAC

INTENDED OUTCOMES:

- Knowledge about the basic building blocks of linear integrated circuits.
- Knowledge about the linear and non-linear applications of operational amplifiers.
- Knowledge about the theory and applications of analog multipliers and PLL.
- Knowledge about the theory of ADC and DAC
- Knowledge about a few special function integrated circuits

UNIT I  OPERATIONAL AMPLIFIER CHARACTERISTICS (9)


UNIT II  OPAMP APPLICATIONS (9)


UNIT III  WAVEFORM GENERATORS AND PLL (9)


UNIT IV  ACTIVE FILTERS & VOLTAGE REGULATOR (9)


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
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<tr>
<td>1</td>
<td>Roy Choudhury and Shail Jain</td>
<td>Linear Integrated Circuits</td>
<td>New Age International Publishers</td>
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<td>2</td>
<td>Ramakant A.Ga yakwad</td>
<td>Op-Amps and Linear Integrated Circuits</td>
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<td>1</td>
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<td>Prentice Hall of India, New Delhi</td>
<td>2001</td>
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<tr>
<td>2</td>
<td>Sergio Franco</td>
<td>Design with operational amplifier and analog integrated circuits</td>
<td>McGraw Hill</td>
<td>2015</td>
</tr>
</tbody>
</table>
OBJECTIVES

- To provide the knowledge of basic concepts such as generalized instrumentation system, general properties of input transducers, static and dynamic characteristics of transducers and sensors.
- To provide a thorough understanding of principle and working of transducers and sensors used for displacement, motion, pressure and temperature measurement, biopotential electrodes, chemical sensors, biosensors, fiber optic sensors, and radiation sensors.
- To study the biomedical applications of the above transducers and sensors.
- To perform experiments based on some of the above transducers and sensors.

INTENDED OUTCOMES

After completion of the above course the students shall be competent in the following ways:

- They have a clear understanding of generalized medical instrumentation system, general properties of input transducers, static and dynamic characteristics of transducers and sensors.
- They have a thorough understanding of various transducers and sensors taught in the course.
- They are able to apply the transducers and sensors learnt in the course in suitable medical contexts.
- They have a working knowledge of some of the transducers and sensors that they have learnt in the course.

UNIT I
INTRODUCTION TO TRANSDUCERS AND ITS CHARACTERISTICS (10)

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)

UNIT IV
ELECTRODES (10)

UNIT V
BIOSENSORS (11)
Enzyme Sensor and Electrode based: Affinity Sensors (Catalytic Biosensors), Two examples of each Biosensors and Immunosensors.

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<td>2</td>
<td>Hermann K P. Neubert</td>
<td>Instrument Transducer – An Intro to their performance and ...</td>
<td>Hermann K P. Neubert</td>
<td>2000</td>
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<tr>
<td>4</td>
<td>Tatsuo Togawa, Toshiyo Tamma and P. Ake Öberg</td>
<td>Biomedical Transducers and Instruments</td>
<td>Tatsuo Togawa,</td>
<td>1994</td>
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<td>2</td>
<td>Leslie Cromwell, Fred. J. Weibell and Pfeiffer</td>
<td>Biomedical instrumentation and measurement</td>
<td>Leslie Cromwell, Fred. J. Weibell and Pfeiffer</td>
<td>2002</td>
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<tr>
<td>3</td>
<td>Richard Aston</td>
<td>Principles of Biomedical Instrumentation and Measurement</td>
<td>Merril Publishing Co., Columbus</td>
<td>1990</td>
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<tr>
<td>5</td>
<td>Jacob Fraden</td>
<td>Handbook of Modern Sensors – Physics, Design and Application</td>
<td>AIP press</td>
<td>2000</td>
</tr>
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</table>

Total : 45
OBJECTIVES:

The student should be made to:

- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

OUTCOMES:

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

- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems.

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

UNIT IV  MICROCONTROLLER  9

UNIT V  INTERFACING MICROCONTROLLER  9

TOTAL: 45
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<tbody>
<tr>
<td>1</td>
<td>Doughlas V.Hall</td>
<td>Microprocessors and Interfacing, Programming and Hardware</td>
<td>TMH</td>
<td>2012</td>
</tr>
</tbody>
</table>
OBJECTIVE

To gain knowledge in the area of biomaterials and artificial organs

INTENDED OUTCOMES

Understanding and gaining the knowledge of various concepts in biomaterials, bio-compatibility, implant materials, polymeric implant materials, tissue replacements and artificial organs.

UNIT I  STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY  (9)
Definition and classification of bio-materials, mechanical properties, visco elasticity, wound-healing process, body response to implants, blood compatibility.

UNIT II  IMPLANT MATERIALS  (9)
Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminium oxides, hydroxyapatite glass ceramics carbons, medical applications.

UNIT III  POLYMERIC IMPLANT MATERIALS  (9)

UNIT IV  TISSUE REPLACEMENT IMPLANTS  (9)
Soft-tissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT V  ARTIFICIAL ORGANS  (9)
Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenateor), Artificial Kidney (Dialyzer membrane), Dental Implants.

Total : 45

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<tr>
<td>2</td>
<td>Joon B.Park Joseph D. Bronzino</td>
<td>Biomaterials - Principles and Applications</td>
<td>CRC Press</td>
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<td>PARK J.B.,</td>
<td>Biomaterials Science and Engineering</td>
<td>Plenum Press</td>
<td>1984</td>
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<tr>
<td>2</td>
<td>Myer Kutz</td>
<td>Standard Handbook of Biomedical Engineering &amp; Design</td>
<td>McGraw- Hill</td>
<td>2003</td>
</tr>
<tr>
<td>3</td>
<td>John Enderle, Joseph D. Bronzino, Susan M. Blanchard</td>
<td>Introduction to Biomedical Engineering</td>
<td>Elsevier</td>
<td>2005</td>
</tr>
</tbody>
</table>
OBJECTIVES:
The student should be made to:
- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

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 Generation

8051 Experiments using kits and MASM
11. Basic arithmetic and Logical operations
12. Code conversion

TOTAL: 45
OBJECTIVES:

1. To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
2. To implement the methods using the spread sheet in Excel

INTENDED OUTCOMES:

1. To develop analytical skills for solving different engineering problems.
2. To understand the concepts of Matrices, sequences and series.
3. To solve problems by applying Differential Calculus and Differential equations.

LIST OF EXPERIMENTS

1. Solution of Transcendental equation
   i) Newton – Raphson Method
   ii) Bisection method
   iii) Iterative method by reducing the equation to the form \( x = f(x) \)

2. Solution of algebraic simultaneous equations
   i) Gauss Jacobi method
   ii) Gauss Seidel method

3. Numerical integration
   i) Gauss 2 point and 3 point formulae
   ii) Trapezoidal method
   iii) Simpson’s 1/3 rule

4. Solution of initial value problems governed by ODE
   i) Runge - Kutta 4th order method
   ii) Modified Euler’s method
   iii) Milne’s method
   iv) Adam – Bashforth method

5. Solution of BVP governed by PDE
   i) Laplace Equation
   ii) One – dimensional heat equation
      a) Explicit method : Bender – Schmidt’s method
      b) Implicit method : Crank - Nicolson’s method
   iii) One dimensional wave equation
      Implicit method
REFERENCES:

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<td>Curtis F. Gerald and Patrick O. Wheatley</td>
<td>Applied Numerical Analysis</td>
<td>Pearson Education, South Asia</td>
<td>2009</td>
</tr>
</tbody>
</table>
LIST OF EXPERIMENTS

1. Inverting, Non-inverting and differential amplifiers.

2. Integrator and Differentiator.

3. Instrumentation amplifier.

4. Active lowpass, highpass and Bandpass filter.

5. Astable, Monostable multivibrators and Schmitt Trigger using op-amp.

6. Phase shift and Wienbridge oscillator using op-amp.

7. Astable and Monostable using NE555 Timer.

8. PLL characteristics and Frequency Multiplier using PLL.


10. Simulation of Experiments 1, 2, 3, 4, 5 using PSpice / MultiSim
OBJECTIVE

To gain the knowledge on various electronic equipments

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

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<td>1</td>
<td>Sujit K. Chaudhuri</td>
<td>Concise Medical Physiology</td>
<td>New Central Book agency</td>
<td>1997</td>
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<tr>
<td>2</td>
<td>Ogata Katsumi</td>
<td>Modern control engineering full</td>
<td>2nd edition, Prentice Hall of India</td>
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<tr>
<td>1</td>
<td>Barry R. Dworkin</td>
<td>Learning and Physiological Regulation (Hardcover)</td>
<td>University Of Chicago Press</td>
<td>March 1993</td>
</tr>
</tbody>
</table>
OBJECTIVE

- To know about various biomedical instrumentation techniques

INTENDED OUTCOMES

- To study and understanding the concepts of bio potential electrodes
- To study and understanding the concepts of electrode configurations
- To study and understanding the concepts of measurements if non electrical parameter
- To study and understanding the concepts of bio chemical measurements

UNIT I  BIO POTENTIAL ELECTRODES (9)


