ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. BIOMEDICAL ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):
PEO1 - To enable the graduates to demonstrate their skills in solving challenges in their chosen field through the core foundation and knowledge acquired in engineering and biology.

PEO2 - To enable the graduates to exhibit leadership, make decisions with societal and ethical responsibilities, function and communicate effectively in multidisciplinary settings.

PEO3 - To ensure that graduates will recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their careers.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OBJECTIVES (PSOs):**

1) To design and develop diagnostic and therapeutic devices that reduces physician burnout and enhance the quality of life for the end user by applying fundamentals of Biomedical Engineering.

2) To apply software skills in developing algorithms for solving healthcare related problems in various fields of Medical sector.

3) To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology

Provide mapping of 1) POs to PEOs and 2) PSOs to PEOs.

Use the following marking:

- Contribution: 1: Reasonable  2: Significant  3: Strong
MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

<table>
<thead>
<tr>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
<th>PROGRAMME OUTCOMES</th>
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<tr>
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<td>A  B  C  D  E  F  G  H  I  J  K  L</td>
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MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

<table>
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<tr>
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<tr>
<td>SUBJECT NAME</td>
<td>COURSE OUTCOMES</td>
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<tr>
<td>COMMUNICATIVE</td>
<td>• Develop listening skills for academic and professional purposes.</td>
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<tr>
<td>ENGLISH</td>
<td>• Gain familiarity with learning approaches connected to successful writing</td>
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<tr>
<td>ENGINEERING</td>
<td>• Demonstrates confidence in using mathematics to obtain realistic solutions to</td>
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<tr>
<td>MATHEMATICS I</td>
<td>problems</td>
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<tr>
<td></td>
<td>• Interpret and communicate mathematics in a variety of problem solving.</td>
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<tr>
<td>ENGINEERING</td>
<td>• Ability to identify, formulate, and solve real world problems.</td>
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<tr>
<td>PHYSICS</td>
<td>• Apply basic knowledge of science to explain observable phenomena.</td>
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<tr>
<td>Course</td>
<td>Objective</td>
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<tr>
<td>ENGINEERING CHEMISTRY</td>
<td>Demonstrate the principles of basic chemistry including the chemical reactions and mechanism</td>
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<td>Enhance the thinking capabilities in the modern trends in Engineering &amp; Technology</td>
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<tr>
<td>PROBLEM SOLVING AND PYTHON PROGRAMMING</td>
<td>Identify and eliminate errors in programs</td>
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<td>Specify, trace, and implement programs written in a contemporary programming language that solve a stated problem in a clean and robust fashion</td>
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<tr>
<td>ENGINEERING GRAPHICS</td>
<td>Know and understand the conventions and the methods of engineering drawing.</td>
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<td>Students will be able to improve their visualization skills so that they can apply these skills in developing new products.</td>
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<tr>
<td>PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY</td>
<td>• Apply good programming design methods for program development.</td>
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<td>• Design and implement Computer programs for simple applications.</td>
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<td>PHYSICS AND CHEMISTRY LABORATORY</td>
<td>• Practice applications of various phenomena of light, which includes laser, fibre optics, spectrometer grating.</td>
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<td>• Gain hands-on knowledge in the quantitative chemical analysis of water quality related parameters</td>
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<td>SEMESTER II</td>
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<tr>
<td><strong>TECHNICAL ENGLISH</strong></td>
<td>• Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.</td>
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<td>• Listen/view and comprehend different spoken excerpts critically and infer unspoken and infer unspoken and implied meanings.</td>
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<tr>
<td><strong>ENGINEERING MATHEMATICS II</strong></td>
<td>• The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions.</td>
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<td>• Students will be able to solve problems related to engineering applications by using mathematical</td>
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<tr>
<td>Course</td>
<td>Techniques</td>
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<tr>
<td><strong>PHYSICS FOR ELECTRONICS ENGINEERING</strong></td>
<td>• Organize, analyze and interpret information and use the scientific method to make inferences about material physics</td>
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<td>• Relate concepts learned in Physical Science and Engineering Department classes to real world situations</td>
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<tr>
<td><strong>ENGINEERING MECHANICS FOR BIOMEDICAL ENGINEERS</strong></td>
<td>• Use scalar and vector analytical techniques for analysing forces in statically determinate structures</td>
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<td>• Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems</td>
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<tr>
<td><strong>FUNDAMENTALS OF BIO CHEMISTRY</strong></td>
<td>• Wide view about the classification, structures and properties of</td>
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<tr>
<td>CIRCUIT ANALYSIS</td>
<td>• Knowledge about the mechanism of actions of enzymes and co-enzymes, clinical importance of enzymes and interpretation of their activities.</td>
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<tr>
<td>CIRCUIT ANALYSIS</td>
<td>• Learn how to develop and employ circuit models for elementary electronic components</td>
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<tr>
<td>CIRCUIT ANALYSIS</td>
<td>• Become adopt at using various methods of circuit analysis</td>
</tr>
<tr>
<td>ENGINEERING PRACTICES LABORATORY</td>
<td>• Ability to fabricate electrical and electronics circuits.</td>
</tr>
<tr>
<td>ENGINEERING PRACTICES LABORATORY</td>
<td>• Demonstrate wide knowledge on mechanical and civil operations</td>
</tr>
<tr>
<td>BIO CHEMISTRY LABORATORY</td>
<td>• Demonstrate a qualitative and quantitative</td>
</tr>
<tr>
<td>Understanding of major biomolecules such as carbohydrates, lipids and proteins</td>
<td>✔</td>
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<tr>
<td>Demonstrate the basic analytical techniques for biochemical applications</td>
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<td>SUBJECT NAME</td>
<td>COURSE OUTCOMES</td>
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<tr>
<td>LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>Compute basic objects associated with vector spaces and linear transformation.</td>
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<tr>
<td>LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>Concepts on eigenvalues and eigenvectors of a matrix and inner product spaces.</td>
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<tr>
<td>LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>The fundamental concepts of partial differential equations and the various solution procedures for solving the first order non-linear partial differential equations.</td>
</tr>
<tr>
<td>LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>Analytical methods for solving higher order partial differential equations and the application of Fourier series for solving the initial boundary value problems in one dimensional wave and heat equations and boundary value problems in elliptic equations.</td>
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<td>SUBJECT NAME</td>
<td>COURSE OUTCOMES</td>
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<tr>
<td><strong>ANATOMY AND HUMAN PHYSIOLOGY</strong></td>
<td>Students would be able to explain basic structure and functions of cell</td>
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<td>Students would be able to explain interconnect of various systems</td>
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<td></td>
<td>Students would be learnt about anatomy and physiology of various systems of human body</td>
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<tr>
<td><strong>ELECTRON DEVICES AND CIRCUITS</strong></td>
<td>Explain the structure and working operation of basic electronic devices.</td>
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<tr>
<td></td>
<td>Able to identify and differentiate both active and passive elements</td>
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<td></td>
<td>Analyze the characteristics of different electronic devices such as diodes and transistors</td>
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<td></td>
<td>Choose and adapt the required components to construct an amplifier circuit.</td>
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<td></td>
<td>Employ the acquired knowledge in design and analysis of oscillators</td>
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<tr>
<td><strong>PATHOLOGY AND MICROBIOLOGY</strong></td>
<td>Analyze structural and functional aspects of living organisms.</td>
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<tr>
<td></td>
<td>Explain the function of microscope</td>
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<td>Discuss the importance of public health.</td>
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<td>Describe methods involved in treating the pathological diseases.</td>
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<td>COURSE OUTCOMES</td>
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<tr>
<td>PATHOLOGY AND MICROBIOLOGY LABORATORY</td>
<td>Student can perform practical experiments on tissue processing, cryoprocessing, staining Processes etc.</td>
</tr>
<tr>
<td>HUMAN PHYSIOLOGY LABORATORY</td>
<td>Identification and enumeration of blood cells</td>
</tr>
<tr>
<td>ENUMERATION OF HAEMATOLOGICAL PARAMETERS</td>
<td>✔</td>
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<tr>
<td>ANALYSIS OF SPECIAL SENSORY ORGANS TEST</td>
<td>✔</td>
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<tr>
<td>MEDICAL PHYSICS</td>
<td>Explain about non-ionizing radiation, interaction with tissue and its effects.</td>
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<tr>
<td>DEFINE AND COMPARE INTENSITIES OF SENSORY STIMULI</td>
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<tr>
<td>SUMMARIZES HOW IONIZING RADIATION INTERACTS WITH THE HUMAN BODY, HOW TO QUANTIFY IT AND ITS LEVELS SEEN IN THE ENVIRONMENT AND HEALTHCARE</td>
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<tr>
<td>EXPLAIN THE FUNDAMENTALS OF RADIOACTIVITY AND RADIOACTIVE ISOTOPES</td>
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<tr>
<td>ILLUSTRATES THE METHODS OF DETECTING AND RECORDING THE IONIZING RADIATION AND ITS INTERACTION WITH MATTER</td>
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<td>COURSE OUTCOMES</td>
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<tr>
<td><strong>BASICS OF ELECTRICAL ENGINEERING</strong></td>
<td>Make right choice on motors for different applications</td>
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<td>Understand power distribution and hence apply safety principles to biomedical equipments</td>
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<td>Analyze electromagnetic fields and its effects on different media</td>
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<tr>
<td><strong>LINEAR INTEGRATED CIRCUITS</strong></td>
<td>Design linear and non linear applications of op – amps</td>
</tr>
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<td>Design applications using analog multiplier and PLL</td>
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<td></td>
<td>Design ADC and DAC using op – amps</td>
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<td></td>
<td>Generate waveforms using op – amp circuits</td>
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<td></td>
<td>Analyze special function ICs</td>
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<tr>
<td><strong>INTEGRATED CIRCUITS LABORATORY</strong></td>
<td>Design oscillators and amplifiers using operational amplifiers</td>
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<td>Design filters using Op-amp and perform experiment on frequency response</td>
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<td>Analyze the working of PLL and use PLL as frequency multiplier</td>
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<td>Design DC power supply using ICs.</td>
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<td>Acquire knowledge in using SPICE</td>
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<td>SUBJECT NAME</td>
<td>COURSE OUTCOMES</td>
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<tr>
<td><strong>SENSORS AND MEASUREMENT</strong></td>
<td>Analyse various electrical parameters with accuracy, precision, resolution</td>
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<tr>
<td></td>
<td>Select appropriate passive or active transducers for measurement of physical phenomenon.</td>
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<td>Understand and select appropriate light sensors for measurement of physical phenomenon.</td>
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<td>Employ AC and DC bridges for relevant parameter measurement</td>
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<td>Employ Multimeter, CRO and different types of recorders for appropriate measurement.</td>
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<tr>
<td><strong>DEVICES AND CIRCUITS LABORATORY</strong></td>
<td>Analyze the characteristics of basic electronic devices</td>
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<td>Design RL and RC circuits</td>
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<td>Understand and Verify Thevinin&amp; Norton theorem KVL &amp; KCL, and Super Position Theorems</td>
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<tr>
<td><strong>BIOCONTROL SYSTEMS</strong></td>
<td>Understand the need for mathematical modeling of various systems, representation of systems in</td>
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<tr>
<td>Block diagrams and signal flow graphs and are introduced to biological control systems</td>
<td>✓</td>
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<tr>
<td>Analyze the time response of various systems and discuss the concept of system stability</td>
<td>✓</td>
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<tr>
<td>Analyze the frequency response characteristics of various systems using different charts</td>
<td>✓</td>
</tr>
<tr>
<td>Understand the concept of modeling basic physiological systems</td>
<td>✓</td>
</tr>
<tr>
<td>Comprehend the application aspects of time and frequency response analysis in physiological control systems.</td>
<td>✓</td>
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</table>