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)


UNIT IV  MEASUREMENT OF NON-ELECTRICAL PARAMETER (10)


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

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<td>Joseph J. Carr and John M. Brown</td>
<td>Introduction to Biomedical Equipment Technology</td>
<td>Pearson Education</td>
<td>2004</td>
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<td>2</td>
<td>John G. Webster</td>
<td>Medical Instrumentation Application and Design</td>
<td>John Wiley and sons</td>
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<td>Leslie Cromwell</td>
<td>Biomedical Instrumentation and measurement</td>
<td>Prentice hall of India, New Delhi</td>
<td>2007</td>
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<td>3</td>
<td>Myer Kutz</td>
<td>Standard Handbook of Biomedical Engineering &amp; Design</td>
<td>McGraw-Hill</td>
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</tbody>
</table>
OBJECTIVE

- To study the bio-signal processing methods and analysis of bio signals

INTENDED OUTCOME

- To study and understanding the concepts of DFT and its computation
- To study and understanding the concepts of designing techniques for digital filters
- To study and understanding the concepts of bio-signal analysis.
- To study and understanding the concepts of special techniques like Heart rate variability Analysis

UNIT I

DISCRETE – TIME SIGNALS AND SYSTEMS (9)

UNIT II

INFINITE IMPULSE RESPONSE DIGITAL FILTERS (9)

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

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</table>
OBJECTIVE

- To enable the students to create an awareness on Engineering Ethics, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  ENGINEERING ETHICS

UNIT II  FACTORS OF CHANGES
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

UNIT IV  DIRECTING AND CONTROLLING

UNIT V  ENTREPRENEURSHIP AND MOTIVATION

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<td>2</td>
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<td>Entrepreneurial Development</td>
<td>S.Chand and Co. Ltd., NewDelhi</td>
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2. [http://tutor2u.net/business/gcse/people_motivation_theories.htm](http://tutor2u.net/business/gcse/people_motivation_theories.htm)

**17BEBME5E--**

**Professional Elective I**

| 17BEBME5E-- | Professional Elective I | 3 0 0 3 | 100 |

**17BEBME5E--**

**Professional Elective II**

| 17BEBME5E-- | Professional Elective II | 3 0 0 3 | 100 |
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
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.
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.
OBJECTIVE

- To expose the students to the fundamentals of medical image acquisition, processing and storage.

INTENDED OUTCOMES

- To study the image fundamentals and mathematical transforms necessary for image processing. To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

UNIT I DIGITAL IMAGE FUNDAMENTAL

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

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

UNIT III IMAGE ENHANCEMENT

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 RESTORATION AND RECONSTRUCTION OF MEDICAL IMAGES

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

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

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<tr>
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<td>Rafael C., Gonzalez and Richard E. Woods</td>
<td>Digital Image Processing</td>
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</table>
UNIT I  
HEART LUNG MACHINE AND ARTIFICIAL HEART  
Condition to be satisfied by the H/L system. Different types of oxygenators, pumps, pulse and continuous types, monitoring process, shunting, the indication for cardiac transplant, driving mechanism, blood handling system, functioning and different types of Artificial heart, mock test setup for assessing its functions.

UNIT II  
CARDIAC ASSIST DEVICES  
Synchronous counter pulsation, assisted through respiration right ventricular by-pass pump, left ventricular bypass pump, open chest and closed chest type, Principle and problems --Intra Aortic balloon pumping, Veno Arterial Pumping, Prosthetic Cardio Valves, Biomaterials for purposes, its characteristics and testing.

UNIT III  
ARTIFICIAL KIDNEY  
Indication and principle of Heamodyalisis, Membrane, Dialasate, different types of Heamodialisers, monitoring systems, wearable artificial kidney, implanting type.

UNIT IV  
PROSTHETIC AND ORTHODIC DEVICES  

UNIT V  
RESPIRATORY AND HEARING AIDS  
Intermittent positive pressure, breathing apparatus operating sequence, electronic IPPB unit with monitoring for all respiratory parameters, audiograms , types of deafness, conductive and nervous, hearing aids, constructional and functional characteristics.

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<td>1</td>
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<td>Advances in Biomedical Engineering and Medical Physics</td>
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<td>Therapeutic Medical Devices</td>
<td>Prentice Hall Inc., New Jersey</td>
<td>1992</td>
</tr>
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Total: 45
OBJECTIVES

The student should be made to:

- Understand the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them
- Learn some of the cardiac assist devices
- Learn to measure the signals generated by muscles
- Understand the need and use of some of the extracorporeal devices.

OUTCOMES

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

- Use 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

UNIT I  CARDIAC EQUIPMENT
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

UNIT III  SKELETAL MUSCULAR EQUIPMENT
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
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

TEXT BOOK:

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<td>Introduction to Biomedical Equipment Technology</td>
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<td>6</td>
<td>John G.Webster</td>
<td>Medical Instrumentation Application and Design</td>
<td>John Wileyand Sons</td>
<td>2006</td>
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</tbody>
</table>
OBJECTIVE

- The purpose of this course is to introduce the students to the field of hospital and equipment management.

INTENDED OUTCOMES

- Understand hospital organization and management.
- Understand equipment management in hospitals.

UNIT I HEALTH SYSTEM

Health organisation of the country, the state, the cities and the region, Health Financing System, Organisation of Technical Section.

UNIT II HOSPITAL ORGANISATION AND MANAGEMENT

Management of Hospital organisation, Nursing section Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human relation in Hospital, Importance to Team Work, Legal aspect in Hospital Management.

UNIT III REGULATORY REQUIREMENT AND HEALTHCARE CODES

FDA Regulation, joint commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

UNIT IV EQUIPMENT MAINTENANCE MANAGEMENT


UNIT V TRAINED TECHNICAL PERSONNEL

Function of Clinical Engineer, Role to be performed in Hospital, Manpower Market, Professional Registration, and Structure in hospital.

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<td>1993</td>
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</tbody>
</table>
PURPOSE

- Implementation of fundamental image processing techniques in Bio Medical Images.

INSTRUCTIONAL OBJECTIVES

At the end of this course students will be able to gain knowledge in,
- Application of various pre-processing techniques in Medical Images.
- Enhancement and Transformation of Medical Images.
- Reconstruction of images.

LIST OF EXPERIMENTS:

1. Digital image Fundamentals.
3. Edge detection and boundary tracing techniques.
5. Image compressions.
6. Restoration of CT images.
7. Reconstruction of images.
8. Image Analysis.
OBJECTIVES:
- To provide practice on recording and analysis of different Bio potentials
- Study the function of different Therapeutic equipments.

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.
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
OBJECTIVE

- To introduce the students to the basics of virtual instrumentation.

INTENDED OUTCOMES

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

1. Make use of analysis tools
2. Use the programming techniques.

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 IVI, 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

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</table>
OBJECTIVES
The student should be made to:

- Gather basic knowledge about measurements of parameters related to respiratory system
- Learn measurement techniques of sensory responses
- Understand different types and uses of diathermy units.
- Know ultrasound imaging technique and its use in diagnosis
- Know the importance of patient safety against electrical hazard

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

- Explain about measurements of parameters related to respiratory system
- Describe the measurement techniques of sensory responses
- Analyze different types and uses of diathermy units
- Discuss ultrasound imaging techniques and its usefulness in diagnosis
- Outline the importance of patient safety against electrical hazard

UNIT I RESPIRATORY MEASUREMENT SYSTEM

UNIT II SENSORY MEASUREMENT
Psycho Physiological Measurements-for testing and sensory Responses, Electro occulograph, Electro retinograph, Audiometer-Pure tone, Speech. EGG (Electrogastrograph), galvanic skin resistance (GSR).

UNIT III DIATHERMY
IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.

UNIT IV ULTRASONIC TECHNIQUE
Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology.