**BIOMEDICAL INSTRUMENTATION LABORATORY**

| Inculcating the knowledge acquired from basic integrated circuits lab to design preamplifiers for various bio signal acquisition. | ✓ | ✓ | ✓ | ✓ | ✓ |
| Design and analyze the characteristics of Isolation amplifier | ✓ | ✓ | ✓ | ✓ | ✓ |
| To analyze the non-electrical and biochemical measurement techniques | ✓ | ✓ | ✓ | ✓ | ✓ |

**DIAGNOSTIC AND THERAPEUTIC EQUIPMENT- I**

<p>| Students would be able to describe the functioning and recording setup of all cardiac and neurological equipments | ✓ | ✓ | ✓ | ✓ |
| To explain the recording of | ✓ | ✓ | ✓ |</p>
<table>
<thead>
<tr>
<th>BIOMECHANICS</th>
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<tr>
<td><strong>EMG and respiratory parameters</strong></td>
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<td>✔</td>
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<tr>
<td><strong>Describe the measurement techniques of sensory responses</strong></td>
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<tr>
<th>DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY</th>
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<tr>
<td><strong>Understand the principles of mechanics</strong></td>
<td>✔</td>
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<tr>
<td><strong>Outline the principles of biofluid dynamics</strong></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td><strong>Explain the fundamentals of bio-solid mechanics</strong></td>
<td>✔</td>
<td>✔</td>
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<td><strong>Apply the knowledge of joint mechanics.</strong></td>
<td>✔</td>
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<tr>
<td><strong>Give Examples of computational mathematical modelling applied in biomechanics.</strong></td>
<td>✔</td>
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<tr>
<th>DIAGNOSTIC AND THERAPEUTIC EQUIPMENT- II</th>
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<tr>
<td><strong>Learn methods to measure different bioelectrical signals and non-electrical parameters</strong></td>
<td>✔</td>
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<tr>
<td><strong>Acquire knowledge about the various diagnostic and therapeutic techniques</strong></td>
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<tr>
<td><strong>Familiarise with electrical safety measurements</strong></td>
<td>✔</td>
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<tr>
<td><strong>Analyse the characteristics of different bio signals using MATLAB and Lab VIEW.</strong></td>
<td>✔</td>
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<tr>
<td><strong>Discuss the various equipments used in ICU and applications of telemetry.</strong></td>
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<td><strong>Explain the types of diathermy and its applications.</strong></td>
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<td><strong>Understand the basics of</strong></td>
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<tr>
<td><strong>RADIOLOGICAL EQUIPMENTS</strong></td>
<td><strong>ultrasound and its application in medicine</strong></td>
<td>✔</td>
<td>✔</td>
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<td>Discuss the various extracorporeal and special diagnostic devices used in hospitals</td>
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<td>Outline the importance of patient safety against electrical hazard</td>
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<td><strong>Describe the working principle of X ray machine and its application</strong></td>
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<td></td>
<td><strong>Illustrate the principle computed tomography</strong></td>
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<td><strong>Interpret the technique used for visualizing various sections of the body using magnetic resonance imaging</strong></td>
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<td></td>
<td><strong>Demonstrate the applications of radio nuclide imaging</strong></td>
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<tr>
<td></td>
<td><strong>Outline the methods of radiation safety.</strong></td>
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</tr>
<tr>
<td><strong>REHABILITATION ENGINEERING</strong></td>
<td>Gain adequate knowledge about the needs of rehabilitations and its future development</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td></td>
<td>Have an in depth idea about Engineering Concepts in Sensory &amp; Motor rehabilitation.</td>
<td>✔</td>
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<td></td>
<td>Apply the different types of Therapeutic Exercise Technique to benefit the society</td>
<td>✔</td>
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<tr>
<td>BIOMEMS</td>
<td>Design and apply different types Hearing aids, visual aids and their application in biomedical field and hence the benefit of the society.</td>
<td>✔</td>
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<td></td>
<td>Gain in-depth knowledge about different types of models of Hand and arm replacement.</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>BIO SIGNAL PROCESSING</td>
<td>BIOMEMS</td>
<td></td>
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<tr>
<td></td>
<td>Describe various MEMS fabrication techniques</td>
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<td>✔</td>
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<td></td>
<td>Explain different types of sensors and actuators and their principles of operation at the micro Scale level.</td>
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<tr>
<td></td>
<td>Apply MEMS in different field of medicine</td>
<td>✔</td>
<td>✔</td>
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<td>BIO SIGNAL PROCESSING</td>
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<td></td>
<td>Plot different types of biomedical signals and analyse their spectral components.</td>
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<td>✔</td>
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<td></td>
<td>Implement different filters on biomedical signals and analyse its performance</td>
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<td>✔</td>
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<td></td>
<td>Identify physiological interferences and artifacts affecting ECG signal</td>
<td>✔</td>
<td>✔</td>
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<td></td>
<td>Compute power and correlation spectra of EEG signal</td>
<td>✔</td>
<td>✔</td>
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<td>PHYSIOLOGICAL MODELLING</td>
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<td>Propose an algorithm to classify biomedical signals.</td>
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<td>Explain the application of Physiological models</td>
<td>✔ ✔ ✔</td>
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<tr>
<td>Describe the methods and techniques for analysis and synthesis of Linear and dynamic system</td>
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<td>Develop differential equations to describe the compartmental physiological model</td>
<td>✔ ✔ ✔ ✔ ✔</td>
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<tr>
<td>Describe Nonlinear models of physiological systems</td>
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<td>Illustrate the Simulation of physiological systems</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
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<table>
<thead>
<tr>
<th>ROBOTICS IN MEDICINE</th>
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<tbody>
<tr>
<td>Understand the basics of robotic systems.</td>
<td>✔</td>
</tr>
<tr>
<td>Design basic Robotics system and formulate Kinematics.</td>
<td>✔ ✔ ✔ ✔</td>
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<tr>
<td>Construct Inverse Kinematic motion planning solutions for various Robotic configurations.</td>
<td>✔ ✔</td>
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<tr>
<td>VIRTUAL REALITY AND AUGMENTED REALITY</td>
<td>Design Robotic systems for Medical application</td>
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<tr>
<td>Analyse &amp; Design a system or process to meet given specifications with realistic engineering constraints</td>
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<tr>
<td>Identify problem statements and function as a member of an engineering design team</td>
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</tr>
<tr>
<td>Utilize technical resources</td>
<td>✔</td>
</tr>
<tr>
<td>Propose technical documents and give technical oral presentations related to design mini project results.</td>
<td>✔</td>
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<tr>
<td>BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS</td>
<td>Comprehend and appreciate the significance and role of this course in the present contemporary world.</td>
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<tr>
<td>Evaluate concept of BCI.</td>
<td>✔</td>
</tr>
<tr>
<td>Assign functions appropriately to the human and to the machine</td>
<td>✔</td>
</tr>
<tr>
<td>Select appropriate feature extraction methods</td>
<td>✔</td>
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<tr>
<td>Use machine learning algorithms for translation</td>
<td>✔</td>
</tr>
<tr>
<td>Develop high-fidelity BCI prototypes</td>
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<tr>
<td>SUBJECT NAME</td>
<td>COURSE OUTCOMES</td>
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<tr>
<td>ANALOG AND DIGITAL COMMUNICATION</td>
<td>Analyze and explain various analog modulation schemes.</td>
</tr>
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<td>Describe various digital modulation and pulse modulation techniques.</td>
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<td>Compare and contrast the strengths and weaknesses of various communication</td>
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<td></td>
<td>systems</td>
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<td>Describe the source and Error control coding of information</td>
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<td>DISCRETE-TIME SIGNAL PROCESSING</td>
<td>Apply DFT for the analysis of digital signals and systems</td>
</tr>
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<td></td>
<td>Design IIR and FIR filters</td>
</tr>
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<td>Characterize the effects of finite precision representation on digital filters</td>
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<td></td>
<td>Design multirate filters</td>
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<td>Apply adaptive filters appropriately in communication systems</td>
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<tr>
<td>ENVIRONMENTAL SCIENCE AND ENGINEERING</td>
<td>Create awareness among the public in maintaining the environment.</td>
</tr>
<tr>
<td></td>
<td>Inculcate the knowledge of environmental cleanliness among the public and to eradicate misconception.</td>
</tr>
<tr>
<td></td>
<td>To develop and improve the standard of living by reducing the environmental disaster</td>
</tr>
<tr>
<td>HOSPITAL MANAGEMENT</td>
<td>Explain the principles of Hospital administration.</td>
</tr>
<tr>
<td></td>
<td>Identify the importance of Human resource management</td>
</tr>
<tr>
<td></td>
<td>List various marketing research techniques.</td>
</tr>
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<td>Identify Information management systems and its uses.</td>
</tr>
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<td>Understand safety procedures followed in hospitals</td>
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<tr>
<td>MINI PROJECT</td>
<td>Formulate a real world problem, identify the requirement and develop the design solutions.</td>
</tr>
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<td></td>
<td>Express the technical ideas, strategies and methodologies.</td>
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<td>Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.</td>
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<td>Test and validate through conformance of the developed prototype and analysis the cost Effectiveness.</td>
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<td>Prepare report and present the oral demonstrations</td>
</tr>
<tr>
<td>DIGITAL IMAGE PROCESSING</td>
<td>Characterize images in the transform domain and configure image compression and restoration techniques in the transform domain.</td>
</tr>
<tr>
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<td>Design image enhancement techniques</td>
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<td>Design image compression techniques</td>
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<td>Apply image segmentation methods as required by the target application</td>
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<tr>
<td><strong>RADIOLOGICAL EQUIPMENTS</strong></td>
<td>Describe the working principle of X-ray machine and its application.</td>
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<td>Design and apply different types Hearing aids, visual aids and their application in biomedical field and hence the benefit of the society</td>
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<td>Gain in-depth knowledge about different types of models of Hand and arm replacement.</td>
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<tr>
<td>DIGITAL IMAGE PROCESSING LABORATORY</td>
<td>Perform enhancing operations on the image using spatial filters and frequency domain filters.</td>
</tr>
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<td>Use transforms and analyze the characteristics of the image.</td>
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<td>Perform segmentation operations in the images.</td>
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<td>Estimate the efficiency of the compression technique on the images.</td>
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<td></td>
<td>Apply image processing technique to solve real health care problems.</td>
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<tr>
<td>HOSPITAL TRAINING</td>
<td>Advocate a patient-centred approach in healthcare</td>
</tr>
<tr>
<td></td>
<td>Communicate with other health professionals in a respectful and responsible manner</td>
</tr>
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<td></td>
<td>Recognize the importance of inter-professional collaboration in healthcare.</td>
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<td></td>
<td>Propose a patient-centred inter-professional health improvement plan based upon the patient’s perceived need</td>
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<td></td>
<td>Use the knowledge of one’s own role and those of other professions to address the healthcare needs of populations and patients served.</td>
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<tr>
<td>NANOTECHNOLOGY AND APPLICATIONS</td>
<td>Thorough knowledge of the general principles of physics, chemistry, electronics and biology that play a role on the nanometer scale</td>
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<td>Understanding of materials and their properties at the atomic and nanometer level, including an understanding of the intimate relationship between material scale (nanostructure) and the properties/functionality of materials</td>
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<td></td>
<td>Understanding the essential concepts used in nanotechnology, synthesis and fabrication</td>
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<td></td>
<td>Having a sound grounding knowledge in characterization of nanomaterials</td>
</tr>
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<td></td>
<td>Demonstrate the socioeconomic impact of nanotechnology and ethical issues associated with it.</td>
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<tr>
<td>BIOMATERIALS</td>
<td>Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use</td>
</tr>
<tr>
<td></td>
<td>Identify significant gap required to overcome challenges and further development in metallic and ceramic materials</td>
</tr>
<tr>
<td></td>
<td>Identify significant gap required to overcome challenges and further development in polymeric materials</td>
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<td></td>
<td>Create combinations of materials that could be used as a tissue replacement implant.</td>
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<td>Understand the testing standards applied for biomaterials</td>
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<tr>
<td>MEDICAL OPTICS</td>
<td>Demonstrate knowledge of the fundamentals of optical properties of tissues</td>
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<td>Analyze the components of instrumentation in Medical Photonics and Configurations</td>
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<td>Describe surgical applications of lasers.</td>
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<td>Describe photonics and its diagnostic applications.</td>
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<td>Investigate emerging techniques in medical optics</td>
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<tr>
<td>ARTIFICIAL ORGANS AND IMPLANTS</td>
<td>Gain adequate knowledge about artificial organs &amp; transplants</td>
</tr>
<tr>
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<td>Get clear idea about implant design and its parameters and solution</td>
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<td></td>
<td>Have in-depth knowledge about blood interfacing implants</td>
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<td>Explain different types of soft tissue replacement and hard tissue replacement</td>
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<td>TELEHEALTH TECHNOLOGY</td>
<td>Apply multimedia technologies in telemedicine</td>
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<tr>
<td></td>
<td>Explain protocols behind encryption techniques for secure transmission of data</td>
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<td>Apply telehealth in healthcare.</td>
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<tr>
<td>BIOFLUIDS AND DYNAMICS</td>
<td>Understand the basics of Fluid Mechanics</td>
</tr>
<tr>
<td></td>
<td>Construe the intracellular fluid mechanics and ocular mechanics.</td>
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<td></td>
<td>Describe the rheology of blood and mechanics of blood vessels.</td>
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<td></td>
<td>Elucidate on cardiorespiratory mechanics and space medicine.</td>
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<td>Develop mathematical models of biological systems with fluids</td>
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<tr>
<td><strong>SOFT COMPUTING TECHNIQUES</strong></td>
<td>Describe various neural, fuzzy and Genetic algorithms.</td>
</tr>
<tr>
<td></td>
<td>Implement Neural, Genetic and Fuzzy algorithms for various classification</td>
</tr>
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<td></td>
<td>applications</td>
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<tr>
<td><strong>FOUNDATION SKILLS IN INTEGRATED</strong></td>
<td>Define, formulate and analyze a problem</td>
</tr>
<tr>
<td><strong>PRODUCT DEVELOPMENT</strong></td>
<td>Solve specific problems independently or as part of a team</td>
</tr>
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<td>Gain knowledge of the Innovation &amp; Product Development process in the Business</td>
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<tr>
<td></td>
<td>Context</td>
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<td></td>
<td>Work independently as well as in teams</td>
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<td></td>
<td>Manage a project from start to finish</td>
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<tr>
<td><strong>NEURAL ENGINEERING</strong></td>
<td>Understand the physiology behind generation of nerve impulses</td>
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<td></td>
<td>Describe various techniques that are used to evaluate the functioning of central and peripheral nervous system.</td>
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</table>
Differentiate between a normal and abnormal signal coming from a healthy and a diseased nervous system respectively

<table>
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<tr>
<th>SUBJECT NAME</th>
<th>COURSE OUTCOMES</th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
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<th>PO 5</th>
<th>PO 6</th>
<th>PO 7</th>
<th>PO 8</th>
<th>PO 9</th>
<th>PO 10</th>
<th>PO 11</th>
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<td>BIOMETRIC SYSTEM</td>
<td>Demonstrate the knowledge and engineering principles underlying in biometric systems.</td>
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<td>Analyze and design the basic biometric system applications</td>
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<tr>
<td>ELECTRICAL SAFETY AND QUALITY ASSURANCE</td>
<td>Develop knowledge and insight into the procedures used in quality control and assurance activities as well as safety measures to be followed in hospitals.</td>
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<tr>
<td>ERGONOMICS</td>
<td>Understand principles of ergonomics.</td>
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<td>✔</td>
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<td>Design biomedical devices</td>
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<td>FUNDAMENTALS OF NANOSCIENCE</td>
<td>Will familiarize about the science of nanomaterials</td>
<td>✔</td>
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## SEMESTER VI

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## SEMESTER VIII

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*Professional Electives are grouped according to elective number as was done previously.*

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## SUMMARY

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I  SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS  12

UNIT II  GENERAL READING AND FREE WRITING  12
Reading- comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures -Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT  12
Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV  READING AND LANGUAGE DEVELOPMENT  12
Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing-letter writing, informal or personal letters--mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs.
UNIT V EXTENDED WRITING


TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, learners will be able to:
- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English.
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005
OBJECTIVES:
The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES

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

UNIT IV MULTIPLE INTEGRALS

UNIT V DIFFERENTIAL EQUATIONS

TOTAL: 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.
TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH8151 ENGINEERING PHYSICS

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS
UNIT IV QUANTUM PHYSICS

UNIT V CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course:
- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I  WATER AND ITS TREATMENT

UNIT II  SURFACE CHEMISTRY AND CATALYSIS

UNIT III  ALLOYS AND PHASE RULE

UNIT IV  FUELS AND COMBUSTION

UNIT V  ENERGY SOURCES AND STORAGE DEVICES
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS
OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.
UNIT IV LISTS, TUPLES, DICTIONARIES

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

UNIT V FILES, MODULES, PACKAGES

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

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

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I  PLANE CURVES AND FREEHAND SKETCHING  7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE  6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

OUTCOMES:
On successful completion of this course, the student will be able to
- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.
TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The Students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C 0 0 4 2

OBJECTIVES
• To write, test, and debug simple Python programs.
• To implement Python programs with conditionals and loops.
• Use functions for structuring Python programs.
• Represent compound data using Python lists, tuples, dictionaries.
• Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux.

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL: 60 PERIODS.

BS8161 PHYSICS AND CHEMISTRY LABORATORY (Common to all branches of B.E. / B.Tech Programmes) L T P C
0 0 4 2

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser 
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

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

- Apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-
Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:

HS8251 TECHNICAL ENGLISH

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking – Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary
Language Development – subject verb agreement - compound words.
UNIT II     READING AND STUDY SKILLS  
Listening- Listening to longer technical talks and completing exercises based on them - Speaking – describing a process -Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Vocabulary Development- vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III    TECHNICAL WRITING AND GRAMMAR  
Listening- Listening to classroom lectures/ talks on engineering/technology - Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV    REPORT WRITING  

UNIT V     GROUP DISCUSSION AND JOB APPLICATIONS  
Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey- Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL : 60 PERIODS

OUTCOMES:
At the end of the course learners will be able to:
- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialization successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

REFERENCES:

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.
OBJECTIVES:
This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES
12

UNIT II VECTOR CALCULUS
12
Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS
12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions \( w = z + c, cz, \frac{1}{z}, z^2 \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION
12

UNIT V LAPLACE TRANSFORMS
12

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:
REFERENCES:

PH8253

PHYSICS FOR ELECTRONICS ENGINEERING

L T P C
(Common to BME, ME, CC, ECE, EEE, E&I, ICE) 3 0 0 3

OBJECTIVES:
- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I

ELECTRICAL PROPERTIES OF MATERIALS
9

UNIT II

SEMICONDUCTOR PHYSICS
9

UNIT III

MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS
9

UNIT IV

OPTICAL PROPERTIES OF MATERIALS
9

UNIT V

NANOELECTRONIC DEVICES
9

TOTAL :45 PERIODS
OUTCOMES:
At the end of the course, the students will able to
- Gain knowledge on classical and quantum electron theories, and energy band structures,
- Acquire knowledge on basics of semiconductor physics and its applications in various devices,
- Get knowledge on magnetic and dielectric properties of materials,
- Have the necessary understanding on the functioning of optical materials for optoelectronics,
- Understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

REFERENCES:

BM8251  ENGINEERING MECHANICS FOR BIOMEDICAL ENGINEERS  L T P C
3 0 0 3

OBJECTIVES:
- Be exposed to the fundamental principles of mechanics
- To learn effect of force on bodies
- To learn basics of fluid mechanics and relate it to bio-fluids
- To understand the action of friction and motion

UNIT I  BASICS AND STATICS OF PARTICLES

UNIT II  EQUILIBRIUM OF RIGID BODIES
UNIT III MECHANICS OF SOLIDS
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of rigid and non rigid bodies - Centroids and centre of mass - Centroids of lines and areas - Rectangular, circular, triangular areas by integration –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle.

UNIT IV BASICS OF MECHANICS OF FLUIDS

UNIT V DYNAMICS OF PARTICLES

OUTCOMES:
At the end of the course students will be able to:
- Use scalar and vector analytical techniques for analysing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems

TEXT BOOKS:

REFERENCES:

BM8201 FUNDAMENTALS OF BIOCHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
The student should be:
- To study structural and functional properties of carbohydrates, proteins, lipids and nucleic acids
- To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules

UNIT I INTRODUCTION TO BIOCHEMISTRY
Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes
UNIT II  CARBOHYDRATES  9

UNIT III  LIPIDS  9
Classification of lipids- simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat..Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, Biosynthesis of Cholesterol. Disorders of lipid metabolism.

UNIT IV  NUCLEIC ACID & PROTEIN  9
Structure of purines and pyrimidines, nucleoside, nucleotide, DNA act as a genetic material, chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type. Metabolism and Disorder of purines and pyrimidines nucleotide Classification, structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation of protein, Inborn Metabolic error of amino acid metabolism

UNIT V  ENZYME AND ITS CLINICAL APPLICATION  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the Course in the students will be able to
- Explain the fundamentals of biochemistry
- Clinical application of Biochemistry

TEXT BOOKS:

REFERENCES:

EC8251  CIRCUIT ANALYSIS  L T P C
4 0 0 4

OBJECTIVES:
- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.
## UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
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## UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network theorems - Superposition theorem, Thevenin’s theorem, Norton’s theorem, Reciprocity theorem, Millman’s theorem, and Maximum power transfer theorem, application of Network theorems - Network reduction: voltage and current division, source transformation – star delta conversion.</td>
<td>12</td>
</tr>
</tbody>
</table>

## UNIT III RESONANCE AND COUPLED CIRCUITS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
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</thead>
<tbody>
<tr>
<td>Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.</td>
<td>12</td>
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## UNIT IV TRANSIENT ANALYSIS

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<th>Topic</th>
<th>Pages</th>
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## UNIT V TWO PORT NETWORKS

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<tr>
<th>Topic</th>
<th>Pages</th>
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</thead>
<tbody>
<tr>
<td>Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.</td>
<td>12</td>
</tr>
</tbody>
</table>

### OUTCOMES:

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

- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits

### TEXT BOOKS:


### REFERENCES:

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE
13
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV  ELECTRONICS ENGINEERING PRACTICE
16
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos (b) Demolition Hammer 2 Nos (c) Circular Saw 2 Nos (d) Planer 2 Nos (e) Hand Drilling Machine 2 Nos (f) Jigsaw 2 Nos

MECHANICAL
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
9. Study purpose items: centrifugal pump, air-conditioner One each.