UNIT V PATIENT SAFETY
Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient s electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – Basic Approaches to Protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

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OBJECTIVE

- To familiarize the students with Virtual Instrumentation and to do programming for applications

INTENDED OUTCOMES

- To study about Programming Techniques
- To study about Data Acquisition and interfacing techniques
- To do programming for process control and other applications

LIST OF EXPERIMENTS

1. Getting Started with LabVIEW – Basic operations, controls and indicators.
2. Simple programming structures and Timing Issues
3. LabVIEW – Debugging a VI, Sub-VI's
4. LabVIEW – Traffic Light - Programming Structure, Sub-Vis, Clusters
5. GPIB-Serial poll Byte
7. Oscilloscope - Attribute Nodes, Menus
8. RC Circuit measurement - Timing issues
9. LabVIEW – 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
UNIT I
INTRODUCTION
Computers in data – computer evolution – structure of medical informatics – hospital information system – security of computer records – sources of data for decision making

UNIT II
COMPUTERIZED SYSTEM DESIGN
Computerized database management system – dialogue of computer method of history taken by computer – computerized medical records evolution –

UNIT III
COMPUTERS IN PATIENT MONITORING
Computers in clinical laboratory – automated hematology laboratory – information flow in A CLINICAL LAB - physiological monitoring – automated ICU – computerized arrhythmia monitoring – interfacing to hospital information system (HIS)

UNIT IV
COMPUTERS IN MEDICAL IMAGING & DECISION MAKING
Computer assistant medical imaging – nuclear medicine computer systems – data acquisition modes – X-ray, CT scan, – medical decision making: - Computer assisted decision making – general model, algorithms – fuzzy set theory

UNIT V
RECENT TRENDS

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Total : 45

17BEBM8E801 PATIENT MONITORING SYSTEMS  3 0 0 3  100

17BEBM8E802 PROFESSIONAL ELECTIVE VI  3 0 0 3  100

17BEBM8E803 PROFESSIONAL ELECTIVE VII  3 0 0 3  100

17BEBM891 PROJECT WORK PHASE II AND VIVAVOCE  0 0 32 16  100
FOR SEMESTER V (ELECTIVE-I & II)

17BEBME5E01 MEDICAL PHYSICS 3 0 0 3 100

OBJECTIVES:
- To Study effects of sound and light in human body
- To study effects of radiation in matter and how isotopes are produced

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze mechanics involved with various physiological systems.
- Perform derivation of mathematical models related to blood vessels

UNIT I NON IONIZING RADIATION AND ITS MEDICAL APPLICATION 9

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

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:

<table>
<thead>
<tr>
<th>S.NO.</th>
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<tr>
<td>1</td>
<td>John R Cameron , James G Skofronick</td>
<td>Medical Physics</td>
<td>John-Wiley &amp; Sons</td>
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<tr>
<td>2</td>
<td>W.J.Meredith and J.B. Massey</td>
<td>Fundamental Physics of Radiology</td>
<td>Varghese Publishing house</td>
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<td>S.Webb</td>
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<td>3</td>
<td>J.P.Woodcock</td>
<td>Ultrasonic, Medical Physics Handbook series</td>
<td>Adam Hilger, Bristol</td>
<td>2002</td>
</tr>
<tr>
<td>4</td>
<td>Hylton B.Meire and Pat Farrant</td>
<td>Basic Ultrasound</td>
<td>John Wiley &amp; Sons</td>
<td>1995</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- 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.

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.

UNIT I  INTRODUCTION TO BIOMETRICS  9

UNIT II  FINGERPRINT TECHNOLOGY  9

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

UNIT V  BIOMETRIC AUTHENTICATION  9

Total : 45
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<tr>
<td>1</td>
<td>James Wayman, Anil Jain, Davide Maltoni</td>
<td>Biometric Systems, Technology Design and Performance Evaluation</td>
<td>Springer</td>
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<td>1</td>
<td>Paul Reid</td>
<td>Biometrics for Network Security</td>
<td>Pearson Education</td>
<td>2004</td>
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<td>2</td>
<td>Nalini K Ratha, Ruud Bolle</td>
<td>Automatic fingerprint Recognition System</td>
<td>Springer</td>
<td>2003</td>
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<td>3</td>
<td>L.C Jain, I Hayashi, S B Lee, U Halici</td>
<td>Intelligent Biometric Techniques in Fingerprint and Face Recognition</td>
<td>CRC Press</td>
<td>1999</td>
</tr>
<tr>
<td>5</td>
<td>Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain</td>
<td>Handbook of Multibiometrics</td>
<td>Springer</td>
<td>2006</td>
</tr>
</tbody>
</table>
UNIT I METABOLISM OF AMINO ACIDS
Biosynthesis of Gly, Ser and Cys; Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and regulation of branched chain amino acids (concerted inhibition, allosteric regulation and enzyme multiplicity, sequential feed back) from oxaloacetate and pyruvate; Biosynthesis of aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc).

UNIT II PROTEIN TRANSPORT AND DEGRADATION
Protein targeting, signal sequence, secretion; Folding, Chaperons and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

UNIT III METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS
Biosynthesis of nucleotides, denovo and salvage pathways for purines and pyrimidines, regulatory mechanisms; Degradation of nucleic acid by exonuclease and endonuclease. Biosynthesis and degradation of starch and glycogen. Triacylglycerol and phospholipid biosynthesis and degradation; Cholesterol biosynthesis and regulation and targets and action of cholesterol lowering drugs.

UNIT IV VITAMINS AND COENZYMES

UNIT V HORMONES

Total : 45

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<td>1</td>
<td>Nelson, D.L et al.,</td>
<td>Lehninger’s Principles of Biochemistry</td>
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UNIT I  
BIOTECHNOLOGY  
9  

UNIT II  
ANIMAL BIOTECHNOLOGY  
9  

UNIT III  
PLANT BIOTECHNOLOGY  
9  

UNIT IV  
INDUSTRIAL & MICROBIAL BIOTECHNOLOGY  
9  

UNIT V  
BIOTECHNOLOGY & INTELLECTUAL PROPERTY RIGHTS ENVIRONMENT  
9  

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<td>1</td>
<td>Prof. P. K. Gupta</td>
<td>Elements of Biotechnology</td>
<td>2nd Edition (3rd Reprint)</td>
<td>2015-16</td>
</tr>
</tbody>
</table>
FOR SEMESTER VI (ELECTIVE-III & IV)

17BEBME6E01          PHYSIOLOGICAL MODELLING          3 0 0 3          100

UNIT I       PROPERTIES OF SYSTEMS AND ELECTRICAL ANALOG          9

UNIT II       TRANSFER FUNCTIONS          9
Transfer functions and its use, Study of transfer function of first order and second order systems, engineering concept in coupled system, example of Transformed signals.

UNIT III       IMPEDANCE CONCEPT          9
Transfer functions with impedance concept, prediction of performance, identification of the system from impedance function, periodic signals, relationship between transfer function and sinusoidal response, evaluation of transfer function from frequency response.

UNIT IV       FEEDBACK SYSTEMS          9
Characteristics of physiological feedback systems, stability analysis of systems.

UNIT V       SIMULATION OF BIOLOGICAL SYSTEMS          9
Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system, endocrinial system, functioning of receptors.

Total : 45

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<td>4</td>
<td>Douglas S.Regs</td>
<td>Control theory and physiological feedback mechanism</td>
<td>TheWilliam &amp; Williams co., Baltimore</td>
<td>1970</td>
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</table>
OBJECTIVES:
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.

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.

UNIT I  
TELEMEDICINE AND HEALTH  
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  

UNIT III  
TELEMEDICAL STANDARDS  

UNIT IV  
MOBILE TELEMEDICINE  
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  
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
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<td>1</td>
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<td>Introduction to Telemedicine. Royal Society of Medicine</td>
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<td>4</td>
<td>Simpson, W.</td>
<td>Video over IP, A practical guide to technology and applications</td>
<td>Focal Press Elsevier</td>
<td>2006</td>
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<tr>
<td>5</td>
<td>Bemmel, J.H. van, Musen, M.A.</td>
<td>Handbook of Medical Informatics</td>
<td>Springer</td>
<td>1997</td>
</tr>
<tr>
<td>6</td>
<td>Mohan Bansal</td>
<td>Medical Informatics</td>
<td>Tata McGraw-Hill</td>
<td>2004</td>
</tr>
</tbody>
</table>
AIM
To develop skills of the students in the area of Cancer Biology.

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.

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

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

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</thead>
</table>
COURSE OBJECTIVE

- To gain in depth knowledge of fundamentals of operational amplifier circuits
- To study the various applications using operational amplifiers.

UNIT 1  
INTRODUCTION TO OPAMP


UNIT 2  
APPLICATION OF OPAMPS

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

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


UNIT 5  
AMPLIFIERS


Total : 45

TEXT / REFERENCE BOOKS

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<tr>
<td>1</td>
<td>Ramakant A Gayakwad</td>
<td>Operational Amplifiers &amp; Linear Integrated Circuits</td>
<td>Prentice Hall</td>
<td>2000</td>
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<td>3</td>
<td>Roy Choudhary</td>
<td>Linear Integrated Circuits</td>
<td>New Age International (P) Ltd.</td>
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<td>Micro Electronics</td>
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<td>Robert Coughlin and Fredrer</td>
<td>Operational Amplifiers &amp; Linear Integrated Circuits</td>
<td>Prentice Hall</td>
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FOR SEMESTER VII (ELECTIVE-V)

17EBE7E01 REHABILITATION ENGINEERING  

OBJECTIVES:

<table>
<thead>
<tr>
<th>The student should be made to:</th>
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<tbody>
<tr>
<td>• Understand generation of x-rays and its uses in imaging.</td>
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<td>• Learn different types of radio diagnostic techniques.</td>
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<tr>
<td>• Know techniques used for visualizing different sections of the body.</td>
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<td>• Learn radiation therapy methodologies and the radiation safety.</td>
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OUTCOMES:

<table>
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<tr>
<th>At the end of the course, the student should be able to:</th>
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<tbody>
<tr>
<td>• Explain the different radio diagnostic and therapeutic techniques.</td>
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UNIT I MEDICAL X-RAY EQUIPMENT  

UNIT II COMPUTED TOMOGRAPHY  

UNIT III MAGNETIC RESONANCE IMAGING  
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  

UNIT V RADIATION THERAPY AND RADIATION SAFETY  

Total : 45
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<td>Myer Kutz</td>
<td>Standard handbook of Biomedical Engineering and</td>
<td>McGraw Hill</td>
<td>2003</td>
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<tr>
<td>4</td>
<td>P. Ragunathan</td>
<td>Magnetic Resonance Imaging and Spectroscopy in Medicine</td>
<td>-</td>
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</tbody>
</table>
OBJECTIVES:
The student should be made to:
- Be familiar with objective property of tissues
- Be exposed to Optical Holography

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Apply lasers in different areas of medicine.
- Explain the special techniques of Lasers.
- Use the Photonics instrumentation.