**ELECTRICAL**
1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

**ELECTRONICS**
1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

**BM8211 BIOCHEMISTRY LABORATORY**

**OBJECTIVES:**
To provide practice on:
- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Estimation and interpretation of biochemical parameter.

**LIST OF EXPERIMENTS:**
1. General guidelines for working and functional component of biochemistry lab
2. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions
3. Standardization of pH meter, preparation of buffers, emulsions.
4. Spectroscopy: Determination of absorption maxima (λmax) of a given solution
5. General tests for carbohydrates, proteins and lipids.
6. Identification of Blood Collection Tubes and Phlebotomy equipments
7. Preparation of serum and plasma from blood.
8. Estimation of Haemoglobin
11. Estimation of urea.
12. Estimation of Uric acid
13. Estimation of cholesterol
14. Assay of SGOT/SGPT.
15. ELISA test
16. Separation of proteins by SDS electrophoresis(Demo)
17. Separation of amino acids by thin layer chromatography (Demo).

**TOTAL: 60 PERIODS**
OUTCOMES:
Upon completion of the course, students will be able to:
- Understand the Biochemistry laboratory functional components
- Understand the basics principle of preparation of buffers.
- Have a sound knowledge of qualitative test of different biomolecules.
- Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
- Have a sound knowledge of separation technology of proteins and aminoacids.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:
Requirement for a batch of 30 students
- Colorimeter 2 Nos
- Spectrophotometer 1 No.
- pH meter 1 No
- Weighing balance 1 No
- Refrigerator 1 No
- SDS gel electrophoresis 1 No
- TLC, ready TLC plates 1 No
- Wintrobe’s tube 2 Nos.
- Centrifuge Normal 1 No
- Microslides 2 packets
- Lancet 5 boxes
- Microscope 1 No
- Neubaur’s Chamber 2 Nos.
- Heparinized Syringe 1box
- Haemoglobinometer 1 No
- Elisa reader.1 nos
- Capillary tubes 1 box

MA8352 LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS

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

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

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III INNER PRODUCT SPACES
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.
UNIT IV PARTIAL DIFFERENTIAL EQUATIONS

UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non-trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Able to solve various types of partial differential equations.
- Able to solve engineering problems using Fourier series

TEXT BOOKS:

REFERENCES:

EC8352 SIGNALS AND SYSTEMS

OBJECTIVES:
- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain
UNIT I  CLASSIFICATION OF SIGNALS AND SYSTEMS  12
Standard signals: Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids.
Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals.
Classification of systems - CT systems and DT systems - Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II  ANALYSIS OF CONTINUOUS TIME SIGNALS  12
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

UNIT III  LINEAR TIME IN Variant CONTINUOUS TIME SYSTEMS  12

UNIT IV  ANALYSIS OF DISCRETE TIME SIGNALS  12
Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

UNIT V  LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS  12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• To be able to determine if a given system is linear/causal/stable
• Capable of determining the frequency components present in a deterministic signal
• Capable of characterizing LTI systems in the time domain and frequency domain
• To be able to compute the output of an LTI system in the time and frequency domains

TEXT BOOK:

REFERENCES:

BM8351  ANATOMY AND HUMAN PHYSIOLOGY  L T P C
3 0 0 3

OBJECTIVES
• To identify all the organelles of an animal cell and their function.
• To understand structure and functions of the various types of systems of human body.
• To demonstrate their knowledge of importance of anatomical features and physiology of human systems.
UNIT I CELL AND TISSUE STRUCTURE 9

UNIT II SKELETAL, MUSCULAR AND RESPIRATORY SYSTEMS 9

UNIT III CARDIOVASCULAR AND LYMPHATIC SYSTEMS 9
Cardiovascular: Components of Blood and functions.- Blood Groups and importance – Structure of Heart – Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle - Heart Beat – Types of Blood vessel – Regulation of Heart rate and Blood pressure. Lymphatic: Parts and Functions of Lymphatic systems – Types of Lymphatic organs and vessels

UNIT IV NERVOUS AND ENDOCRINE SYSTEMS AND SENSE ORGANS 9

UNIT V DIGESTIVE AND URINARY SYSTEMS 9

TOTAL: 45 PERIODS

OUTCOMES:
At end of the course

- Students would be able to explain basic structure and functions of cell
- Students would be learnt about anatomy and physiology of various systems of human body
- Students would be able to explain interconnect of various systems

TEXT BOOKS:

REFERENCES:
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2013
OBJECTIVES:
The student should be made to:
- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers.
- Know the different bridges for measurement.
- Know the different display and recording devices.

UNIT I SCIENCE OF MEASUREMENT 6+6
Measurement System – Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis – Calibration - Primary and secondary standards.

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 6+6
Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC SENSORS 6+6
Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer- Equivalent circuit and its characteristics.

UNIT IV SIGNAL CONDITIONING CIRCUITS 6+6
Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges - wheat stone bridge, Kelvin, Maxwell, Hay, Schering

UNIT V DISPLAY AND RECORDING DEVICES 6+6
Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

LIST OF LABORATORY EXPERIMENTS TO DEMONSTRATE:
1. Characteristics of various temperature sensors – RTD, Thermistor and Thermocouple
2. Displacement measurement using LVDT.
3. Characteristics of various light sensors – LDR, Photodiode and Phototransistor
4. Measurement of resistance using DC bridges
5. Measurement of inductance using Maxwell bridge
6. Measurement of capacitance using Schering bridge
7. Measurement of amplitude, time, frequency using CRO

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Measure various electrical parameters with accuracy, precision, resolution.
- Select appropriate passive or active transducers for measurement of physical phenomenon.
- Select appropriate light sensors for measurement of physical phenomenon.
- Use AC and DC bridges for relevant parameter measurement.
- Employ Multimeter, CRO and different types of recorders for appropriate measurement.
TEXT BOOKS:

REFERENCES:

EC8353 ELECTRON DEVICES AND CIRCUITS

OBJECTIVES:
The student should be made to:
- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES
PN junction diode – structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, – Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model – Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS

TOTAL: 45 PERIODS
OUTCOMES:
Upon Completion of the course, the students will be able to:
- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

REFERENCES:

BM8302 PATHOLOGY AND MICROBIOLOGY

OBJECTIVES:
The student should be made to:
- Gain a knowledge on the structural and functional aspects of living organisms.
- Know the etiology and remedy in treating the pathological diseases.
- Empower the importance of public health.

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA 9
Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT II FLUID AND HEMODYNAMIC DERANGEMENTS 9

UNIT III MICROBIOLOGY 9
Structure of Bacteria and Virus. Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria, culture media and its types, culture techniques and observation of culture. Disease caused by bacteria, fungi, protozoal, virus and helminthes.
UNIT IV  MICROSCOPES  9

UNIT V  IMMUNOPATHOLOGY  9

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze structural and functional aspects of living organisms.
- Explain the function of microscope
- Discuss the importance of public health.
- Describe methods involved in treating the pathological diseases.

TEXT BOOKS:

REFERENCES:

BM8311  PATHOLOGY AND MICROBIOLOGY LABORATORY  L T P C
0 0 4 2

OBJECTIVES:
The student should be made to:
- Use Compound microscope
- Practice on chemical examinations, Cryoprocessing, Histopathological examinations etc

LIST OF EXPERIMENTS:
1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Capsule stain
10. Simple stain.
12. AFB stain.
13. Antigen-Antibody reaction Immuno electrophoresis
15. Haematology slides of anemia and leukemia.
16. Study of bone marrow charts.

TOTAL: 60 PERIODS

OUTCOME:
- Student can perform practical experiments on tissue processing, cryoprocessing, staining Processes etc.

TEXT BOOK :

BM8312 DEVICES AND CIRCUITS LABORATORY

OBJECTIVES:
- To learn the characteristics of basic electronic devices such as Diode, BJT, FET, SCR
- To understand the working of RL, RC and RLC circuits
- To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems

LIST OF EXPERIMENTS
1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics
5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications of Thevinin & Norton theorem
9. Verifications of KVL & KCL
10. Verifications Of Super Position Theorem
11. Verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

LABORATORY REQUIREMENTS
BC 107, BC 148, 2N2646, BFW10 - 25 each
1N4007, Zener diodes - 25 each
Resistors, Capacitors, Inductors - sufficient quantities
Bread Boards - 15 Nos
CRO (30MHz) – 10 Nos.
Function Generators (3MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

TOTAL: 60 PERIODS
OBJECTIVES:
- To estimation and quantification of blood cells
- To learnt methods for identification of blood groups
- To estimation of haematological parameters
- To learnt the analysis of visual and hearing test

LIST OF EXPERIMENTS
1. Collection of Blood Samples
2. Identification of Blood groups (Forward and Reverse)
3. Bleeding and Clotting time
4. Estimation of Hemoglobin
5. Total RBC Count
6. Total WBC Count
7. Differential count of Blood cells
8. Estimation of ESR
9. PCV, MCH, MCV, MCHC
10. Hearing test – Tuning fork
11. Visual Activity – Snellen’s Chart and Jaeger’s Chart

OUTCOMES:
At end of the course, Students would be able to
- Identification and enumeration of blood cells
- Enumeration of haematological parameters
- Analysis of special sensory organs test

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:
Requirement for a batch of 30 students

- Microscope: 2 Nos
- Centrifuge Normal: 1 No
- Wintrobe’s tube: 2 Nos.
- PCV tube: 2 Nos.
- Neubaur’s Chamber: 2 Nos.
- Heparinized Syringe: 1 box
- Haemoglobinometer: 1 No
- Blood grouping kit: 1 No
- Capillary tubes: 1 box
- Ophthalmoscope: 1 No
- Tuning fork: (256Hz to 512Hz) 5 Nos.
- Microslides: 2 packets
- Lancet: 5 boxes

TOTAL: 30 PERIODS
MA8391 PROBABILITY AND STATISTICS

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

UNIT I PROBABILITY AND RANDOM VARIABLES
12

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES
12
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS
12
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS
12
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V STATISTICAL QUALITY CONTROL
12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students will be able to:
- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:
REFERENCES:

BM8401 MEDICAL PHYSICS L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
- To study principles and effects of ionizing and non-ionizing radiation in human body
- To discuss the physics of the senses
- To explore the effects of radiation in matter and how isotopes are produced
- To understand various detectors for detecting the presence of ionizing radiation.

UNIT I NON-IONIZING RADIATION AND ITS MEDICAL APPLICATIONS
Introduction and objectives - Tissue as a leaky dielectric - Relaxation processes, Debye model, Cole–Cole model, Overview of non-ionizing radiation effects - Low Frequency Effects - Higher frequency effects. Physics of light, Measurement of light and its unit - limits of vision and color vision an overview, Ultraviolet

UNIT II PHYSICS OF THE SENSES
Introduction and objectives - Cutaneous sensation - The chemical senses – Audition – Vision - Psychophysics

UNIT III PRINCIPLES OF RADIOACTIVE NUCLIDES
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, Target and Its Processing Equation for Production of Radionuclides, radionuclide Generator-Technetium generator.

UNIT IV RADIOACTIVE DECAY AND INTERACTIONOF RADIATION WITH MATTER

UNIT V SCINTILLATION, SEMICONDUCTOR and GAS FILLED DETECTORS

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Explain about non-ionizing radiation, interaction with tissue and its effects.
- Define and compare intensities of sensory stimuli
- Summarizes how ionizing radiation interacts with the human body, how to quantify it and its levels seen in the environment and healthcare
- Explain the fundamentals of radioactivity and radioactive isotopes
- Illustrates the methods of detecting and recording the ionizing radiation and its interaction with matter

TEXT BOOKS:

REFERENCES:

EE8452 BASICS OF ELECTRICAL ENGINEERING L T P C
3 0 0 3

AIM
To make the students understand the basics of electrical engineering required for incorporating the knowledge for smart application development.