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

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<td>1</td>
<td>Leon Goldman, M.D., &amp; R.James Rockwell</td>
<td>Lasers in Medicine</td>
<td>Gordon and Breach, Science Publisher</td>
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<td>CRC Press, Bocaraton</td>
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<tr>
<td>2</td>
<td>Glasser, O.,</td>
<td>Medical Physics -- Vol 1, 2, 3</td>
<td>Adam Hilgar Brustol Inc</td>
<td>1987</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care.
- To make the students aware of the role of biomedical engineer in hospitals, especially in the management of electrical supply, maintenance of electrical safety.

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, QA 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

Total : 45

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<td>Principles of Hospital administration and Planning</td>
<td>JAYPEE Brothers, Medical Publishers</td>
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OBJECTIVES:
The student should be made to:
- Understand generation of x-rays and its uses in imaging.
- Learn different types of radio diagnostic techniques.
- Know techniques used for visualizing different sections of the body.
- Learn radiation therapy methodologies and the radiation safety.

OUTCOMES:
At the end of the course, the student should be able to:
- Explain the different radio diagnostic and therapeutic techniques.

UNIT I  MEDICAL X-RAY EQUIPMENT 9

UNIT II  COMPUTED TOMOGRAPHY 9

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

UNIT V  RADIATION THERAPY AND RADIATION SAFETY 9

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</tr>
</tbody>
</table>
FOR SEMESTER VIII (ELECTIVE-VI & VII)

17BEBME8E01 BIOLOGICAL SPECTROSCOPY 3 0 0 3 100

OBJECTIVE
To develop the skills of students in the area of Biological spectroscopy.

OUTCOMES:
At the end of the course, the student would have learnt about various kinds spectroscopic techniques to study biological system. This course is very effective in the area of Drug Design.

UNIT I OPTICAL ROTATORY DISPERSION 5

UNIT II NUCLEAR MAGNETIC RESONANCE 10

UNIT III MASS SPECTROMETRY 10
Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION 10

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

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Author(s) Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Campbell I.D and Dwek R.A</td>
<td>Biological Spectroscopy</td>
<td>Benjamin Cummins and Co</td>
<td>1986</td>
</tr>
</tbody>
</table>
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.

INTENDED OUTCOMES:

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

- Explain the basic concepts of working of robot
- Analyze the function of sensors in the robot
- Write a program to use a robot for a typical application
- Use Robots indifferent applications

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)

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS (9)

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)

Total : 45

TEXT BOOKS:

<table>
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<tr>
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</tr>
<tr>
<td>1</td>
<td>Deb.S.R</td>
<td>Robotics Technology and flexible Automation</td>
<td>John Wiley, USA</td>
<td>1992</td>
</tr>
<tr>
<td>3</td>
<td>McKerrow P.J</td>
<td>Introduction to Robotics</td>
<td>Addison Wesley, USA,</td>
<td>1991</td>
</tr>
<tr>
<td>5</td>
<td>Barry Leatham- Jones</td>
<td>Elements of industrial Robotics</td>
<td>PITMAN Publishing</td>
<td>1987</td>
</tr>
</tbody>
</table>
**OBJECTIVE:**
To study and gain the knowledge of Nanotechnology in the field of medicine.

**INTENDED OUTCOMES:**
After learning the course the students should be able to understand:
1. Applications of nanotechnology health care and medicine.
2. Importance of nanomaterials in drug delivery.
3. Application of nanomaterials and nanosystems in Medical Diagnostics and Therapeutics.
4. Application of nanotechnology in health monitoring systems.

---

**UNIT I**
**INTRODUCTION**
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**
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**
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**
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**
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.

**TEXT BOOK:**

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Tuan Vo-Dinh</td>
<td>Nanotechnology in Biology and Medicine: Methods, Devices and Applications</td>
<td>CRC press</td>
<td>2006</td>
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**REFERENCE BOOKS:**

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<tbody>
<tr>
<td>1</td>
<td>Chala Kumar</td>
<td>Bio functionalization of nanomaterials</td>
<td>Wiley</td>
<td>2005</td>
</tr>
<tr>
<td>2</td>
<td>Charles Pooles, Frank J. Ownes</td>
<td>Introduction to Nanotechnology</td>
<td>Wiley</td>
<td>2003</td>
</tr>
<tr>
<td>3</td>
<td>Bharat Bhushan</td>
<td>Handbook of Nanotechnology</td>
<td>Springer</td>
<td>2003</td>
</tr>
</tbody>
</table>
OBJECTIVES:
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

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

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)

Total: 45
### TEXT BOOKS:

<table>
<thead>
<tr>
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<tr>
<td>1</td>
<td>Bernhard O. Palsson, Sangeeta N. Bhatia</td>
<td>Tissue Engineering</td>
<td>Pearson Publishers</td>
<td>2009</td>
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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.

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.

UNIT I  BASIC CONCEPTS  9

UNIT II  SPEECH ANALYSIS  9

UNIT III  SPEECH MODELING  9

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
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<td>Lawrence Rabiner and Biing-Hwang Juang</td>
<td>Fundamentals of Speech Recognition</td>
<td>Pearson Education</td>
<td>2003</td>
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<tr>
<td>2</td>
<td>Daniel Jurafsky and James H Martin</td>
<td>Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition</td>
<td>Pearson Education</td>
<td>2002</td>
</tr>
<tr>
<td>3</td>
<td>Frederick Jelinek</td>
<td>Statistical Methods of Speech Recognition</td>
<td>MIT Press</td>
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<tr>
<td>1</td>
<td>Steven W. Smith</td>
<td>The Scientist and Engineer’s Guide to Digital Signal Processing</td>
<td>California Technical Publishing</td>
<td>1997</td>
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<tr>
<td>2</td>
<td>Thomas F Quatier</td>
<td>Discrete-Time Speech Signal Processing – Principles and Practice</td>
<td>Pearson Education</td>
<td>2004</td>
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<tr>
<td>3</td>
<td>Claudio Becchetti and Lucio Prina Ricotti</td>
<td>Speech Recognition</td>
<td>John Wiley and Sons</td>
<td>1999</td>
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</tbody>
</table>
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.

OUTCOME:
• To provide knowledge on different types of Rapid Prototyping systems and its
  applications in various fields

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

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
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<tr>
<td>1</td>
<td>Rafiq I. Noorani</td>
<td>Rapid Prototyping – Principles and Applications</td>
<td>Wiley &amp; Sons</td>
<td>2006</td>
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<td>1</td>
<td>N.HOPKINSON, R.J.M, HAUGE, P M, DICKENS</td>
<td>Rapid Manufacturing – An Industrial revolution for the digital age</td>
<td>Wiley</td>
<td>2006</td>
</tr>
<tr>
<td>2</td>
<td>IAN GIBSON</td>
<td>Advanced Manufacturing Technology for Medical Applications</td>
<td>Wiley</td>
<td>2006</td>
</tr>
<tr>
<td>4</td>
<td>D.T.Pham and S.S. Dimov</td>
<td>Rapid Manufacturing</td>
<td>Springer Verlog</td>
<td>2001</td>
</tr>
</tbody>
</table>
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.

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.

UNIT I MEMS MATERIALS AND FABRICATION
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
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
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
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
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
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<tbody>
<tr>
<td>3</td>
<td>Chang Liu,</td>
<td>Foundations of MEMS</td>
<td>Pearson Education International, New Jersey, USA</td>
<td>2006</td>
</tr>
</tbody>
</table>
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.

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
- 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

UNIT II PATENTS, COPYRIGHTS AND TRADEMARKS

UNIT III INTERNATIONAL STANDARDISATION

UNIT IV INDIAN STRATEGIES

UNIT V CASE STUDIES
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
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<tbody>
<tr>
<td>1</td>
<td>Eli Whitney</td>
<td>United States Patent Number: 72X</td>
<td>Cotton Gin</td>
<td>March 14, 1794</td>
</tr>
<tr>
<td>2</td>
<td>Derwent IP Matters</td>
<td>Using the Internet for non-patent prior art searches</td>
<td>-</td>
<td>July 2000.</td>
</tr>
</tbody>
</table>
OBJECTIVE
- To impart adequate knowledge on the presentation and structures of artificial intelligence and to study in depth about the expert systems and its tools.

UNIT I  AI & INTERNAL REPRESENTATION  9

UNIT2  KNOWLEDGE REPRESENTATION  9

UNIT3  SLOT & FILLER STRUCTURES  9

UNIT4  EXPERT SYSTEMS  9

UNIT5  TOOLS FOR BUILDING EXPERT SYSTEMS  9

Total : 45

TEXT/REFERENCE BOOKS

<table>
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<tr>
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</table>
OBJECTIVES:
The student should be made to:
- Understand biological and statistical foundations of neural networks,
- Learn Perceptron, MLPs, SVMs, RBFN and competitive learning

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.

UNIT I  NEURON MODEL NETWORK ARCHITECTURE  9

UNIT II  LEARNING PROCESS  9

UNIT III  PERCEPTRONS  9

UNIT IV  ATTRACTOR NEURAL NETWORK AND ART  9

UNIT V  PRINCIPAL COMPONENT ANALYSIS AND SELF ORGANIZATION 9

TOTAL: 45
## TEXT BOOKS:

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<tr>
<td>2</td>
<td>Laurene Fausett</td>
<td>Fundamentals of Neural Networks: Architectures, Algorithms, and Applications</td>
<td>Pearson/ Prentice Hall</td>
<td>-</td>
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<tr>
<td>1</td>
<td>Simon Haykin</td>
<td>Neural Networks and Learning Machines</td>
<td>3rd Edition-Pearson/ Prentice Hall</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td>Robert J Schalkoff</td>
<td>Artificial Neural Networks</td>
<td>McGraw Hill</td>
<td>1997</td>
</tr>
</tbody>
</table>
LIST OF OPEN ELECTIVES OFFERED BY
SCIENCE AND HUMANITIES DEPARTMENT

17BESHOE01 PROBABILITY AND RANDOM PROCESS 3 0 0 3 100

OBJECTIVES:

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

INTENDED 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.

UNIT I MEASURES OF CENTRAL TENDENCY AND PROBABILITY (9)
Measures of central tendency – Mean, Median, Mode - Standard Deviation

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)

Total: 45
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<tbody>
<tr>
<td>1</td>
<td>Ross, S</td>
<td>A first Course in Probability</td>
<td>Pearson Education, New Delhi (Chap 2 to 8)</td>
<td>2012</td>
</tr>
</tbody>
</table>

WEBSITES:

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

- To know the fundamentals of fuzzy Algebra.
- To know the basic definitions of fuzzy theory
- To know the applications of fuzzy Technology

INTENDED OUTCOME:

- The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I  FUZZY SETS  (9)

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)

UNIT V  FUZZY INFERENCE  (9)
Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Total: 45

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<td>Michal Baczynski and Balasubramaniam Jayaram</td>
<td>Fuzzy Implications</td>
<td>Springer-Verlag publishers, Heidelberg</td>
<td>2008</td>
</tr>
<tr>
<td>3</td>
<td>Kevin M Passino and Stephen Yurkovich</td>
<td>Fuzzy Control</td>
<td>Addison Wesley Longman publishers, USA</td>
<td>1998</td>
</tr>
</tbody>
</table>

## WEBSITES:

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

- To know the fundamentals of linear Algebra.
- To study about the linear transformations
- To introduce the concepts of inner product spaces

INTENDED OUTCOMES:

The student will be able to

- Recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
- Visualize linear transformations as matrix form
- Articulate the importance of Linear Algebra and its applications in branches of Mathematics

UNIT I VECTOR SPACES

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space,

UNIT II EIGEN VALUES AND EIGEN VECTORS

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

UNIT III SYSTEM OF LINEAR EQUATIONS


UNIT IV LINEAR TRANSFORMATIONS

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors

UNIT V INNER PRODUCT SPACES

The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

TEXTBOOKS:

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<tr>
<th>S.NO.</th>
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<tbody>
<tr>
<td>3</td>
<td>Jim Defranza, Daniel Gagliardi</td>
<td>Introduction to Linear Algebra with Application</td>
<td>Tata McGraw-Hill, New Delhi.</td>
<td>2008</td>
</tr>
</tbody>
</table>

WEBSITES:

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

- To provide mathematical basis for acoustics waves and the characteristic behaviour of sound in pipes, resonators and filters.
- To introduce the properties of hearing and speech.

INTENDED OUTCOME:

- The students will have the knowledge on acoustics waves, the characteristic behaviour of sound in pipes, resonators and filters and that knowledge will be used by them in different engineering and technology applications.

UNIT I INTRODUCTION

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES
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

UNIT IV ARCHITECTURAL ACOUSTICS

UNIT V TRANSDUCTION
Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker– horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

Total: 45
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</thead>
</table>

**WEBSITES:**

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

- To understand about the solid waste.
- To study about the waste treatment.
- To gain knowledge on the disposal of waste and waste management.
- To get the information on energy conservation.

INTENDED OUTCOME:

- The students will know solid waste and energy conservation. They will understand the methodologies to disposal of solid waste and its management.

UNIT I  SOLID WASTE

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

UNIT III  WASTE DISPOSAL

UNIT IV  HAZARDOUS WASTE MANAGEMENT

UNIT V  ENERGY GENERATION FROM WASTE

Total: 45

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</tr>
</thead>
</table>

# WEBSITES:

2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
4. nzic.org.nz/Chem Processes/environment/
OBJECTIVES:
- To understand about the green chemistry.
- To study the atom efficient process and synthesis elaborately.
- To gain knowledge on the green technology and renewable energy resources.
- To get the information on catalysis.

INTENDED OUTCOME:
- Students will know the chemistry and application of green technology for energy sources. They will understand the role of green catalyst in industries.

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
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<tbody>
<tr>
<td>1</td>
<td>Sanjay K. Sharma, AckmezMudhoo</td>
<td>Green Chemistry for Environmental Sustainability</td>
<td>CRC Press, London</td>
<td>2010</td>
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1. [http://www.organic-chemistry.org/topics/green-chemistry.shtm](http://www.organic-chemistry.org/topics/green-chemistry.shtm)
2. [http://www.essentialchemicalindustry.org/processes/green-chemistry.html](http://www.essentialchemicalindustry.org/processes/green-chemistry.html)
4. [http://www.epa.gov/research/greenchemistry/](http://www.epa.gov/research/greenchemistry/)
5. [http://www.amazon.in/Green-Chemistry-Catalysis](http://www.amazon.in/Green-Chemistry-Catalysis)
OBJECTIVES:

- To get the information on electrochemical material.
- To study about the conducting polymers.
- To understand about the fuel.
- To gain knowledge on the batteries and power sources.

INTENDED OUTCOME:

- Students will understand about the fuel. They will get knowledge on the batteries and power sources.

UNIT I METAL FINISHING


UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS

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

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

UNIT IV BATTERIES AND POWER SOURCES-II

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

Solar cells- Preparation of CdS/Cu₂S 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.

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<tr>
<td>1</td>
<td>M. Barak</td>
<td>Electrochemical Power Sources</td>
<td>IEEE series, Peter Peregrinius Ltd, Steverage, U.K.</td>
<td>1997</td>
</tr>
<tr>
<td>2</td>
<td>Bruno Scrosati</td>
<td>Applications of Electroactive Polymers</td>
<td>Chapman &amp; Hall, London</td>
<td>1993</td>
</tr>
</tbody>
</table>

### WEBSITES:

2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
OBJECTIVES:

- To understand about the fuel.
- To study about the abrasives and lubricants.
- To gain knowledge on inorganic chemicals and explosive materials.
- To get the information on agriculture chemicals.

INTENDED OUTCOME:

- The student will acquire basic knowledge on cement. The student will understand the interaction of engineering materials and their utilization in industries.

UNIT I  CEMENT AND LIME


UNIT II  ABRASIVES AND REFRACTORIES


UNIT III  INORGANIC CHEMICALS


UNIT IV  EXPLOSIVES


UNIT V  AGRICULTURE CHEMICALS


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<tr>
<td>1</td>
<td>Harikrishan</td>
<td>Industrial Chemistry</td>
<td>Goel Publishing House, Meerut.</td>
<td>2014</td>
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**REFERENCES:**

**WEBSITES:**

2. [http://www.hon.ch/HONselect/Selection/D01.html](http://www.hon.ch/HONselect/Selection/D01.html)
Purposes: 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.

Objectives:

- Develop abilities to write technically and expressively.
- Recognize writing as a constructive, meaningful process.
- Practise using reading strategies for effective writing.

Intended 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.

Unit I Basics of Writing

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing – Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer’s block – Prioritizing for effective writing– Avoiding plagiarism.