OBJECTIVES:
- To introduce the fundamental concepts of electrical circuits connections with load.
- To understand the basic theory, operational characteristics of AC and DC machines
- To study the operating principles of measuring instrument for V, I, energy, power.
- To create awareness on the methods for electrical safety, load protection.
- To observe the electricity supply sources based on classical and standalone systems.

UNIT I ELECTRICAL CIRCUITS AND ANALYSIS
Ohm’s law, DC and AC circuits fundamentals, Energy sources, Kirchhoff’s laws, Mesh and Nodal analysis, Star-delta and Delta-star transformation; theorems and simple problems: Superposition, Thevenin’s, Maximum power transfer theorem.

UNIT II ELECTRICAL MACHINES

UNIT III BASIC ELECTRICAL INSTRUMENTATION
Introduction, classification of instruments, operating principles, essential features of measuring instruments (elementary Treatment only)- Moving coil, permanent magnet (PMMC) instruments, Moving Iron of Ammeters and Voltmeters Energy meter, Current Transformer, Potential Transformer.
UNIT IV ELECTRICAL WIRING AND SAFETY

UNIT V ELECTRICAL POWER SYSTEM AND ITS APPLICATION

OUTCOMES:
At the end of the course, students will be able to

- Design simple electrical circuits and understand through nodal, mesh analysis about constructing series and parallel configuration of circuits with sources and variable loads.
- Get knowledge on electrical machines and on its efficient operating principle.
- Understand metering principles, safety measures while working with electrical circuits.
- Analyse existing power distribution and hence apply technology in electrical applications

TEXT BOOKS:
2. P.C. Sen, Principles of Electrical Machines and Power Electronics, Wiley, 2016(Reprint)

REFERENCES:

EC8453 LINEAR INTEGRATED CIRCUITS

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

UNIT I BASICS OF OPERATIONAL AMPLIFIERS
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.
UNIT III  ANALOG MULTIPLIER AND PLL

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

UNIT IV  ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS


UNIT V  WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

TOTAL:45 PERIODS

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

- Design linear and non linear applications of OP – AMPS
- Design applications using analog multiplier and PLL
- Design ADC and DAC using OP – AMPS
- Generate waveforms using OP – AMP Circuits
- Analyze special function ICs

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To learn the features of C
- To learn the linear and non-linear data structures
- To explore the applications of linear and non-linear data structures
- To learn to represent data using graph data structure
- To learn the basic sorting and searching algorithms

UNIT I  C PROGRAMMING BASICS  9

UNIT II  FUNCTIONS, POINTERS, STRUCTURES AND UNIONS  9

UNIT III  LINEAR DATA STRUCTURES  9
Arrays and its representations – Stacks and Queues – Linked lists – Linked list based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT IV  NON-LINEAR DATA STRUCTURES  9
Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

UNIT V  SEARCHING AND SORTING ALGORITHMS  9

TOTAL: 45 PERIODS

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

- Implement linear and non-linear data structure operations using C
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem
- Modify or suggest new data structure for an application
- Appropriately choose the sorting algorithm for an application

TEXTBOOKS:
REFERENCES:

EC8392 DIGITAL ELECTRONICS

OBJECTIVES:
- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

UNIT I DIGITAL FUNDAMENTALS 9
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II COMBINATIONAL CIRCUIT DESIGN 9

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS 9
Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

TOTAL:45 PERIODS
OUTCOMES:
At the end of the course:
- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

TEXT BOOK:

REFERENCES

EC8381 FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY

OBJECTIVES:
- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

LIST OF EXERCISES:
1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

TOTAL:60 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:
- Write basic and advanced programs in C
- Implement functions and recursive functions in C
- Implement data structures using C
- Choose appropriate sorting algorithm for an application and implement it in a modularized way

BM8411 INTEGRATED CIRCUITS LABORATORY

OBJECTIVES:
- To expose the students to linear and integrated circuits
- To understand the basics of linear integrated circuits and available ICs
- To understand characteristics of operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

LIST OF EXPERIMENTS
DESIGN AND TESTING OF
1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
6. RC Phase shift and Wien bridge oscillators using op-amp.
7. Astable and monostable multivibrators using NE555 Timer.
8. PLL characteristics and its use as Frequency Multiplier.
9. DC power supply using LM317 and LM723.

LIST OF DIGITAL EXPERIMENTS
10. Design and implementation of code converters using logic gates
   (i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
11. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
12. Design and implementation of Multiplexer and De-multiplexer using logic gates
13. Design and implementation of encoder and decoder using logic gates
14. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
15. Design and implementation of 3-bit synchronous up/down counter
17. SPICE Simulation studies.

OUTCOMES:
At the end of the course, the student should be able to:
- Design oscillators and amplifiers using operational amplifiers.
- Design filters using Opamp and perform experiment on frequency response.
- Analyse the working of PLL and use PLL as frequency multiplier.
- Design DC power supply using ICs.
- Aquire knowledge in using SPICE

TOTAL : 60 PERIODS
OBJECTIVES:
The student should be made to:
- Understand analog and digital communication techniques.
- Learn data and pulse communication techniques.
- Be familiarized with source and Error control coding.
- Gain knowledge on multi-user radio communication.

UNIT I  ANALOG COMMUNICATION  9

UNIT II  PULSE AND DATA COMMUNICATION  9

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.

UNIT III  DIGITAL COMMUNICATION  9

UNIT IV  SOURCE AND ERROR CONTROL CODING  9
Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.

UNIT V  MULTI-USER RADIO COMMUNICATION  9
Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.
- Utilize multi-user radio communication.

TEXT BOOK:
REFERENCES:

BM8501 BIOCONTROL SYSTEMS L T P C 4 0 0 4

OBJECTIVES
The student should be made:
- To understand the concept behind feedback and continuum in various systems and subsystems.
- To analyse the systems in time and frequency domain and to understand the concept of stability.
- To apply mathematical modelling principles in understanding the various fundamental biological systems
- To analyse biological system models using MATLAB

UNIT I INTRODUCTION 12
Open and Closed loop Systems, Modeling and Block Diagrams, Block diagram and signal flow graph representation of systems, reduction of block diagram and signal flow graph, Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control system.

UNIT II TIME RESPONSE ANALYSIS 12
Step and impulse responses of first order and second order systems, time domain specifications of first and second order systems, steady state error constants, Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability.

UNIT III FREQUENCY RESPONSE ANALYSIS 12
Frequency domain specifications - Polar plots, Bode plots, Nyquist plot, Nyquist stability criterion, closed loop stability, Constant M and N circles, Nichol’s chart.

UNIT IV BIOLOGICAL SYSTEM MODELS 12
Distributed parameter versus lumped parameter models, Model development of Cardiovascular system- Heart model-circulatory model, Pulmonary mechanics- Lung tissue visco-elastance-chest wall- airways, Interaction of Pulmonary and Cardiovascular models, Static analysis of physiological systems – Regulation of cardiac output, Regulation of ventilation.

UNIT V BIOLOGICAL CONTROL SYSTEM ANALYSIS 12

TOTAL: 60 PERIODS
OUTCOMES:
Upon completion of this subject, the student will be able to:

- Understand the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
- Analyze the time response of various systems and discuss the concept of system stability
- Analyze the frequency response characteristics of various systems using different charts
- Understand the concept of modeling basic physiological systems
- Comprehend the application aspects of time and frequency response analysis in physiological control systems.

TEXTBOOKS:

REFERENCES:

BM8502 BIOMEDICAL INSTRUMENTATION L T P C

3 0 0 3

OBJECTIVES:
The student should be made to

- To illustrate origin of bio potentials and its propagations
- To understand the different types of electrodes and its placement for various recordings
- To design bio amplifier for various physiological recordings
- To learn the different measurement techniques for non-physiological parameters.
- To summarize different biochemical measurements.

UNIT I BIOPOTENTIAL ELECTRODES
Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, Contact impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT II BIOPOTENTIAL MEASUREMENTS
Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT III SIGNAL CONDITIONING CIRCUITS
UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS


UNIT V BIOCHEMICAL MEASUREMENT AND BIOSENSORS


OUTCOMES:
At the end of the course, the student should be able to:
- Differentiate different bio potentials and its propagations.
- Illustrate different electrode placement for various physiological recordings
- Design bio amplifier for various physiological recordings
- Explain various technique for non-electrical physiological measurements
- Demonstrate different biochemical measurement techniques.

TEXT BOOK:

REFERENCES:

EC8553 DISCRETE-TIME SIGNAL PROCESSING

OBJECTIVES:
- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering
UNIT I DISCRETE FOURIER TRANSFORM 12

UNIT II INFINITE IMPULSE RESPONSE FILTERS 12

UNIT III FINITE IMPULSE RESPONSE FILTERS 12
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window). Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECTS 12
Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 12
DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to
- Apply DFT for the analysis of digital signals and systems
- Design IIR and FIR filters
- Characterize the effects of finite precision representation on digital filters
- Design multirate filters
- Apply adaptive filters appropriately in communication systems

TEXT BOOK:

REFERENCES:
OBJECTIVES:
The student should be made:

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts

LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor

TOTAL: 60 PERIODS

OUTCOMES:

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

- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems
- Analyze the architecture of a DSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- Design a DSP system for various applications of DSP
OBJECTIVES:
- To provide hands-on training on designing of bio signal acquisition system and measurement of physiological parameters, biochemical parameters.

LIST OF EXPERIMENTS:
1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC’s
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artifacts.
3. Design of EMG amplifier
4. Design a suitable circuit to detect QRS complex and measure heart rate
5. Design of frontal EEG amplifier
6. Design of EOG amplifier to detect eye blink
7. Design a right leg driven ECG amplifier.
8. Design and study the characteristics of optical Isolation amplifier
9. Design a Multiplexer and Demultiplexer for any two biosignals.
13. Measurement and recording of peripheral blood flow
14. Design a PCB layout for any bio amplifier using suitable software tool.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the lab, the student should be able to:
- Design preamplifiers and amplifiers for various bio signal recordings.
- Measure various non-electrical parameters using suitable sensors/transducers
- Design PCB layout for any bio amplifier.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS:
pH meter and conductivity meter: 1 No.
Photo transducer for pulse measurement: 1 No.
Sphygmomanometer and Stethoscope: 1 No.
Blood flow measurement system: 1 No.
Multiparameter (ECG, EMG, EEG) Simulator: 2 No.
Function generator, DSO, Regulated Power supplies, Bread boards – 8 each
IC LM 324, AD 620, INA series (126,128 etc.), 555 Timer: 20 each
Opto Isolator IC: MCT2E – 1 No.
Software tool for PCB design: 1
OBJECTIVES:
The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill - its importance - speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification - Improving pronunciation - pronunciation basics - taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information - give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources - converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency - factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist - listen for detail.

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech - listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal.
TEXT BOOKS:

REFERENCES:

EC8691 MICROPROCESSORS AND MICROCONTROLLERS

OBJECTIVES:
- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

UNIT I THE 8086 MICROPROCESSOR
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE

UNIT III I/O INTERFACING

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

UNIT V INTERFACING MICROCONTROLLER
Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the students should be able to:

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

TEXT BOOKS:

REFERENCES:
1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012

BM8601 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT- I L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:

- Understand the devices for measurement of parameters related to cardiology.
- Illustrate the recording and measurement of EEG
- Demonstrate EMG recording unit and its uses.
- Explain diagnostic and therapeutic devices related to respiratory parameters.
- Understand the various sensory measurements that hold clinical importance.