Unit II Paragraphs and Essays


Unit III Letters, Memos and Email


Unit IV The Art of Condensation and Technical Proposals


Unit V Reports and Research Articles


Total: 45
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</thead>
<tbody>
<tr>
<td>1</td>
<td>V.N. Arora &amp; Lakshmi</td>
<td>Improve Your Writing: Revised First Edition</td>
<td>OUP</td>
<td>2014</td>
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<tr>
<td>1</td>
<td>Crème, P. and M. Lea.</td>
<td>Writing at University: A guide for students.</td>
<td>OUP</td>
<td>2003</td>
</tr>
<tr>
<td>2</td>
<td>Graham King</td>
<td>Collins Improve Your Writing</td>
<td>Collins; First edition</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>David Morley</td>
<td>The Cambridge Intro. To Creative Writing</td>
<td>Cambridge</td>
<td>2008</td>
</tr>
</tbody>
</table>

**WEBSITES:**

2. [http://www.nyu.edu/classes/keefer/brain/net2.html](http://www.nyu.edu/classes/keefer/brain/net2.html)
LIST OF OPEN ELECTIVES OFFERED BY
COMPUTER SCIENCE ENGINEERING DEPARTMENT

17BECSEO01 INTERNET PROGRAMMING

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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

UNIT I INTRODUCTION

UNIT II HTML

UNIT III PERL

UNIT IV CLIENT-SERVER PROGRAMMING
UNIT V  INTERNET TELEPHONY


Total: 45

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<tbody>
<tr>
<td>1.</td>
<td>Rahul Banerjee</td>
<td>Internetworking Technologies, An Engineering Perspective</td>
<td>PHI Learning, Delhi</td>
<td>2011</td>
</tr>
</tbody>
</table>
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.

UNIT I  INTRODUCTION


UNIT II  CREATING ANIMATION IN FLASH


UNIT III  3D ANIMATION & ITS CONCEPTS


UNIT IV  MOTION CAPTION


UNIT V  CONCEPT DEVELOPMENT

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

Total: 45

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<tbody>
<tr>
<td>1.</td>
<td>Ranjan Parekh</td>
<td>Principles of Multimedia</td>
<td>TMH</td>
<td>2007</td>
</tr>
</tbody>
</table>
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.

UNIT I INTRODUCTION

UNIT II PERIPHERAL DEVICES

UNIT III PC HARDWARE OVERVIEW

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE

UNIT V TROUBLESHOOTING

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<tr>
<td>1.</td>
<td>B. Govindarajalu</td>
<td>IBM PC Clones Hardware, Troubleshooting and Maintenance</td>
<td>TMH</td>
<td>2002</td>
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<tbody>
<tr>
<td>1.</td>
<td>Peter Abel, Niyaz Nizamuddin</td>
<td>IMB PC Assembly Language and Programming</td>
<td>Pearson Education</td>
<td>2007</td>
</tr>
<tr>
<td>2.</td>
<td>Scott Mueller</td>
<td>Repairing PC’s</td>
<td>PHI</td>
<td>1992</td>
</tr>
</tbody>
</table>
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

UNIT I  INTRODUCTION TO JAVA
- Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method

UNIT II  PACKAGES

UNIT III  I/O STREAMS

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

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

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<tr>
<td>2.</td>
<td>Timothy Budd</td>
<td>Understanding Object-oriented programming with Java Updated Edition</td>
<td>Pearson Education</td>
<td>2002</td>
</tr>
</tbody>
</table>

WEBSITES:

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.

INTENDED OUTCOMES:

- At the end of the course the student will be understand the concept of electric hybrid vehicle and its energy storage schemes.

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 Motor 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
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<tbody>
<tr>
<td>1</td>
<td>Iqbal Hussein</td>
<td>Electric and Hybrid Vehicles: Design Fundamentals</td>
<td>CRC Press – 2nd edition</td>
<td>2010</td>
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OBJECTIVES:

- To gain the knowledge about energy management.
- To understand the basic concepts in economic analysis in energy management.
- To understand the basic principles of energy audit.

INTENDED OUTCOME:

- At the end of the course the student will be able to understand the concept of energy efficient motors, economic crisis and energy management.

UNIT I ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting – Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II ECONOMIC ASPECTS AND ANALYSIS

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV ENERGY EFFICIENT MOTORS

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-


UNIT V POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS


Total: 45

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<tr>
<td>1</td>
<td>John.C.Andreas</td>
<td>Energy Efficient Electric Motors</td>
<td>Marcel Dekker Inc Ltd – 3rd edition</td>
<td>2005</td>
</tr>
</tbody>
</table>
PROGRAMMABLE LOGIC CONTROLLER

OBJECTIVES:
- To understand the basic principles of PLC systems.
- To gain the knowledge about data handling functions.
- To understand the principles of PID.

INTENDED 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.

UNIT I  INTRODUCTION
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II  PLC PROGRAMMING
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III  REGISTERS AND PLC FUNCTIONS
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV  DATA HANDLING FUNCTIONS
Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V  PID PRINCIPLES
Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

Total: 45

TEXTBOOK:

<table>
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<tbody>
<tr>
<td>1</td>
<td>John Webb and Ronald A Reiss</td>
<td>Programmable Logic Controllers – Principle and Applications</td>
<td>Fifth edition, PHI</td>
<td>2004</td>
</tr>
</tbody>
</table>

WEBSITE:

1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,-
   Introduction to programmable Logic controller.
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 understand the basic principles fuel cell, Geo thermal power plants.
- To gain the knowledge about hydro energy.

INTENDED OUTCOME:

- At the end of the course student understands about all types of energy sources and utilization.

UNIT I INTRODUCTION

UNIT II SOLAR ENERGY

UNIT III WIND ENERGY

UNIT IV HYDRO ENERGY
Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES
Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Total: 45

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<tbody>
<tr>
<td>1</td>
<td>Rai.G.D</td>
<td>Non-conventional sources of energy</td>
<td>Khanna publishers</td>
<td>2011</td>
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<tr>
<td>1</td>
<td>Rao.S. &amp; Parulekar</td>
<td>Energy Technology</td>
<td>Khanna publishers, Eleventh Reprint</td>
<td>2013</td>
</tr>
</tbody>
</table>

**WEBSITES:**

1. [www.energycentral.com](http://www.energycentral.com)
2. [www.catelectricpowerinfo.com](http://www.catelectricpowerinfo.com)
LIST OF OPEN ELECTIVES OFFERED BY
ELECTRONICS AND COMMUNICATION ENGINEERING

17BEECOE01 REAL TIME EMBEDDED SYSTEMS L T P C 100
                                  3 0 0 3

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

INTENDED OUTCOMES:

• Ability to understand embedded systems, its hardware and software.
• Gain knowledge about devices and buses used for embedded networking.
• Gain knowledge 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 System Architecture (CISC and RISC)-Categories of Embedded Systems-
embedded processor selection &tradeoffs- Embedded design life cycle -Product specifications-
hardware / software partitioning- iterations and implementation- hardware software integration –
product testing techniques–ARM7.

UNIT-II  OPERATING SYSTEM OVERVIEW 9
Introduction–Advantage and Disadvantage of Using RTOS– Multitasking– Tasks– Real Time Kernels –
Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- Reentrant Functions–
Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion– Deadlock– Inter-
task Communication– Message Mailboxes– Message Queues– Interrupts– Task Management–
Memory Management– Time Management– Clock Ticks.

UNIT-III  TASK MANAGEMENT 9
Introduction-μ C/OS-II Features- Goals of μ C/OS-II Hardware and Software Architecture–Kernel
μ C/OS-II – Clock Tick–μ C/OS-II Initialization. Task Management: Creating Tasks– Task Stacks–
Stack Checking– Task’s Priority– Suspending Task– Resuming Task. Time Management: Delaying
a Task– Resuming a Delayed Task– System Time. Event Control Blocks- Placing a Task in the ECB
Wait List– Removing a Task from an ECB wait List.

UNIT-IV  SEMAPHORE MANAGEMENT AND MESSAGE PASSING 9
Semaphore Management: Semaphore Management Overview– Signaling a Semaphore.
Message Mailbox Management: Creating a Mailbox– Deleting Mailbox– Waiting for a Message
box– Sending Message to a Mailbox– Status of Mailbox. Message Queue Management: Creating
Message Queue– Deleting a Message Queue– Waiting for a Message Queue– Sending Message to a
Queue – Flushing a Queue.

UNIT-V MEMORY MANAGEMENT


Total: 45

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<tr>
<td>1</td>
<td>Jean J. Labrosse</td>
<td>Micro C/OS–II The Real Time Kernel</td>
<td>CMPBOOKS</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>Steve Furbe.</td>
<td>ARM System-on-Chip Architecture,</td>
<td>Addison-Wesley Professional, California</td>
<td>2000</td>
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</thead>
</table>
OBJECTIVES:

- To study about various speakers and microphone
- To learn the fund a mental of television systems and standards
- To learn the process of audio recording and reproduction
- To study the various telephone networks

INTENDED OUTCOMES:

- Gain knowledge about various speakers and microphone
- Gain knowledge about the fundamental of television systems and standards
- Gain knowledge about the process of audio recording and reproduction
- Gain knowledge about the various telephone networks

UNIT I LOUDSPEAKERS AND MICROPHONES 9

UNIT II TELEVISION STANDARDS AND SYSTEMS 9

UNIT III OPTICAL RECORDING AND REPRODUCTION 9

UNIT IV TELECOMMUNICATION SYSTEMS 9

UNIT V 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

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<tr>
<td>1</td>
<td>S.P. Bali</td>
<td>Consumer Electronics</td>
<td>PearsonEducation</td>
<td>2007</td>
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<tr>
<td>2</td>
<td>J.S.Chitode</td>
<td>Consumer Electronics</td>
<td>Technical</td>
<td>2007</td>
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<td>1</td>
<td>Philip Hoff, Philip Herbert Hoff.</td>
<td>Consumer Electronics for Engineers.</td>
<td>Cambridge University Press</td>
<td>1998</td>
</tr>
</tbody>
</table>
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.

INTENDED OUTCOMES:

- Understand the basic concepts of neural networks and its applications in various domain
- Ability to develop the use of Soft Computing to solve real-world problems
- Understand the Basic Neural Network.

UNIT I INTRODUCTION TO NEURAL NETWORKS
Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT II LEARNING PROCESS

UNIT III PERCEPTION

UNIT IV ATTRACT OR NEURAL NETWORK AND ART

UNIT V SELF ORGANIZATION

Total: 45

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<table>
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<tr>
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<tr>
<td>1</td>
<td>Simon Haykin</td>
<td>Neural Networks and Learning Machines</td>
<td>Pearson/Prentice Hall 3rd Edition</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td>Satish Kumar</td>
<td>Neural Networks: A Classroom Approach</td>
<td>TMH</td>
<td>2008</td>
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<td>S.NO.</td>
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<td>3</td>
<td>Wasserman P.D</td>
<td>Neural Computing Theory &amp; Practice</td>
<td>Van Nortrand Reinhold</td>
<td>1989</td>
</tr>
<tr>
<td>4</td>
<td>Freeman J.A., Skapura D.M</td>
<td>Neural networks, algorithms, applications, and programming techniques.</td>
<td>AdditionWesley</td>
<td>2005</td>
</tr>
</tbody>
</table>
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.

INTENDED OUTCOMES:

- Understand the basic concepts of Fuzzy logic and its applications in various domain
- Ability to develop how to use Fuzzy computation to solve real-world problems
- Understand basic fuzzy models.

UNIT I
Basics of Fuzzy Logic: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II
Theory of Approximate Reasoning: Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III
Fuzzy Knowledge Based Controllers (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

UNIT V
Fuzzy based systems: Simple applications of FKBC-washing machines-traffic regulations-lift control-fuzzy in medical Applications-Introduction to ANFIS.

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<tbody>
<tr>
<td>2</td>
<td>G.J. Klirand T.A. Folger</td>
<td>Fuzzy Sets Uncertainty and Information</td>
<td>PHI IEEE</td>
<td>1995</td>
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<tr>
<td>1</td>
<td>Timothy J. Ross</td>
<td>Fuzzy Logic with Engineering Applications</td>
<td>McGraw Hill</td>
<td>1997</td>
</tr>
<tr>
<td>2</td>
<td>George. J Klir and Bo Yuan</td>
<td>Fuzzy Sets and Fuzzy Logic</td>
<td>Prentice Hall, USA</td>
<td>1995</td>
</tr>
</tbody>
</table>
LIST OF OPEN ELECTIVES OFFERED BY
BIO TECHNOLOGY DEPARTMENT

17BTBTOE01  BIOREACTOR DESIGN  L T P C
              3003

OBJECTIVES:
- To understand the basic design of bioreactors
- To understand the principle of heat transfer inside a bioreactor

INTENDED 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.

UNIT I  ENGINEERING PROPERTIES AND STORAGE TANK  9
Introduction to various mechanical properties of materials to be used, material of construction, design of cylindrical storage tank.

UNIT II  REACTOR DESIGN  9
Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III  HEAT TRANSFER EQUIPMENTS  9
Design of Shell and tube heat exchanger, Double pipe heat exchanger, Long tube vertical evaporator and forced circulation evaporator.

UNIT IV  MASS TRANSFER EQUIPMENTS  9
Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber.

UNIT V  SEPARATION EQUIPMENTS  9
Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotary drum drier and Swenson–Walker crystallizer.

Total: 45
### TEXTBOOKS:

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<tr>
<td>2</td>
<td>Don W. Green, Robert H. Perry</td>
<td>Chemical Engineer Handbook</td>
<td>The McGraw-Hill Companies, Inc.</td>
<td>2008</td>
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<tbody>
<tr>
<td>1</td>
<td>Pauline M. Doran</td>
<td>Bioprocess Engineering Principles</td>
<td>Academic Press</td>
<td>2013</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the importance of food processing
- To make the students learn the various processing and preservation techniques.

INTENDED OUTCOMES:
- The students are exposed to:
  - Properties of food material.
  - Various methods used for preserving fruits and vegetables.

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

UNIT III  FOOD CONVERSION OPERATIONS  9
Size reduction - Fibrous foods, dry foods and liquid foods - Theory and equipment - Membrane separation - Filtration - Equipment and application.

UNIT IV  FOOD PRESERVATION BY COOLING  9
Refrigeration, Freezing - Theory, Freezing time calculation, methods of freezing, freezing equipment, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V  PRESERVATION METHODS FOR FRUITS AND VEGETABLES  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
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<tr>
<td>3</td>
<td>Mircea EnachescuDauthy</td>
<td>Fruit and Vegetable Processing</td>
<td>FAO Agricultural Services Bulletin no. 119</td>
<td>1995</td>
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<tr>
<td>1</td>
<td>M.A. Rao, Syed S.H. Rizvi, Ashim K. Datta</td>
<td>Engineering properties of foods</td>
<td>CRC Press</td>
<td>2005</td>
</tr>
<tr>
<td>2</td>
<td>B. Sivasankar</td>
<td>Food processing and preservation</td>
<td>PHI Learning Pvt. Ltd</td>
<td>2002</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To enable the students to get aware of available tools and databases for performing research in bioinformatics.
- To provide the thorough understanding of protein structure in detail.

INTENDED 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.

UNIT I  OVERVIEW OF BIOINFORMATICS
The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases—contents, structure & annotation: file formats; annotated sequenced databases; miscellaneous databases.

UNIT II  RETRIEVAL OF BIOLOGICAL DATA
Data retrieval with Entrez & DBGET/LinkDB; data retrieval with SRS (sequence retrieval system). Searching sequenced databases by sequences similarity criteria; sequences similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families; multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III  PHYLOGENETICS
Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV  STRUCTURAL BIOINFORMATICS
Conceptual model of protein structure; the relationship of protein in three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.
UNITV MICROARRAYDATAANALYSIS

Microarray data, analysis methods; microarray data tools & resources; sequencing & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharmainformatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

Total: 45

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<td>1</td>
<td>Dan E. Krane, Michael Rayme</td>
<td>Fundamental Concepts of Bioinformatics</td>
<td>Pearson Education</td>
<td>2004</td>
</tr>
<tr>
<td>3</td>
<td>David W. Mount</td>
<td>Sequence and Genome Analysis</td>
<td>Cold Spring Harbor Laboratory</td>
<td>2004</td>
</tr>
<tr>
<td>4</td>
<td>Jonathan Pevsner</td>
<td>Bioinformatics and Functional Genomics</td>
<td>Wiley-Liss</td>
<td>2003</td>
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<tr>
<td>1</td>
<td>Michael J. Korenberg</td>
<td>Microarray Data Analysis: Methods and Applications</td>
<td>Springer Science &amp; Business Media</td>
<td>2007</td>
</tr>
</tbody>
</table>
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.

INTENDED 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.

UNIT I INTRODUCTION (9)

UNIT II NANO PARTICLES (9)

UNIT III APPLICATIONS (9)

UNIT IV NANO BIOTECHNOLOGY (9)
Clinical applications of nanodevices, Artificial neurons, Real-time nanosensors - Applications in cancer biology, Nanomedicine, Synthetic retinyl chips based on bacteriorhodopsins, High throughput DNA sequencing with nanocarbontubules, Nanosurgical devices.

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY (9)

Total: 45
**TEXTBOOKS:**

<table>
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<th>S.NO.</th>
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<tr>
<td>1</td>
<td>Niemeyer,C.M. and Mirkin,C.A</td>
<td>Nanobiotechnology: Concepts, Applications and</td>
<td>Wiley-VCH</td>
<td>2004</td>
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<tr>
<td>2</td>
<td>Goodsell,D.S.</td>
<td>Bionanotechnology</td>
<td>John Wiley and Sons, Inc</td>
<td>2004</td>
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<tr>
<td>2</td>
<td>Bhushan,B.</td>
<td>Springer Handbook of Nanotechnology</td>
<td>Springer-Verlag Berlin Heidelberg</td>
<td>2004</td>
</tr>
<tr>
<td>3</td>
<td>Freitas Jr, R.A.</td>
<td>Nanomedicine</td>
<td>Landes Biosciences</td>
<td>2004</td>
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</tbody>
</table>
# LIST OF OPEN ELECTIVES OFFERED BY MECHANICAL ENGINEERING DEPARTMENT

**17BEMEOE01 COMPUTER AIDED DESIGN**

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**OBJECTIVE:**
- To provide an overview of how computers are being used in mechanical component design

## 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

## UNIT III  GEOMETRIC MODELING  9

## UNIT IV  PARAMETRIC DESIGN AND OBJECT REPRESENTATION  9

## UNIT V  PRODUCT DESIGN AND DEVELOPMENT  9

Total: 45
### TEXTBOOKS:

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<tr>
<td>2</td>
<td>Radhakrishnan P and Subramanyan S</td>
<td>CAD/CAM/CIM</td>
<td>New Age International Pvt. Ltd</td>
<td>2004</td>
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<th>Year of Publication</th>
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</thead>
</table>
OBJECTIVE

- Upon completion of this course, the students can able to understand the role of logistics and understand the phases of supply chain

UNIT I INTRODUCTION TO LOGISTICS
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
The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS

UNIT IV SUPPLY CHAIN ACTIVITIES
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
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:

<table>
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<tr>
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<tbody>
<tr>
<td>2</td>
<td>Steudel H.J and Desruelle P</td>
<td>Manufacturing in the nineteen - How to become a mean, lean and world class competitor</td>
<td>Van Nostrand Reinhold, New York</td>
<td>1992</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- Upon completion of this course, the students can able to understand the relationship between free energy, entropy, internal energy, and enthalpy.

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
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<tbody>
<tr>
<td>1</td>
<td>Geankoplis, C. J</td>
<td>Transport Processes and Separation Processes Principles</td>
<td>Prentice Hall</td>
<td>2003</td>
</tr>
</tbody>
</table>

### WEB REFERENCE:

1. [https://laulima.hawaii.edu/portal](https://laulima.hawaii.edu/portal)
OBJECTIVE:

- Biomechanics provides key information on the most effective and safest movement patterns, equipment, and relevant exercises to improve human movement.

UNIT I INTRODUCTION
Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS
Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

UNIT IV ANATOMICAL DESCRIPTION
Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

REFERENCES:

<table>
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<tr>
<td>1</td>
<td>Duane Knudson</td>
<td>Fundamentals of Biomechanics</td>
<td>Springer Science+ Business Media, LLC</td>
<td>2007</td>
</tr>
<tr>
<td>2</td>
<td>C. Ross Ethier, Craig A. Simmons</td>
<td>Introductory Biomechanics</td>
<td>Cambridge University Press</td>
<td>2007</td>
</tr>
</tbody>
</table>

Total: 45
LIST OF OPEN ELECTIVES OFFERED BY
AEROSPACE ENGINEERING DEPARTMENT

17BTAROE01 NON-DESTRUCTIVE TESTING L T P C 3 0 0 3

OBJECTIVES:

- To provide in-depth knowledge on various techniques of non-destructive testing.

UNIT I INTRODUCTION
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
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

UNIT IV EDDY CURRENT AND ELECTRO-MAGNETIC METHODS

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS
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

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</table>

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/
OBJECTIVES:

- Ability to design UAV system
- Ability to identify different hardware for 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

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

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<tr>
<td>1.</td>
<td>Re1 Austin</td>
<td>Unmanned Aircraft Systems UAV design, development and deployment</td>
<td>John Wiley &amp; Sons New York</td>
<td>2011</td>
</tr>
<tr>
<td>2.</td>
<td>Jay Gundlach</td>
<td>Designing Unmanned Aircraft Systems</td>
<td>American Institute of Aeronautics and Astronautics,Reston</td>
<td>2014</td>
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**WEB REFERENCE:**

1. www.draganfly.com/.../introduction-to-unmanned-aerial-vehicles-uavs/  
   rahauav.com/Library/.../Unmanned-Air-Systems  
   spaceflight.nasa.gov/shuttle/reference/shutref/orbiter/.../plcomm.html  
3. www.theuav.com/
OBJECTIVES:

- To study the procedure of the formation of aerodrome, its design and the concepts of air transportation.

UNIT I  INTRODUCTION
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
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.


UNIT III  PRINCIPLES OF AIRLINES SCHEDULING
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

UNIT V  VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES
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
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### WEB REFERENCE:

1. www.grc.nasa.gov/WWW/k-12/airplane/
4. www.britannica.com/EBchecked/topic/.../Aircraft-configurations
5. www.brown.edu/Departments/EEB/EML/.../principles_flight.html
OBJECTIVES:

- To introduce the basic concepts of various avionics systems of aircraft.

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

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

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

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<tr>
<td>1.</td>
<td>Ian Moir, Allan Seabridge, Malcolm Jukes</td>
<td>Civil Avionics Systems</td>
<td>John Wiley &amp; Sons, New Jersey, USA.</td>
<td>2013</td>
</tr>
</tbody>
</table>

WEB REFERENCES:

1.  [www.ntps.edu/courses/116-introduction-to-avionics-systems-course](http://www.ntps.edu/courses/116-introduction-to-avionics-systems-course)
2.  [www.ece.ucsb.edu/courses/ECE152/152A_Su11Shynk/Lec1.pdf](http://www.ece.ucsb.edu/courses/ECE152/152A_Su11Shynk/Lec1.pdf)
4.  [www.pbase.com/bruceleibowitz/cockpit](http://www.pbase.com/bruceleibowitz/cockpit)
5.  [www.cranfield.ac.uk/soe/shortcourses/.../avionics-introduction.html](http://www.cranfield.ac.uk/soe/shortcourses/.../avionics-introduction.html)
LIST OF OPEN ELECTIVES OFFERED BY
AUTOMOBILE ENGINEERING DEPARTMENT

17BEAOE01    AUTOMOBILE ENGINEERING    L T P C
             3 0 0 3

INTENDED OBJECTIVES:

- This course enables the students to know about all the main and auxiliary systems of automobile with its base construction and working.

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

UNITIII  SUSPENSION SYSTEM   9

UNITIV  BRAKES   9

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:**

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<tbody>
<tr>
<td>3.</td>
<td>Dr.Kirpal Singh</td>
<td>Automobile Engineering</td>
<td>Standard Publishes</td>
<td>2011</td>
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</table>

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</table>
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.

UNIT I INTRODUCTION

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

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

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

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

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.

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</table>
OBJECTIVES:

- The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.

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

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</table>
OBJECTIVES:

- This course enables the students to have a knowledge about the recent technologies that is in use in automobile.

UNIT I  TRENDS IN POWER PLANTS  9

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

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<tr>
<td></td>
<td>Bechhold,</td>
<td>“Understanding Automotive Electronics”</td>
<td>SAE</td>
<td>1998</td>
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LIST OF OPEN ELECTIVES OFFERED BY
CIVIL ENGINEERING DEPARTMENT

17BECEOE01 HOUSING, PLAN AND MANAGEMENT L T P C 3 0 0 3

OBJECTIVE:

- At the end of the this course the students should have learnt the basic terms of housing programmes, planning and designing of housing projects, construction techniques and cost effective materials and housing finance and 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

Total: 45
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<tbody>
<tr>
<td>2.</td>
<td>Francis Cherunilam and Odeyar D Hegge</td>
<td>Housing in India</td>
<td>Himalaya Publishing House, Bombay</td>
<td>2001</td>
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<td>1.</td>
<td>Development Control Rules for Chennai Metropolitan Area,CMAM Chennai</td>
<td>2002</td>
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<tr>
<td>2.</td>
<td>UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi</td>
<td>2000</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- At the end of this course the students should have learnt various machineries of construction, electrical systems in building, design and principle of illumination, refrigeration principle and application and various fire safety installations.

UNIT I  MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II  ELECTRICAL SYSTEMS IN BUILDINGS


UNIT III  PRINCIPLES OF ILLUMINATION & DESIGN


UNIT IV  REFRIGERATION PRINCIPLES & APPLICATIONS


UNIT V  FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel
ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

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<td>2.</td>
<td>Handbook for Building Engineers in Metric systems</td>
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<td>NBC, New Delhi</td>
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**Total:** 45
OBJECTIVE:

- At the end of this course the students should have learnt the irrigation system requirements, irrigation scheduling, strategies in water use management, canal operation places and involvement of stake holder.

UNIT I  IRRIGATION SYSTEM REQUIREMENTS  9

UNIT II  IRRIGATION SCHEDULING  9

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

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<tr>
<td>1.</td>
<td>Maloney, C. and Raju, K.V</td>
<td>Managing Irrigation TogetherPractice</td>
<td>Stage Publication, New Delhi, India</td>
<td>2000</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- At the end of this course, the students should have learnt the modern construction methods, methods for special structures, modern equipments used for excavation, conveyance etc and principles and practices of temporary structures.

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

UNIT - III MODERN CONSTRUCTION EQUIPMENTS -I

9
Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting.

UNIT - IV MODERN CONSTRUCTION EQUIPMENTS -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:**

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
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<tbody>
<tr>
<td>1.</td>
<td>Varma, M</td>
<td>Construction Equipment and its Planning &amp; Applications</td>
<td>Metropolitan Book Co</td>
<td>2000</td>
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<td>3.</td>
<td>Ataev, S.S</td>
<td>Construction Technology</td>
<td>MIR , Pub</td>
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</tbody>
</table>