UNIT I CARDIAC EQUIPMENT 9
Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac Pacemaker-Internal and External Pacemaker- Batteries, AC and DC Defibrillator- Internal and External, Defibrillator Protection Circuit, Cardiac ablation catheter.

UNIT II NEUROLOGICAL EQUIPMENT 8
Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential—Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

UNIT III MUSCULAR AND BIOMECHANICAL MEASUREMENTS 10

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 10
UNIT V  SENSORY MEASUREMENT

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Describe the working and recording setup of all basic cardiac equipment.
- Understand the working and recording of all basic neurological equipment.
- Discuss the recording of diagnostic and therapeutic equipment’s related to EMG.
- Explain about measurements of parameters related to respiratory system.
- Describe the measurement techniques of sensory responses.

TEXT BOOKS:

REFERENCES:

BM8651  BIOMECHANICS  L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
- Explain the principles of mechanics.
- Discuss the mechanics of physiological systems.
- Explain the mechanics of joints.
- Illustrate the mathematical models used in the analysis of biomechanical systems

UNIT I  INTRODUCTION TO MECHANICS
UNIT II BIOFLUID MECHANICS

UNIT III BIOSOLID MECHANICS

UNIT IV BIOMECHANICS OF JOINTS
Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video.

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

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Understand the principles of mechanics
- Outline the principles of biofluid dynamics.
- Explain the fundamentals of bio-solid mechanics.
- Apply the knowledge of joint mechanics.
- Give Examples of computational mathematical modelling applied in biomechanics.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.
UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT
From unsustainable to sustainable development – urban problems related to energy –
water conservation, rain water harvesting, watershed management – resettlement and
rehabilitation of people; its problems and concerns, case studies – role of non-governmental
organization- environmental ethics: Issues and possible solutions – climate change, global
warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. –
wasteland reclamation – consumerism and waste products – environment production act – Air
(Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act –
Wildlife protection act – Forest conservation act – enforcement machinery involved in
environmental legislation- central and state pollution control boards- Public awareness.

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

OUTCOMES:
• Environmental Pollution or problems cannot be solved by mere laws. Public participation is
an important aspect which serves the environmental Protection. One will obtain knowledge
on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:
   2006.
2. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, 2nd edition,

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

MD8091 HOSPITAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
• To understand the fundamentals of hospital administration and management.
• To know the market related research process
• To explore various information management systems and relative supportive services.
• To learn the quality and safety aspects in hospital.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION
Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital
Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management –
Telemedicine - Bio-Medical Waste Management.
UNIT II       HUMAN RESOURCE MANAGEMENT IN HOSPITAL

UNIT III      MARKETING RESEARCH PROCESS

UNIT IV      HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

UNIT V        QUALITY AND SAFETY ASPECTS IN HOSPITAL

OUTCOMES:
At the end of the course, the student should be able to:
- Explain the principles of Hospital administration.
- Identify the importance of Human resource management.
- List various marketing research techniques.
- Identify Information management systems and its uses.
- Understand safety procedures followed in hospitals.

TEXT BOOKS:

REFERENCES:

TOTAL: 45 PERIODS
OBJECTIVES:
- To Introduce ALP concepts, features and Coding methods
- 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:
8086 Programs using kits and MASM
1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripheral and Interfacing Experiments
7. Traffic light controller
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM
14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2’s complement of a number
16. Unpacked BCD to ASCII

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:
HARDWARE:
8086 development kits - 30 nos
Interfacing Units - Each 10 nos
Microcontroller - 30 nos

SOFTWARE:
Intel Desktop Systems with MASM - 30 nos
8086 Assembler
8051 Cross Assembler
OBJECTIVES:
The student should be made to
- To demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.

LIST OF EXPERIMENTS:
1. Measurement of visually evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Study of shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Study of hemodialysis model
6. Electrical safety measurements
8. Study of medical stimulator
9. Analyze the working of ESU – cutting and coagulation modes
10. Recording of Audiogram
11. Study the working of Defibrillator and pacemakers
12. Analysis of ECG, EEG and EMG signals
13. Study of ventilators
14. Study of Ultrasound Scanners
15. Study of heart lung machine model

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the lab, the student should be able to:
- Measure different bioelectrical signals using various methods
- Assess different non-electrical parameters using various methodologies
- Illustrate various diagnostic and therapeutic techniques
- Examine the electrical safety measurements
- Analyze the different bio signals using suitable tools.

LAB REQUIREMENTS FOR 30 STUDENTS
Visually evoked potential setup: 1 No.
GSR setup: 1 No.
Multi-output power supply (+15v, -15v, +30V variable, +5V, 2A): 2 Nos.
Short wave Diathermy 1 No.
Ultrasound diathermy 1 No.
Multiparameter biotelemetry system 1 No.
Electrical Safety Analyser 1 No.
Spirometry with associated analysis system: 1 No.
ECG Simulator 1 No.
Medical stimulator 1 No.
Surgical diathermy with analyzer 1 No.
Audiometer 1 No.
Pacemaker and Defibrillator: 1 No. each
Haemodialysis model and Heart lung Model: 1 No. each
Ventilator: 1 No.
Ultrasound Scanner: 1 No.
Software to Analyze ECG, EEG and EMG: 1 No.
BM8612 MINI PROJECT

OBJECTIVES
• To develop skills to formulate a technical project.
• To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of a Biomedical/ Electronics/ Mechatronic/ Instrumentation system.
• To teach use of new tools, algorithms and techniques required to carry out the projects.
• To give guidance on the various procedures for validation of the product and analyze the cost effectiveness.
• For enabling the students to gain experience in organization and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.
• To provide guidelines to prepare technical report of the project.

TOTAL: 30 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Formulate a real world problem, identify the requirement and develop the design solutions.
• Express the technical ideas, strategies and methodologies.
• Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
• Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
• Prepare report and present the oral demonstrations.

HS8581 PROFESSIONAL COMMUNICATION

OBJECTIVES:
The course aims to:
• Enhance the Employability and Career Skills of students
• Orient the students towards grooming as a professional
• Make them Employable Graduates
• Develop their confidence and help them attend interviews successfully.

UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL : 30 PERIODS
OUTCOMES:
At the end of the course Learners will be able to:
- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:

BM8701 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – II  L T P C  3 0 0 3

OBJECTIVES:
The student should be made to:
- Understand the devices used in ICU and principles of Telemetry.
- Describe types of diathermy and its uses
- Demonstrate applications of ultrasound in medicine
- Explain extracorporeal devices used in critical care
- Discuss the importance of patient safety against electrical hazard

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

UNIT II  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 III  ULTRASONIC EQUIPMENTS
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 IV EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES 9


UNIT V PATIENT SAFETY 9


TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the various equipment used in ICU and applications of telemetry.
- Explain the types of diathermy and its applications.
- Express the basics of ultrasound and its application in medicine
- Discuss the various extracorporeal and special diagnostic devices used in hospitals
- Outline the importance of patient safety against electrical hazard

TEXT BOOKS:


REFERENCES:


EC8093 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

UNIT II  IMAGE ENHANCEMENT  9
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–
Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier
Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and
Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III  IMAGE RESTORATION  9
Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order
Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum
Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV  IMAGE SEGMENTATION  9
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation –
Region growing – Region splitting and merging – Morphological processing- erosion and dilation,
Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed
segmentation algorithm.

UNIT V  IMAGE COMPRESSION AND RECOGNITION  9
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG
standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional
Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on
matching.

TOTAL  45  PERIODS

OUTCOMES:
At the end of the course, the students should be able to:
- Know and understand the basics and fundamentals of digital image processing, such as
digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition
methods for color models.

TEXT BOOKS:
   2010.

REFERENCES:
OBJECTIVES:
The student should be made
- To understand the generation of X-ray and its uses in imaging
- To describe the principle of Computed Tomography.
- To know the techniques used for visualizing various sections of the body.
- To learn the principles of different radio diagnostic equipment in Imaging
- To discuss the radiation therapy techniques and radiation safety.

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), and shim coils, Electronic components, fMRI.

UNIT IV  NUCLEAR MEDICINE TECHNIQUES  9
Nuclear imaging – Anger scintillation camera –Nuclear tomography – single photon emission computer tomography, positron emission tomography – Recent advances .Radionuclide imaging-Bone imaging, dynamic renal function, myocardial perfusion. Non imaging techniques- hematological measurements, Glomerular filtration rate, volume measurements, clearance measurement, whole -body counting, surface counting

UNIT V  RADIATION THERAPY AND RADIATION SAFETY  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the student should be able to
- Describe the working principle of X ray machine and its application.
- Illustrate the principle computed tomography.
- Interpret the technique used for visualizing various sections of the body using magnetic resonance imaging
- Demonstrate the applications of radio nuclide imaging.
- Outline the methods of radiation safety.
TEXT BOOKS:

REFERENCES:

BM8703 REHABILITATION ENGINEERING L T P C 3 0 0 3

OBJECTIVES:
- To understand the rehabilitation concepts and Rehabilitation team members for future development and applications.
- To study various Principles of Rehabilitation Engineering.
- To understand different types of Therapeutic Exercise Technique.
- To understand the tests to assess the hearing loss, development of electronic devices to compensate for the loss and various assist devices for visually and auditory impaired.
- To study the various orthotic devices and prosthetic devices to overcome orthopedic problems.

UNIT I INTRODUCTION TO REHABILITATION 9
What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II PRINCIPLES OF REHABILITATION 9

UNIT III THERAPEUTIC EXERCISE TECHNIQUE 9

UNIT IV MANAGEMENT OF COMMUNICATION & VIRTUAL REALITY 9
Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids. Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.
UNIT V  ORTHOTIC, PROSTHETIC DEVICES & RESTORATION TECHNIQUES  9


OUTCOMES
Students will be able to
- Gain adequate knowledge about the needs of rehabilitations and its future development.
- Have an in depth idea about Engineering Concepts in Sensory & Motor rehabilitation. Apply the different types of Therapeutic Exercise Technique to benefit the society.
- Design and apply different types Hearing aids, visual aids and their application in biomedical field and hence the benefit of the society.
- Gain in-depth knowledge about different types of models of Hand and arm replacement.

TEXT BOOKS:

REFERENCES:
4. Rory A Cooper (Editor), Hisaichi Ohnabe (Editor), Douglas A. Hobson (Editor), 'An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering' CRC Press, 2006.

EC8762  DIGITAL IMAGE PROCESSING LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To practice the basic image processing techniques.
- To compute magnitude and phasor representation of images.
- To understand the concepts of image restoration and segmentation.
- To explore the applications of image processing techniques.

LIST OF EXPERIMENTS
Simulation using MATLAB
1. Image sampling and quantization
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Histogram Processing and Basic Thresholding functions
7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection.
10. Basic Morphological operations.
11. Region based Segmentation
12. Segmentation using watershed transformation
13. Analysis of images with different color models.
14. Study of DICOM standards
15. Image compression techniques
16. Image restoration
17. A mini project based on medical image processing

TOTAL : 60 PERIODS

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

- Perform enhancing operations on the image using spatial filters and frequency domain filters.
- Use transforms and analyse the characteristics of the image.
- Perform segmentation operations in the images.
- Estimate the efficiency of the compression technique on the images.
- Apply image processing technique to solve real health care problems.

REFERENCE:

MD8751 HOSPITAL TRAINING

OBJECTIVES:
The student should be made to

- Observe medical professionals at work in the wards and the roles of Allied Health Professionals;
- Provide access to healthcare Professionals to get a better understanding of their work;
- Demonstrate patient-care in a hospital setting.

ASSESSMENT:
- Students need to complete training in any leading Multi-speciality hospital for a period of 15 days. They need to prepare an extensive report and submit to their respective course in-charges during the session.
- Out of the following departments, it is mandatory to complete training in any 10. The students can give a presentation of the remaining departments during laboratory hours.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Departments for visit</th>
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<tbody>
<tr>
<td>1</td>
<td>Cardiology</td>
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<td>2</td>
<td>ENT</td>
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<td>Ophthalmology</td>
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<td>Orthopaedic and Physiotherapy</td>
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<td>ICU/CCU</td>
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<td>Operation Theatre</td>
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<td>Neurology</td>
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<td>Radiology</td>
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<td>Nuclear Medicine</td>
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<td>Urology</td>
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<td>13</td>
<td>Obstetrics and Gynaecology</td>
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</tbody>
</table>
OUTCOMES:
At the end of the course, the student should be able to:
- Advocate a patient-centred approach in healthcare
- Communicate with other health professionals in a respectful and responsible manner
- Recognize the importance of inter-professional collaboration in healthcare.
- Propose a patient-centred inter-professional health improvement plan based upon the patient's perceived needs
- Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

BM8811 PROJECT WORK

OBJECTIVES:
To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES:
On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.
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.

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, microfluidic 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, Biosensors- sensors for glucose, uric acid, urea and triglyceride sensor.

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.

TEXT BOOKS:
REFERENCES:

EC8075 NANOTECHNOLOGY AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES
- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology

UNIT I INTRODUCTION TO NANOTECHNOLOGY
Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bionano-particles.

UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS
Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.

UNIT III PROPERTIES AND MEASUREMENT OF NANOMATERIALS
Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV NANO STRUCTURES
Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

UNIT V APPLICATIONS OF NANOTECHNOLOGY
Nano electronics, Nanosensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Describe the basic science behind the properties of materials.
- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Comprehend the exciting applications of nanotechnology at the leading edge of scientific research
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.
TEXT BOOKS:
1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004. (Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCES:

BM8072 BIOMATERIALS
L T P C
3 0 0 3

OBJECTIVES
The student should be made to:
- Learn characteristics and classification of Biomaterials
- Understand different metals, ceramics and its nanomaterial's characteristics as biomaterials
- Learn polymeric materials and its combinations that could be used as a tissue replacement implants
- Get familiarized with the concepts of Nano Science and Technology
- Understand the concept of biocompatibility and the methods for biomaterials testing

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

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

UNIT III POLYMERIC IMPLANT MATERIALS

UNIT IV TISSUE REPLACEMENT IMPLANTS

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

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.
- Identify significant gap required to overcome challenges and further development in metallic and ceramic materials
- Identify significant gap required to overcome challenges and further development in polymeric materials
- Create combinations of materials that could be used as a tissue replacement implant.
- Understand the testing standards applied for biomaterials.

TEXT BOOKS:

REFERENCES:

BM8001 MEDICAL OPTICS L T P C

OBJECTIVES:
To Study about:
- The optical properties of the tissues and the interactions of light with tissues.
- The instrumentation and components in Medical Optics.
- The Medical Lasers and their applications
- The optical diagnostic applications
- The emerging optical diagnostic and therapeutic techniques

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9
Fundamental Properties of light - Refraction, Reflection, Laws (Snell’s law and Fresnel law) Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology, Laser tissue Interactions – Photo chemical, Photo thermal and Photo mechanical interactions, Fluorescence, Speckles, Photo ablative processes.

UNIT II INSTRUMENTATION IN PHOTONICS 9
Instrumentation for absorption, Scattering and emission measurements, Excitation light sources – high pressure arc lamps, LEDs, Lasers, Optical filters – Prism and Monochromators, Polarizers, Optical detectors – Single Channel and Multichannel detectors, Time resolved and phase resolved detection methods, Optical fibers – Total Internal Reflection.
UNIT III  SURGICAL THERAPEUTIC APPLICATIONS OF LASERS  9
Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT IV  NON THERMAL DIAGNOSTIC APPLICATIONS  9
Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM
Raman Spectroscopy and Imaging, FLIM – Holographic and Speckle applications of lasers in
biology and medicine.

UNIT V  DIAGNOSTIC AND THERAPEUTIC TECHNIQUES  9
Near field imaging of biological structures, In vitro clinical diagnostics, Phototherapy,
Photodynamic therapy (PDT) - Principles and mechanisms - Oncological and non-oncological

OUTCOMES:
At the end of the course, the students should be able to:
- Demonstrate knowledge of the fundamentals of optical properties of tissues
- Analyze the components of instrumentation in Medical Photonics and Configurations
- Describe surgical applications of lasers.
- Describe photonics and its diagnostic applications.
- Investigate emerging techniques in medical optics

TEXT BOOKS:

REFERENCES:
3. Leon Goldman, M.D., & R. James Rockwell, Jr., “Lasers in Medicine”, Gordon and Breach,

GE8074   HUMAN RIGHTS   L T P C
                     3 0 0 3

OBJECTIVE:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I
Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural,
Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective
/ Solidarity Rights.

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.
UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

GE8077  TOTAL QUALITY MANAGEMENT

OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I  INTRODUCTION

UNIT II  TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III  TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV  TQM TOOLS AND TECHNIQUES II
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V  QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS
OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO9001-2015 standards

BM8074 BIO SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES
The student should be made to
- Understand characteristics of some of the most commonly used biomedical signals, including ECG, EEG, EOG, and EMG.
- Understand choice of filters to remove noise and artifacts from biomedical signals.
- Apply established engineering methods to analyse ECG signal problems.
- Apply established engineering methods to analyse neurological signals.
- Analyse various biomedical signals through advanced techniques.

UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS
Bio signal Characteristics of Electro Cardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electoretinogram (ERG), Electrogastrogram (EGG), Electroneurogram (ENG), Event related potentials (ERPs), Phonocardiogram (PCG), Speech signal, Objectives of Biomedical signal analysis, Difficulties in Biomedical signal analysis, Computer-aided diagnosis.

UNIT II FILTERING FOR REMOVAL OF ARTIFACTS

UNIT III CARDIOVASCULAR APPLICATIONS
UNIT IV  NEUROLOGICAL APPLICATIONS
EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.

UNIT V  ANALYSIS ON WAVESHAPE, SIGNAL CLASSIFICATION AND RECOGNITION

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course student should be able to
- Draw different types of biomedical signals and identify their spectral components.
- Use different filters on biomedical signals and judge filter performance.
- Identify physiological interferences and artifacts affecting ECG signal.
- Compute power and correlation spectra of EEG signal.
- Propose an algorithm to classify biomedical signals.

TEXT BOOKS:
2. Semmlow, "Biosignal and Biomedical Image Processing", Marcel Dekker, 2004

REFERENCES:

BM8002  ARTIFICIAL ORGANS AND IMPLANTS
L T P C  3 0 0 3

OBJECTIVES
- To have an overview of artificial organs & transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To study about various blood interfacing implants
- To study about soft tissue replacement and hard tissue replacement
UNIT I ARTIFICIAL ORGANS & TRANSPLANTS 9
ARTIFICIAL ORGANS:-Introduction, outlook for organ replacements, design consideration, evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN 9
Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION 9
Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS 9
Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS 9
Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

TOTAL : 45 PERIODS

OUTCOMES:
Students will be able to
- Gain adequate knowledge about artificial organs & transplants
- Get clear idea about implant design and its parameters and solution
- Have in-depth knowledge about blood interfacing implants
- Explain different types of soft tissue replacement and hard tissue replacement

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The students should be made to
- Learn the key principles for telemedicine and health
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications.

UNIT I  FUNDAMENTALS OF TELEMEDICINE  9

UNIT II  TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE  9
Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT III  ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE  9
Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights.

UNIT IV  PICTURE ARCHIVING AND COMMUNICATION SYSTEM  9
Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V  APPLICATIONS OF TELEMEDICINE  9
Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health and Cyber Medicine.

TOTAL : 45 PERIODS

OUTCOMES:
The students will be able to
- Apply multimedia technologies in telemedicine
- Explain protocols behind encryption techniques for secure transmission of data
- Apply telehealth in healthcare.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
The student should be made
- To understand the basics of fluid mechanics,
- To analyze cellular, ocular, cardiovascular and respiratory fluid mechanics
- To learn mathematical modelling of fluid biological systems.

UNIT I  BIOFLUID MECHANICS  8

UNIT II  CELLULAR AND OCULAR MECHANICS  8

UNIT III  BLOOD RHEOLOGY AND BLOOD VESSEL MECHANICS  10

UNIT IV  CARDIO RESPIRATORY MECHANICS AND SPACE MEDICINE  9

UNIT V  COMPUTATIONAL FLUID DYNAMICS  10

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Understand the basics of Fluid Mechanics
- Construe the intracellular fluid mechanics and ocular mechanics.
- Describe the rheology of blood and mechanics of blood vessels.
- Elucidate on cardiorespiratory mechanics and space medicine.
- Develop mathematical models of biological systems with fluids

TEXT BOOKS:

REFERENCES:
4. C. Ross Ethier, Craig A Simmons, “Introduction to Biomechanics- From Cells to Organisms”, Cambridge Texts in Biomedical Engineering, 2007

GE8075 INTELLECTUAL PROPERTY RIGHTS L T P C 3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

UNIT IV DIGITAL PRODUCTS AND LAW 9

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UNIT V ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL : 45 PERIODS

OUTCOME:
• Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

REFERENCES

MD8752 PHYSIOLOGICAL MODELING

OBJECTIVES:
The student should be made to:
• To explain the application of Physiological models and vital organs.
• To Formulate the methods and techniques for analysis and synthesis of dynamic models
• To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
• To describe nonlinear models of physiological systems
• To compute the Simulation of physiological systems

UNIT I INTRODUCTION TO PHYSIOLOGICAL MODELING
Approaches to modeling: The technique of mathematical modeling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modeling.Introduction to physiology (homeostasis, cell biology) Modeling physical systems, linearmodels of physiological systems, the Laplace transform, Transfer functions and block diagram analysis Physiology.

UNIT II MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM
Dynamic systems and their control, modeling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

UNIT III NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEMS
UNIT IV  COMPARTMENTENTAL PHYSIOLOGICAL MODEL  
Modeling the body as compartments, behaviour in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modeling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation. Mathematical modeling of the system: Thermo regulation, Thermoregulation of cold bloodedness & warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body.

UNIT V  SIMULATION OF PHYSIOLOGICAL SYSTEMS  
Simulation of physiological systems using Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

TOTAL: 45 PERIODS

OUTCOMES:  
At the end of this course, the student should be able to  
- Explain the application of Physiological models  
- Describe the methods and techniques for analysis and synthesis of Linear and dynamic system  
- Develop differential equations to describe the compartmental physiological model  
- Describe Nonlinear models of physiological systems  
- Illustrate the Simulation of physiological systems

TEXT BOOKS:

REFERENCES:

BM8004  ROBOTICS IN MEDICINE  
L T P C  
3 0 0 3

OBJECTIVES  
The student should be made to  
- Understand the basics of Robotics, Kinematics.  
- Understand the basics of Inverse Kinematics.  
- Explore various kinematic motion planning solutions for various Robotic configurations.  
- Explore various applications of Robots in Medicine.
UNIT I  INTRODUCTION 9
Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct
Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link
coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot

UNIT II  KINEMATICS 9
Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-
Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope and
examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated
motion, Straight-line motion.

UNIT III  ROBOT VISION 9
Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis,
Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers,
Perspective transformation, Structured illumination, Camera calibration.

UNIT IV  PLANNING 9
Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion,
Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal
scenes, Task Planner simulation.

UNIT V  APPLICATIONS 9
Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural
Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical
– Gynaecology, Orthopaedics, Neurosurgery

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course student should be able to
• Understand the basics of robotic systems.
• Design basic Robotics system and formulate Kinematics.
• Construct Inverse Kinematic motion planning solutions for various Robotic configurations.
• Design Robotic systems for Medical application.

TEXT BOOKS:

REFERENCES:
1. Staagaard, Andrew C,“Robotics and Artificial Intelligence: An Introduction to Applied
   Machine Learning”, Prentice Hall Of India, 1987
2. Grover, Wiess, Nagel, Oderey, “Industrial Robotics: Technology, Programming and
OBJECTIVES:
- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT

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

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

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES

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

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Raspberry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

TEXTBOOK:
REFERENCES:
https://www.arduino.cc/

BM8078 SOFT COMPUTING TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
The student should be made to
- Understand the different soft computing techniques.
- Understand neural network architectures and learning algorithms, for different applications
- Explore the use of Fuzzy and Genetic Algorithm
- Understand different Optimization techniques in soft computing
- To introduce Hybrid and Other advanced model in soft computing.

UNIT I FROM BIOLOGY TO ARTIFICIAL NEURAL NETWORKS –INTRODUCTION 9
Biological Neural Networks, Components of Artificial Neural Networks – Connections, Propagation function and Network Inputs, Common Activation Functions, Threshold, Network Topologies, Learning - Supervised, Unsupervised, Reinforcement. Backpropagation, Radial Basis Function, Self-Organizing Maps, Counter Propagation Networks, Adaptive Resonant Theory (ART).

UNIT II FUZZY SET THEORY 10

UNIT III GENETIC ALGORITHM 9
Genetic Algorithms: Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators methods of selection, crossover and mutation, simple GA (SGA), other types of GA, generation gap, steady state GA.

UNIT IV OPTIMIZATION USING SOFT COMPUTING 9
Single variable optimization - Region Elimination Methods, Fibonacci Search Method, Multivariable Optimization - Cauchy's Steepest Descent Method, Newton's method, Swarm Intelligence-Particle Swarm Optimization, ANT Intelligence – ANT Colony Optimization, Artificial Bee Colony Algorithm, Jumping Frog Optimization.
UNIT V  HYBRID AND ADVANCED MODEL IN SOFT COMPUTING


TOTAL : 45 PERIODS

OUTCOMES:
Upon successful completion of the course student should be able to
- Describe various neural, fuzzy and Genetic algorithms.
- Implement Neural, Genetic and Fuzzy algorithms for various classification applications

TEXT BOOKS:

REFERENCES:

GE8072  FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
UNIT I  
FUNDAMENTALS OF PRODUCT DEVELOPMENT  

UNIT II  
REQUIREMENTS AND SYSTEM DESIGN  

UNIT III  
DESIGN AND TESTING  

UNIT IV  
SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  

UNIT V  
BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.
REFERENCES:

GE8071 DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and.
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc.- Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.
UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

BM8079 VIRTUAL REALITY AND AUGMENTED REALITY L T P C 3 0 0 3

OBJECTIVES:
The student should be made:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I INTRODUCTION


UNIT II VR DEVELOPMENT PROCESS

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.
UNIT III CONTENT CREATION CONSIDERATIONS FOR VR
Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR ON THE WEB & VR ON THE MOBILE

UNIT V APPLICATIONS
Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy

TOTAL: 45 PERIODS

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

- Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
- Identify problem statements and function as a member of an engineering design team.
- Utilize technical resources
- Propose technical documents and give technical oral presentations related to design mini project results.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:
- Understand the hazardous materials used in hospital and its impact on health
- Understand various waste disposal procedures and management.

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

UNIT II BIOMEDICAL WASTE MANAGEMENT 9
Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III HAZARDOUS MATERIALS 9

UNIT IV FACILITY SAFETY 9

UNIT V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY 9

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to
- Analyse various hazards, accidents and its control
- Design waste disposal procedures for different biowastes
- Categorise different biowastes based on its properties
- Design different safety facility in hospitals
- Propose various regulations and safety norms
TEXT BOOKS:

REFERENCE:

BM8005 NEURAL ENGINEERING  

OBJECTIVES: 
The student should be made

- To discuss the physiological concepts of nerve impulse generation and Electromyography
- To discuss about EEG and its various applications
- To Explore Evoked potentials and its importance in medicine
- To introduce various techniques to study central and peripheral nerve function
- To discuss the electrophysiological evaluation in special situations.

UNIT I NERVE EXCITABILITY AND ELECTROMYOGRAPHY 8 

UNIT II ELECTROENCEPHALOGRAPHY 10 
Electroencephalography (EEG): General Principles and Clinical Applications, Neonatal and Paediatric EEG, EEG Artefacts and Benign Variants, Video EEG monitoring for epilepsy, Invasive Clinical Neurophysiology in Epilepsy and movement disorders, Topographic mapping, Frequency analysis and other quantitative techniques in EEG, Intraoperative EEG monitoring during carotid endarterectomy and cardiac surgery, Magnetoencephalography.

UNIT III EVOKED POTENTIALS 9 

UNIT IV FUNCTIONAL NEUROIMAGING AND COGNITION 9 

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UNIT V ELECTROPHYSIOLOGICAL EVALUATION IN SPECIAL SITUATIONS

Electrophysiological evaluation of sacral function: Bladder, bowel and sexual function, Vestibular laboratory testing, Polysomnographic evaluation of sleep disorders, Electrophysiologic evaluation of: brain death, patients in the intensive care unit, patients with suspected neurotoxic disorders.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course learner will be able to,

- Understand the physiology behind generation of nerve impulses.
- Describe various techniques that are used to evaluate the functioning of central and peripheral nervous system.
- Differentiate between a normal and abnormal signal coming from a healthy and a diseased nervous system respectively.

TEXT BOOKS:

REFERENCES:

UNIT I INTRODUCTION TO BIOMETRICS

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometrics Vs traditional techniques – Benefits of biometrics - Operation of a biometric system– Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, FTA rate and rate- Need for strong authentication – Protecting privacy and biometrics and policy – Biometric applications

UNIT II FINGERPRINT IDENTIFICATION TECHNOLOGY

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.
UNIT III   FACE RECOGNITION
Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition, Representation and Classification, Kernel-based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT IV   VOICE SCAN

UNIT V   FUSION IN BIOMETRICS
Introduction to Multibiometric - Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics - Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples – biopotential and gait based biometric 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.

TEXT BOOKS:

REFERENCES:

GE8076   PROFESSIONAL ETHICS IN ENGINEERING

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

UNIT I   HUMAN VALUES
UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V  GLOBAL ISSUES

TOTAL: 45 PERIODS

OUTCOME:
• Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org
OBJECTIVE
To provide electrical protection and maintenance in working environment and ensure that electrical safety.

UNIT I  ELECTRICAL HAZARDS  12

UNIT II  STANDARDS AND REQUIREMENTS  12
National electrical Safety code - Standards and statutory requirements – Indian electricity acts and rules – statutory requirements from Electrical inspectorate. Hazardous area classification and classification of electrical equipments for hazardous areas (IS, NFPA, API and OSHA standards).

UNIT III  ELECTRICAL PROTECTION AND MAINTENANCE  9
Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance. First aid-cardio pulmonary resuscitation(CPR).

UNIT IV  STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS  6
Define Quality- Need for Standarization & Quality Management, QM in Health care organization- Quality assurance methods ,QA in (Medical Imaging & Nuclear medicine) Diagnostic services – Classification of equipments

UNIT V  REGULATORY REQUIREMENT FOR HEALTH CARE  6
CE and FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

TOTAL :45 PERIODS

OUTCOME:
- The purpose of this course is to help students to develop knowledge and insight into the procedures used in quality control and assurance activities as well as safety measures to be followed in hospitals.

TEXT BOOKS:
1. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd. 24

REFERENCES:
OBJECTIVES:
The student should be made to:

- Be exposed to principles of ergonomics.
- Learn the mechanics of muscle physiology.
- Be familiar with the mathematical models, analysis and design of biomedical devices using case studies.

UNIT I VISUAL AND AUDITORY ERGONOMICS 9
Process of seeing – visual capabilities-factors affecting visual acuity and contrast sensitivity – human factor aspects of hard copy text and computer screen text, factors in selecting graphic representations symbols, qualitative visual display-process of hearing-principles of auditory display.

UNIT II MUSCLE PHYSIOLOGY 9
Muscle physiology -muscle metabolism-respiratory response-joint motion study- measure of physiological in-efficiency and energy consumption-work rest cycles-aspects of manual and posture study, material handling (MMH) Bio-mechanical recommended limits of MMH.

UNIT III CONTROLS AND DISPLAYS 9
Spatial compatibility physical arrangement of displays and controls- movement capability- rotary controls and rotar displays movement of displays- orientation of the operator and movement relationships control orders and control responses- human limitations in tracking task.

UNIT IV ANTHROPOMETRY 9
Anthropometry- anthropometric design principles –work space envelope- factors in design of work space surfaces- principles of seat design –principles of control panel. Organization classification of human errors-theories of accident causation-reducing accidents by altering behavior.

UNIT V CASE STUDIES 9
Case Study 1: computer design, control panel design of an electronic instrument, computer keyboard, hand drill etc. Case Study 2: Biomedical Application, Design optimization of Medical Equipments.

TOTAL: 45 PERIODS

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

- Understand principles of ergonomics.
- Design biomedical devices.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:

- Understand the basic concepts of brain computer interface
- Study the various signal acquisition methods
- Learn about the signal processing methods used in BCI
- Understand the various machine learning methods of BCI.
- Learn the various applications of BCI

UNIT I    INTRODUCTION TO BCI
Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI.

UNIT II    BRAIN ACTIVATION

UNIT III   FEATURE EXTRACTION METHODS
Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artefacts reduction, Feature Extraction - Phase synchronization and coherence

UNIT IV    MACHINE LEARNING METHODS FOR BCI
Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF’s, Perceptron’s, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis

UNIT V     APPLICATIONS OF BCI
Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs:P300 Mind Speller, Visual cognitive BCI, Emotion detection. Ethics of Brain Computer Interfacing.

TOTAL : 45 PERIODS

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

- Comprehend and appreciate the significance and role of this course in the present contemporary world.
- Evaluate concept of BCI.
- Assign functions appropriately to the human and to the machine.
- Select appropriate feature extraction methods
- Use machine learning algorithms for translation.

TEXT BOOKS:


REFERENCES:


EC8791 EMBEDDED AND REAL TIME SYSTEMS

OBJECTIVES:
The student should be made to:

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the real time operating systems

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN


UNIT II ARM PROCESSOR AND PERIPHERALS


UNIT III EMBEDDED PROGRAMMING

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT IV REAL TIME SYSTEMS


UNIT V PROCESSES AND OPERATING SYSTEMS

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:

- Describe the architecture and programming of ARM processor
- Outline the concepts of embedded systems
- Explain the basic concepts of real time operating system design
- Model real-time applications using embedded-system concepts

TEXT BOOKS:

REFERENCES:

GE8073 FUNDAMENTALS OF NANOSCIENCE

OBJECTIVE:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS
UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

REFERENCES: