PROGRAMME EDUCATIONAL OBJECTIVES:

- **PEO1**: To provide the students a strong basic in electronics, mathematics and life science and make them prepared to integrate these concepts for developing new medical devices.
- **PEO2**: To instill interpersonal skill for creating a conducive environment to make technological advancement that addresses societal needs.
- **PEO3**: To encourage the interest on research, leadership and ethics, and to disseminate the acquired knowledge to upcoming engineers.

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 Life sciences and Engineering.

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

3) To develop indigenous medical devices by combining innovative ideas of their core field and emerging information and communication technologies (ICT)

**PEO AND PO MAPPING**

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<tr>
<th>PEO</th>
<th>PO1</th>
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<td>SUBJECT NAME</td>
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<td>COMMUNICATIVE ENGLISH</td>
<td>• Develop listening skills for academic and professional purposes.</td>
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<td></td>
<td>• Gain familiarity with learning approaches connected to successful writing</td>
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<tr>
<td>ENGINEERING MATHEMATICS I</td>
<td>• Demonstrates confidence in using mathematics to obtain realistic solutions to problems</td>
<td>✓</td>
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<td></td>
<td>• Interpret and communicate mathematics in a variety of problem solving.</td>
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<tr>
<td>ENGINEERING PHYSICS</td>
<td>• Ability to identify, formulate, and solve real world problems.</td>
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<td>• Apply basic knowledge of</td>
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<td>Science to explain</td>
<td>Observable phenomena.</td>
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<td>Engineering Chemistry</td>
<td>• Demonstrate the principles of basic chemistry including the chemical</td>
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<td>reactions and mechanism</td>
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<td>• Enhance the thinking capabilities in the modern trends in Engineering &amp;</td>
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<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</td>
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<td>programming language that solve a stated problem in a clean and robust</td>
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<td>Engineering Graphics</td>
<td>• Know and understand the conventions and the methods of engineering</td>
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<td>• Students will be able to improve their visualization skills so that</td>
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<td>they can apply</td>
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<tr>
<td>PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY</td>
<td>these skills in developing new products.</td>
<td>✓</td>
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<tr>
<td>PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY</td>
<td>• Apply good programming design methods for program development.</td>
<td>✓</td>
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<tr>
<td>PHYSICS AND CHEMISTRY LABORATORY</td>
<td>• Design and implement Computer programs for simple applications.</td>
<td>✓</td>
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<tr>
<td>PHYSICS AND CHEMISTRY LABORATORY</td>
<td>• Practice applications of various phenomena of light, which includes laser, fibre optics, spectrometer grating.</td>
<td>✓</td>
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<tr>
<td>PHYSICS AND CHEMISTRY LABORATORY</td>
<td>• Gain hands-on knowledge in the quantitative chemical analysis of water quality related parameters</td>
<td>✓</td>
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### TECHNICAL ENGLISH

- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.  
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### ENGINEERING MATHEMATICS II

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions.
- Students will be able to solve problems related to engineering applications by using mathematical
<p>| PHYSICS FOR ELECTRONICS ENGINEERING | • Organize, analyze and interpret information and use the scientific method to make inferences about material physics | ✓ | ✓ | ✓ | ✓ | ✓ |
|• Relate concepts learned in Physical Science and Engineering Department classes to real world situations | ✓ | ✓ | ✓ | ✓ | ✓ |
| ENGINEERING MECHANICS FOR BIOMEDICAL ENGINEERS | • 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 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CIRCUIT ANALYSIS | • Learn how to develop and employ circuit models for elementary electronic components | ✓ | ✓ | ✓ | ✓ |
|                 | • Become adopt at using various methods of circuit analysis | ✓ | ✓ | ✓ | ✓ |
| ENGINEERING PRACTICES LABORATORY | • Ability to fabricate electrical and electronics circuits. | ✓ | ✓ | ✓ | ✓ |
|                 | • Demonstrate wide knowledge on mechanical and civil operations | ✓ | ✓ | ✓ | ✓ |</p>
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<tr>
<th>SUBJECT NAME</th>
<th>COURSE OUTCOMES</th>
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<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
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<tbody>
<tr>
<td>ANATOMY AND HUMAN PHYSIOLOGY</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>Students would be learnt about anatomy and physiology of various systems of human body</td>
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<td>ELECTRONIC CIRCUITS</td>
<td>Analyze the different types of BJT and FET</td>
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<td>Design and analyze the feedback amplifiers and oscillators</td>
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<td>Design circuits using multivibrator circuits, power amplifier circuits</td>
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<td>Analyze various application of amplifiers, oscillators, multivibrators</td>
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<td>Understand the various sequential circuits and their applications</td>
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III semester
<table>
<thead>
<tr>
<th>MEASUREMENTS AND INSTRUMENTATION</th>
<th>To Find the importance of standards, Calibration and Error Finding</th>
<th>✔</th>
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<tr>
<td></td>
<td>Use AC and DC bridges For relevant parameter measurement.</td>
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<td>Measure various electrical parameters with accuracy, precision, resolution</td>
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<td>Use Signal Generator, Frequency counter, CRO and digital IC tester for appropriate measurement.</td>
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<td>To understand and analyze the importance of various transducers &amp; their applications.</td>
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<thead>
<tr>
<th>SUBJECT NAME</th>
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<tr>
<td>INSTRUMENTATION LABORATORY</td>
<td>PO 1</td>
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<tr>
<td>Understand the concepts of various measurements by using sensors &amp; transducers</td>
<td>✔</td>
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<tr>
<td>Stimulate the students to implement sensors for both invasive and non invasive biological measurement.</td>
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<tr>
<td>Subject Name</td>
<td>Course Outcomes</td>
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<tr>
<td><strong>Medical Instrumentation</strong></td>
<td>Define basic medical terms and physical values that can be handled by medical instrumentation</td>
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<td>To understand the basics of bio potentials &amp; importance of its measuring and amplifications</td>
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<td>To analyze the importance of basic physiological parameter.</td>
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<td>Concepts of medical imaging &amp; its clinical importance.</td>
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<td>Design, Development, Testing tools &amp; software requirement for biomedical devices.</td>
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<tr>
<td><strong>Medical Instrumentation</strong></td>
<td>Measurement of various physiological parameters of the body</td>
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<td>Laboratory</td>
<td>Recording &amp; analysis of bio signal</td>
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<td>Measurement of biochemical parameters</td>
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<td>Importance of Amplifier and the need of bio signal amplifications.</td>
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11
## V SEMESTER

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<tr>
<th>SUBJECT NAME</th>
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<th>PO 11</th>
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<tr>
<td>THERAPEUTIC EQUIPMENTS</td>
<td>Electrical Responses of cell and Tissues.</td>
<td>✔</td>
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<td>To know the medical equipments used in Thermal therapy, Electro therapy,</td>
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<td>Magneto therapy and radio therapy</td>
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<td>To understand the uses of radio nuclides in imaging &amp; therapy</td>
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<tr>
<td>BIO MATERIALS AND ARTIFICIAL ORGANS</td>
<td>Design a biomaterial system with the appropriate properties and its performance</td>
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<td>Determine the biocompatibility of different types of material systems in</td>
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<td>particular toxicity related phenomena and study about applications of</td>
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<td>To gain adequate knowledge about artificial organs &amp; transplants.</td>
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<td>To know the different types of soft tissues replacement and hard tissue</td>
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<td>Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use</td>
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<td>Identify significant gap required to overcome challenges and further development in metallic and ceramic materials</td>
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<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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<td>Able to Analyze the various biosignal and their stimulations techniques.</td>
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<td>To attain the knowledge of Pacemaker ESU technology</td>
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<td>To check the safety of any medical equipments</td>
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<td>HUMAN ASSIST DEVICES</td>
<td>Define and explain the basic function of the major components of a prosthesis or orthosis terminology. Understand the concepts of IABP techniques and prosthetic cardiac valves.</td>
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<td>Learn the Constructional and functional characteristics of hearing implants</td>
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<td>Understand the Applications of Microprocessor and micro controller in various prosthesis.</td>
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<td>To know the advancement in visual prosthesis</td>
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<td>MEDICAL IMAGING TECHNIQUES</td>
<td>Demonstrate knowledge and a broad understanding of Medical imaging.</td>
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<td>To gain Sound knowledge about CT, Spectroscopy, and Fluoroscopy.</td>
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<td>To understand the concepts of neuro Magnetic imaging and MRI</td>
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<td>To attain the knowledge about the usage of Radio isotopes</td>
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<td><strong>TELEHEALTH TECHNOLOGY</strong></td>
<td>Describe the benefits &amp; limitation of telemedicine.</td>
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<td>Understand the need of ICI for telemedicine.</td>
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<td>Learn the Ethical and Legal aspects in telemedicine</td>
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<td>Learn the Picture archiving techniques and technical issues.</td>
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<td>Aspire the knowledge in various applications of telemedicine in health care sector.</td>
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<td><strong>HOSPITAL MANAGEMENT</strong></td>
<td>Explain the principles of Hospital administration.</td>
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<td>Identify the importance of Human resource management</td>
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<td>List various marketing research techniques.</td>
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<td>Identify Information management systems and its uses.</td>
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<td>Understand safety procedures followed in hospitals</td>
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<td><strong>MEDICAL INFORMATICS</strong></td>
<td>Understand the basic structures of medical informatics and functional capabilities of hospital information system.</td>
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<td>Describe the need of computer</td>
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<td>MEDICAL ELECTRONICS SYSTEM DESIGN LABORATORY</td>
<td>Have the ability to setup the Medical Equipments design using assembled circuits and electrical components</td>
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<td>To make Familiar with PCB design and various process involved</td>
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<td>Design and simulate various Electronic PCB required for prototyping and testing using software tools and testing equipments</td>
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<td>Identity, formulate and solve Engineering Problems associates with assembly and testing of medical electronics circuits.</td>
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<td>MINI PROJECT</td>
<td>Formulate a real world problem, identify the requirement and develop the design solutions.</td>
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<td>Express the technical ideas, strategies and methodologies.</td>
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<td>Utilize the new tools.</td>
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in medical imaging and automation in clinical laboratory.

Analyze and understand the Medical standards

Identify recent trends and different ICT applications in medical informatics.

MEDICAL ELECTRONICS SYSTEM DESIGN LABORATORY

Have the ability to setup the Medical Equipments design using assembled circuits and electrical components

To make Familiar with PCB design and various process involved

Design and simulate various Electronic PCB required for prototyping and testing using software tools and testing equipments

Identity, formulate and solve Engineering Problems associates with assembly and testing of medical electronics circuits.

MINI PROJECT

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

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<tr>
<th>SUBJECT NAME</th>
<th>COURSE OUTCOMES</th>
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<td>To explain the concept of pattern recognition and its different phases</td>
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<td>AND ARTIFICIAL</td>
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VII - SEMESTER
<p>| PHYSIOLOGICAL MODELING | To know the various approaches for physiological modeling. Know the relationships between time, Laplace, transform and physiological modeling | ✔ | ✔ | ✔ |  |
| | To understand the nonlinear models of physiological system | ✔ | ✔ | ✔ | ✔ |
| | Analyses the dynamic physiological systems and their control. Compartmental analysis of physiological systems. To determine the functions physiological models using simulations soft wares | ✔ | ✔ | ✔ | ✔ |
| NEURAL NETWORKS AND ITS APPLICATIONS | 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 | ✔ | ✔ | ✔ | ✔ |</p>
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<td>Apply, build and modify decision models to solve real problems</td>
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<td>Design and develop Artificial Intelligence Based Decision Support Systems and discuss the role these systems play in the business environment.</td>
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<td>Build a prototype Artificial Intelligence Based Decision Support System</td>
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<td>Communicate with other health professionals in a respectful and responsible manner</td>
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<td>To attain knowledge about holography and Medical applications of Lasers.</td>
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VIII SEMESTER
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<th>WEARABLE SYSTEMS</th>
<th>Able to describe the hardware requirements of BAN and review the network topologies, Protocols and Standards used for BAN</th>
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<td>To understand various issues during implementations of BAN and various applications of BAN</td>
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<td>Understand the basics of wearable sensors, Signals and  Signal processing</td>
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<td>Able to understand the Energy harvesting methods for wearable devices.</td>
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<td>Attain knowledge of the diagnosis applications of wearable systems in Health Care.</td>
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<td>To manipulate the data mining for clinical analysis</td>
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# ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
### B.E. MEDICAL ELECTRONICS
#### REGULATIONS – 2017
##### CHOICE BASED CREDIT SYSTEM
###### I - VIII SEMESTERS CURRICULA AND SYLLABI

## SEMESTER I

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## SEMESTER II

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## Professional Electives (PE)

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**ELECTIVE - V**

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

### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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**SUMMARY**
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.

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 - e-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

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-

Listening – listening to talks-

Speaking – participating in conversations- short group conversations-

Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-

fixed and semi-fixed expressions.

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  12
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  12

UNIT III   INTEGRAL CALCULUS  12
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  12

UNIT V   DIFFERENTIAL EQUATIONS  12

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

L T P C
3 0 0 3

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  9

UNIT II  SURFACE CHEMISTRY AND CATALYSIS  9

UNIT III  ALLOYS AND PHASE RULE  9

UNIT IV  FUELS AND COMBUSTION  9

UNIT V  ENERGY SOURCES AND STORAGE DEVICES  9
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

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

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

UNIT II DATA, EXPRESSIONS, STATEMENTS

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

UNIT III CONTROL FLOW, FUNCTIONS

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

REFERENCES:

TEXT BOOKS:

REFERENCES:

GE8152  ENGINEERING GRAPHICS  L T P C
2 0 4 4
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)  1
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.

TOTAL: 90 PERIODS

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.

TOTAL: 60 PERIODS

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.

BS8161 PHYSICS AND CHEMISTRY LABORATORY (Common to all branches of B.E. / B.Tech Programmes)

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:

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

TOTAL: 30 PERIODS

TEXTBOOKS:

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  12

UNIT II  READING AND STUDY SKILLS  12
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  12
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 12


UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

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

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 specialisation 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.

MA8251 ENGINEERING MATHEMATICS – II L T P C

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  
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of  
Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices –  
Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic  
forms.

UNIT II  VECTOR CALCULUS  
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  
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 $w = z + c, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  
Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s  
series – Singularities – Residues – Residue theorem – Application of residue theorem for  
evaluation of real integrals – Use of circular contour and semicircular contour.

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

TOTAL: 60 PERIODS

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 :
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons,  

REFERENCES :
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

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
Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moment and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

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

Displacements, Velocity and acceleration, their relationship – Relative motion – Newton’s laws of
motion – Work Energy Equation– Friction force – Laws of sliding friction – equilibrium analysis of
simple systems with sliding friction.

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:
2. Frank Bell, “Principles of Mechanics and Biomechanics”,Stanley Thorne (Publishers) Ltd.,
1998.
2006.

EC8251  CIRCUIT ANALYSIS  L T P C

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  12
Ohm’s Law – Kirchhoff’s laws – Mesh current and node voltage method of analysis for D.C and
A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence
matrices – Trees –Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and
Tie set schedules -Twig voltages and Cutset schedules, Duality and dual networks.

UNIT II  NETWORK THEOREMS FOR DC AND AC CIRCUITS  12
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.

UNIT III  RESONANCE AND COUPLED CIRCUITS  12
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.
UNIT IV  TRANSIENT ANALYSIS  12

UNIT V  TWO PORT NETWORKS  12
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.

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:

EC8252  ELECTRONIC DEVICES  L T P C
3 0 0 3

OBJECTIVES:
• To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

UNIT I  SEMICONDUCTOR DIODE  9
PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II  BIPOLAR JUNCTION TRANSISTORS  9

UNIT III  FIELD EFFECT TRANSISTORS  9
JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.
UNIT IV  SPECIAL SEMICONDUCTOR DEVICES  9
Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET,
Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device,
LASER diode, LDR.

UNIT V  POWER DEVICES AND DISPLAY DEVICES  9
UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor,
Opto Coupler, Solar cell, CCD.

OUTCOMES:
At the end of the course the students will be able to:
• Explain the V-I characteristic of diode, UJT and SCR
• Describe the equivalence circuits of transistors
• Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect
  Transistors, Power control devices, LED, LCD and other Opto-electronic devices

TEXT BOOKS:
   Inc. 2012.

REFERENCES:

GE8261  ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

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  13
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 18

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.
8. Power Tool: Angle Grinder 2 Nos
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
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

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.

TOTAL: 60 PERIODS

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

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.

TEXTBOOKS:

REFERENCES:
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

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

UNIT III  LINEAR TIME INvariant 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:

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: 45PERIODS

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:
- Learn the basics of Measurement Systems and
- Analyze the Characteristics of Instruments
- Know the relevance of digital instruments in measurements and need for data acquisition systems

UNIT I INTRODUCTION
Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

UNIT III COMPARISON METHODS OF MEASUREMENTS
D.C & A.C potentiometers, DC Bridges –Wheatstone, Kelvin , AC bridges- Maxwell, Hay, Schering and Wien bridge.– Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES
Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze the functions of different electronic instruments
- Select right kind of transducers for specific application
- Design Data Acquisition system.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To familiarize the student with the analysis and design of basic transistor
- To learn about amplifier circuits, feedback amplifiers,
- To gain knowledge about wave shaping and multivibrator circuits, power amplifiers
- To know about application of amplifiers, oscillators and multivibrators

UNIT I  SMALL SIGNAL ANALYSIS
Two port network, h-parameter model, small signal analysis of BJT (CE and CC Configuration), high frequency model of BJT (CE configuration), small signal analysis of JFET (CS configuration) and MOSFET, frequency response of BJT and FET

UNIT II  FEEDBACK AMPLIFIER AND STABILITY

UNIT III  OSCILLATORS AND MULTIVIBRATORS
Oscillator : Positive feedback concept, Barkhausen criteria for oscillator RC Oscillators- phase shift oscillator, Wein bridge oscillator. LC Oscillators- Hartley oscillator, Colpitts oscillator and Crystal oscillator, Multivibrator: Astable multivibrator, Monostable multivibrator and Bi-stable multivibrator

UNIT IV  POWER AMPLIFIER AND TUNED AMPLIFIER
Power Amplifier: Definition , Types of power amplifier, Class A power amplifier, Class B power amplifier , Class AB power amplifier, Class C , Class D and Class S power amplifier, Tuned Amplifier: coil losses, unloaded Q of tank circuits, single tuned amplifier , double tuned amplifier and cascading of tuned amplifiers

UNIT V  RECTIFIERS AND REGULATORS
Rectifiers - Half wave, Full wave and bridge rectifiers, Performance comparison of rectifiers, Need for voltage regulator, Voltage regulator-series and shunt voltage regulator, Comparison, Design of power supply.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the Students should be able to
- Analyze the different types of BJT and FET
- Design and analyze the feedback amplifiers and Oscillators
- Design circuits using multi vibrator circuits, power amplifiers
- Analyze various application of amplifiers, oscillators and multivibrators

TEXT BOOKS:

REFERENCES:
1. David A Bell, ‘Electronic Devices and Circuits’, Prentice hall of India, New Delhi, 2008
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

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


UNIT III  SYNCHRONOUS SEQUENTIAL CIRCUITS


UNIT IV  ASYNCHRONOUS SEQUENTIAL CIRCUITS

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

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

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, the students will be able to:

- 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:

MD8311 INSTRUMENTATION LABORATORY

OBJECTIVE:
To study the characteristics of sensors, signal conditioning circuits and their biomedical applications

LIST OF EXPERIMENTS:
1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensors
4. Measurement of skin temperature – contact and non-contact method
5. Characteristics of Light sensors-Photodiode, Photo Transistor
6. Measurement of SpO2
7. Bridge Circuits for Measurement of Resistance, capacitance and inductance
8. Measurement of respiration rate

TOTAL: 60 PERIODS

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS
Strain gauge Trainer Kit 1 No
Loads for measurement 1 set
LVDT trainer kit 1 No
LVDT sensor 1 No
Thermocouple trainer kit 1 No
Thermocouple 1 No
Thermistor Trainer kit 1 No
Thermistor 1 No
RTD Trainer Kit 1 No
RTD 1 No
Thermometer 3 No
Heater with water bath 3 No
LDR, Photo Diode, Photo Transistor trainer kit 1 No
Light Source with Variable power supply 1 No
Piezoelectric Trainer Kit 1 No
Piezoelectric transducer 1 No
Vibration exciter 1 No
Wheatstone bridge 1 No
Kelvin’s Bridge 1 No
Schering Bridge 1 No
Maxwell Bridge 1 No
Respiration inductance kit 1 No
Thermal imaging camera setup – 1 no
Decade resistance Box 3 nos
Decade Inductance Box 3 Nos
Decade Capacitance Box 3 Nos
X-Y Recorder 1 No
Voltmeter 10 Nos
Multi meter 10 Nos
Regulated power supply 10 Nos
CRO 10 Nos
Connecting wires Pathcards
Tachometer 1NOS

OUTCOME:
Students are able to design measurement system for various biomedical applications.

EC8361 ANALOG AND DIGITAL CIRCUITS LABORATORY

OBJECTIVES:
The student should be made to:
- Study the Frequency response of CE, CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristics of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits
- Design and implement the Combinational and sequential logic circuits

LIST OF ANALOG EXPERIMENTS:
1. Design of Regulated Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement
5. Cascode and Cascade amplifiers
6. Determination of bandwidth of single stage and multistage amplifiers
7. Analysis of BJT with Fixed bias and Voltage divider bias using P-Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using PSpice
9. Analysis of Cascode and Cascade amplifiers using PSpice
10. Analysis of Frequency Response of BJT and FET using PSpice

LIST OF DIGITAL EXPERIMENTS
1. 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
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
6. Design and implementation of 3-bit synchronous up/down counter

TOTAL : 60 PERIODS

OUTCOMES:
On completion of this laboratory course, the students should be able to:
- Design and Test rectifiers, filters and regulated power supplies.
- Design and Test BJT/JFET amplifiers.
- Differentiate cascode and cascade amplifiers.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Measure CMRR in differential amplifier
- Simulate and analyze amplifier circuits using PSpice.
- Design and Test the digital logic circuits.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>EQUIPMENTS FOR ANALOG LAB</th>
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<tbody>
<tr>
<td>1</td>
<td>CRO/DSO (30MHz) – 15 Nos.</td>
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<tr>
<td>2</td>
<td>Signal Generator /Function Generators (3 MHz) – 15 Nos</td>
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<td>3</td>
<td>Dual Regulated Power Supplies (0 – 30V) – 15 Nos.</td>
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<tr>
<td>4</td>
<td>Standalone desktop PCs with SPICE software – 15 Nos.</td>
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<tr>
<td>5</td>
<td>Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos</td>
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<tr>
<td>6</td>
<td>Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.</td>
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<td>7</td>
<td>SPICE Circuit Simulation Software: (any public domain or commercial software)</td>
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<tr>
<th>S.NO</th>
<th>EQUIPMENTS FOR DIGITAL LAB</th>
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<tbody>
<tr>
<td>1</td>
<td>Dual power supply/ single mode power supply - 15 Nos</td>
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<tr>
<td>2</td>
<td>IC Trainer Kit - 15 Nos</td>
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<tr>
<td>3</td>
<td>Bread Boards - 15 Nos</td>
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<td>4</td>
<td>Seven segment display -15 Nos</td>
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<td>5</td>
<td>Multimeter - 15 Nos</td>
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<td>6</td>
<td>ICs each 50 Nos</td>
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<td>7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 /</td>
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<td>7485 / 7473 / 74138 / 7411 / 7474</td>
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</table>
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.

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:

MD8401 MEDICAL INSTRUMENTATION L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
- To gain knowledge on basic concepts of medical instrumentation.
- Know about biopotential electrodes and amplifiers
- Know the basic measurements of physiological parameters
- Know about medical equipment design and developments.

UNIT I BASIC CONCEPTS OF MEDICAL INSTRUMENTATION AND BIO SENSORS
BASIC CONCEPTS OF MEDICAL INSTRUMENTATION:
Terminology of medicine and medical devices, generalized medical instrumentation system, alternative operational modes, medical measurement constraints-classification of biomedical instruments-biostatistics-regulations of medical devices.

BIO POTENTIAL & BIO SENSORS:

BIOSENSOR: Need of sensors, working principle of biosensor, various types of biosensors and its applications, bio transducers, bio interface.

UNIT II ELECTRODE CONFIGURATIONS & BIO AMPLIFIER
Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.


UNIT III MEASUREMENTS OF BLOOD PRESSURE, BLOOD VOLUME AND CARDIAC OUTPUT
BLOOD PRESSURE: direct and indirect measurements-harmonic analysis of blood pressure waveforms-heart sounds-phonocardiography - Blood volume: electromagnetic flow meters-ultrasonic flowmeters-chamber plethysmography-photo plethysmography.

CARDIAC OUTPUT MEASUREMENTS: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.
UNIT IV  CLINICAL LABORATORY INTRUMENTS  9

UNIT V  DESIGN AND DEVELOPMENT OF BIOMEDICAL DEVICES AND SYSTEMS  9

Developing Biomedical Devices- Emerging Issues in Healthcare- Innovation and Rights- Industrial Designs- Patent Classification- Examples of Industrial Design Requirements Evaluations

TOTAL : 45 PERIODS

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

- Perform Electrical and non-electrical physiological measurements
- Explain the function of bio amplifiers.
- Explain the functions of laboratory and radiological equipments
- Explain about medical equipment designing procedure

TEXT BOOKS:

REFERENCES:
1. Developing Biomedical Devices-Design, Innovation and Protection.by Andreoni, Giuseppe, Barbieri, Massimo, Colombo, Barbara-poliMi springer briefs-2014

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

TOTAL : 45 PERIODS

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:
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 9
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 9
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 9
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 9

UNIT V  WAVEFORM GENERATORS AND SPECIAL FUNCTION IC'S 9
Sine-wave generators, Multivibrators and Triangular 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:

EC8393 FUNDAMENTALS OF DATA STRUCTURES IN C

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
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:
OBJECTIVES:
- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I  SYSTEMS COMPONENTS AND THEIR REPRESENTATION  9
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros-Multivariable control system

UNIT II  TIME RESPONSE ANALYSIS  9
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD,PI,PID control systems

UNIT III  FREQUENCY RESPONSE AND SYSTEM ANALYSIS  9
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation

UNIT IV  CONCEPTS OF STABILITY ANALYSIS  9

UNIT V  CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS  9
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

TEXT BOOK:

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

UNIT III
NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. 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:
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) PVT, LTD,
Hydrabad, 2015.
4. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India
PVT, LTD, Delhi, 2014.

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

EC8462 LINEAR INTEGRATED CIRCUITS LABORATORY

OBJECTIVES:
- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the 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

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS
1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators using Op-amp
8. Astable and Monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
11. DC power supply using LM317 and LM723.
12. Study of SMPS

SIMULATION USING SPICE:
1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/D converter (Flash Type)
4. Analog multiplier

TOTAL: 60 PERIODS
OUTCOMES:
On completion of this laboratory course, the student should be able to:
- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design DC power supply using ICs.
- Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.NO  | EQUIPMENTS                      | QTY
-------|---------------------------------|-----
1      | CRO/DSO (Min 30MHz)             | 15 Nos
2      | Signal Generator /Function Generators (2 MHz) | 15 Nos
3      | Dual Regulated Power Supplies (0 – 30V) | 15 Nos
4      | Digital Multimeter             | 15 Nos
5      | IC Tester                      | 5 Nos
6      | Standalone desktops PC         | 15 Nos
7      | Components and Accessories     | 50 Nos

COMPONENTS AND ACCESSORIES:
Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs.

Note:

MD8411  | MEDICAL INSTRUMENTATION LABORATORY | L T P C
        |                                  | 0 0 4 2

OBJECTIVE:
To provide hands on training on Measurement of physiological parameters, biochemical parameters measurement and biosignal analysis.

LIST OF EXPERIMENTS:
1. Simple Op Amp Circuit Measurements
2. Design and analysis of biological pre amplifiers
3. Experiment of Thermistors
4. Blood pressure measurement
5. Experiment of Photoplethysmography
6. Recording of ECG signal and analysis
7. Recording of EMG-Signal
8. Recording of various physiological parameters using patient monitoring system and telemetry units.
10. Measurement and recording of peripheral blood flow
11. Study of characteristics of optical isolation amplifier
12. Measurement of PH and Conductivity

TOTAL: 60 PERIODS
LAB REQUIREMENTS:
- Op amp kit: 1 no
- Thermistor setup: 1 no
- Spigmomanometer: 1 no
- Photoplethysmograph unit: 1
- Multiparameter patient monitoring system: 1 No.
- Respiration measurement kit: 1 no
- ECG recorder: 1 No.
- EMG recorder: 1 No.
- Blood flow measurement system using ultrasound transducer: 1 No.
- Function Generators
- Glucometer: 1 No.
- PH and conductivity Meter: 1 no
- DSOs
- Regulated Power supplies
- Bread boards
- IC 741

OUTCOMES:
Student is able to:
- Design the amplifier for Bio signal measurements
- Recording and analysis of bio signals

EC8394  ANALOG AND DIGITAL COMMUNICATION  L T P C
3 0 0 3

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

UNIT II  PULSE AND DATA COMMUNICATION

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
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.

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:

MD8501 THERAPEUTIC EQUIPMENTS

OBJECTIVES:
The student should be made to:
- To gain knowledge on basic concepts of therapeutic Equipments.
- Know about the cardiac and respiratory assist devices
- Know the various diathermy techniques and extra corporeal devices
- Know about medical equipments used in radiotherapy.

UNIT I CARDIAC ASSIST DEVICES
9
Cardiac pacemakers-Need, types and functional characteristics, AC Cardiac defibrillators, disadvantages , DC defibrillator, types- Instantaneous , Cardioverter.
UNIT II  DIATHERMY AND MEDICAL STIMULATORS 9

UNIT III  EXTRACORPOREAL DEVICES 9
Indication and principle of Hemodyalisis, Dialysate, different types of Hemo dialysers, peritoneal dialyser monitoring systems, Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, monitoring systems.

UNIT IV  RESPIRATORY AIDS 9
Ventilator- Need, Types, Intermittent positive pressure, breathing apparatus operating sequence, electronic IPPB unit with monitoring for all respiratory parameters, Humidifier, Nebulizer, Aspirator, Infant incubators.

UNIT V  RADIATION THERAPY AND RADIATION SAFETY 9

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Explain the basic principles of cardiac and respiratory assist devices
- Explain the function of therapeutic equipments.
- Explain the function of extra corporeal devices
- Explain the functions radiotherapy equipments

TEXT BOOK:

REFERENCES:
OBJECTIVES
The student should be made to:

- Learn characteristics and classification of Biomaterials
- Understand different metals, ceramics and its nanomaterials characteristics as biomaterials
- Learn polymeric materials and combinations that could be used as a tissue replacement implants
- To have an overview of artificial organs & transplants
- To study about soft tissue replacement and hard tissue replacement

UNIT I  INTRODUCTION TO BIO-MATERIALS  9
Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, nanoscale phenomena.

UNIT II  METALLIC AND CERAMIC MATERIALS  9
Metallic implants - Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bioinert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bioceramics.

UNIT III  POLYMERIC IMPLANT MATERIALS  9
Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin. Medical Textiles, Case study of organ regeneration.

UNIT IV  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 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:

- Analyze different types of Biomaterials and its classification.
- Identify different metals, ceramics and its nanomaterials characteristics as biomaterials
- Perform combinations of materials that could be used as a tissue replacement implant.
- Will gain adequate knowledge about artificial organs & transplants
- Will know the different types of soft tissue replacement and hard tissue replacement

TEXT BOOKS:
REFERENCES:

EC8553 DISCRETE-TIME SIGNAL PROCESSING L T P C
4 0 0 4

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:

EC8562 DIGITAL SIGNAL PROCESSING LABORATORY L T P C
0 0 4 2

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

MD8511 MEDICAL EQUIPMENT LABORATORY

OBJECTIVE:
- To provide practice on recording and analysis of different Bio potentials
- Study the function of different Therapeutic equipments.

LIST OF EXPERIMENTS:
1. Simulation of ECG – detection of QRS complex and heart rate
2. Study of shortwave and ultrasonic diathermy
3. Study of biotelemetry
4. Electrical safety measurements.
7. Study of ESU – cutting and coagulation modes
8. Recording of Audiogram
9. Design of ECG amplifier, recording and analysis using Lab View
10. A visual acuity measurement
11. Simulation of EEG – record the EEG waveforms
12. Measurement of drug delivery system by using syringe pump
13. Measurement of drug delivery system by using infusion pump
14. Study Of OPG-Orthopantomogram

PERIODS LAB REQUIREMENTS FOR 30 STUDENTS
1. Multioutput power supply (+15v, -15v, +30V variable, +5V, 2A) 2 Nos.
2. Short wave Diathermy 1 No.
3. Ultrasound diathermy 1 No.
4. Single parameter biotelemetry system 1 No.
5. Electrical Safety Analyser 1 No.
6. Spirometry with associated analysis system 1 No.
7. ECG Simulator 1 No. Medical stimulator 1 No.
8. Surgical diathermy with analyzer 1 No Audiometer 1 No Lab View.
9. visual acuity measurement kit 1 No
10. Syringe pump 1 No
11. Infusion pump 1 No

OUTCOME:
The learner is able to analyze the Bio medical signals, to check the safety of any medical equipment and to have the knowledge about therapeutic equipments.
OBJECTIVES:
The objective of this to know the principle, design and application of various human assist devices and aids. Additionally, a brief introduction to design aspects of prosthetic and orthotic devices will be given.

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

UNIT II PROSTHETIC AND ORTHODIC DEVICES
PROSTHESIS INTRODUCTION
Incidence and Epidemiology- Rehabilitation of an Amputee- Problems in Stump- Immediate Postoperative Prosthetic Fitting- Prosthesis in Foot and Ankle Amputation (should go to Unit II)

UNIT III VISUAL AIDS
Ultra sonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually Challenged, Text to voice converter, Screen readers

UNIT IV HEARING AND SPEECH AIDS
Audiograms, types of deafness - conductive and nervous, hearing aids- Types, constructional and functional characteristics. Cochlear implants- Need, constructional details, speech trainer.

UNIT V REHABILITATION MEDICINE AND ADVOCACY
Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in day-to-day life.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students will be:
- Know the role and importance of assist devices .
- Know the importance of rehabilitation and related aspects

TEXT BOOK:

REFERENCES:
2. Short Textbook of Prosthetics and Orthotics- R Chinnathurai- Jaypee Brothers Medical Publishers (P) Ltd-2010
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

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

MD8602 MEDICAL IMAGING TECHNIQUES

OBJECTIVES
- To gain sound knowledge about Radiography, CT, Fluoroscopy and Image quality
- To understand the concepts of Neuro Magnetic Imaging and MRI.

UNIT I RADIOGRAPHY AND FLUOROSCOPY

UNIT II COMPUTED TOMOGRAPHY

UNIT III MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY
- Fundamentals of magnetic resonance- overview. Relaxation processes T1 and T2. Block Diagram approach of MRI system: system Magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, contrast agents- tissue contrast in MRI: MRangiography, MR spectroscopy, fMRI

UNIT IV RADIO ISOTOPIC IMAGING AND INFRARED IMAGING

UNIT V ULTRASOUND, NEUROMAGNETIC IMAGING

OUTCOMES:
- Study about various medical image acquisition methods.
- Gain sound knowledge about CT, Fluoroscopy and Image quality
- Understand the concepts of Neuro Magnetic Imaging and MRI.
- Analyze the principle and operation modes of Ultrasound Imaging.

TEXT BOOKS:
REFERENCES:

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:

MD8603 MEDICAL INFORMATICS L T P C
3 0 0 3

OBJECTIVE:
- To learn and adapt ICT applications in health informatics

UNIT I INTRODUCTION TO MEDICAL INFORMATICS 9
Introduction - Medical Informatics – Structure of Medical Informatics- Computer based medical information retrieval, Functional capabilities of a computerized Hospital Information System, Health Informatics – Medical Informatics, Bioinformatics, Clinical informatics, Nursing informatics, Public health informatics.

UNIT II MEDICAL DATA STORAGE AND AUTOMATION 9

UNIT III MEDICAL STANDARDS AND COMPUTERISED PATIENT RECORD 9
Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA – LOINC – HIPPA. Computer based Patient Records-History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, CPR in Radiology, Clinical information system, Computerized prescriptions for patients.

UNIT IV HEALTH INFORMATICS 9
Bioinformatics Databases, Bio-information technologies, Genome Analysis, Semantic web and Bioinformatics, Genome projects. Clinical information system, data for decision making, Medical diagnostic and decision support systems, Decision analysis in health informatics.
UNIT V  RECENT TRENDS IN MEDICAL INFORMATICS
Virtual reality applications in medicine, Computer assisted surgical techniques—Virtual endoscopy, Computer assisted surgery, Surgical simulation. Computer assisted medical education, Computer assisted patient education and health. Telemedicine, virtual Hospitals - Smart Medical Homes – Personalized e-health services.

OUTCOMES:
Upon completion of the course, students will be able to:
- Discuss the structure of medical Informatics and functional capabilities of Hospital Information System.
- Describe the need of computers in medical imaging and automation in clinical laboratory.
- Analyze medical standards
- Identify recent trends and different ICT applications in medical Informatics.

TEXT BOOKS:

REFERENCES:

MD8611 MEDICAL ELECTRONICS SYSTEM DESIGN LABORATORY

OBJECTIVES:
- To familiarize the electronic components and Medical sensors.
- To make familiar with PCB design and various processes involved.
- To provide the knowledge in assembling and testing of the PCB based Medical electronic circuits.

1. Study of PCB design software (open source) like KiCad, Eagle, etc.,
2. Design of a Bio Amplifier
3. Design of Bio-Electrode Equivalent Circuit
4. Design and setup a notch filter circuit and Active Band Pass Filter
5. Design and setup a threshold detector, sample and hold circuit using op-amp
6. Design and setup a Patient Isolation Circuit
7. Design of body temperature measuring circuit using thermistors
8. Design and setup a circuit for skin contact impedance
9. Design of Plethysmography circuit
10. Design of Pace Maker circuit
11. Design of Bio-Telemetry using IC4046
12. Design a Power Supply for Low Power Wearable Devices

TOTAL : 60 PERIODS
OUTCOMES:
After learning this course the students will be able to
- Have the ability to conduct experiments using designed and assembled circuits for medical applications
- Design and simulate various electronic PCB required for prototyping and testing using software tools and testing equipments.
- Identify, formulate, and solve engineering problems associated with assembly and testing of Medical electronic circuits

EC8681  MICROPROCESSORS AND MICROCONTROLLERS LABORATORY  L T P C
0 0 4 2

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

MD8612 MINI PROJECT L T P C
TOTAL: 30 PERIODS
0 0 2 1

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.

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
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:
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

UNIT III  IMAGE RESTORATION 9

UNIT IV  IMAGE SEGMENTATION 9

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:
REFERENCES

MD8701 PATTERN RECOGNITION AND ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Understand the pattern recognition system and its types.
• Be familiar with the statistical and syntactic approach
• Understand the different knowledge representation schemes for AI problems.
• Explore different search strategies for a problem.

UNIT I PATTERN RECOGNITION OVERVIEW 8
Typical Pattern Recognition System, Patterns and Features Extraction, Training and Learning in Pattern Recognition system, Different types of Pattern Recognition Approaches – Statistical, Syntactic, Neural. Discriminant functions.

UNIT II STATISTICAL PATTERN RECOGNITION 10
Parametric estimation and supervised learning, Maximum likelihood estimation, Bayesian parameter estimation, Non-parametric approaches - Parzen window, k-NN estimation, Unsupervised Learning – Clustering Concepts.

UNIT III SYNTACTIC PATTERN RECOGNITION 9

UNIT IV ARTIFICIAL INTELLIGENCE 9
Introduction and historical perspective, Hard and Soft AI disciplines and applications, Theories of Intelligence, Detecting and Measuring Intelligence, Knowledge based approach, the prepare-deliberate engineering trade-off, Procedural v/s Declarative knowledge, Criticism of symbolic AI, Knowledge representation, desirable properties of KR schemata, Use of predicate calculus in AI

UNIT V EXPERT SYSTEMS 9
Components of Expert Systems, Production rules, Backwards vs Forward reasoning, Statistical reasoning, Meta level knowledge, Introspection, Knowledge engineering case studies, Heuristic search of state space, DFS, BFS, UCS, choice of a search algorithm, Admissibility theorems, search performance metrics, AI programming environments. AI oriented language and architecture.

TOTAL: 45 PERIODS

OUTCOMES:
Upon successful completion of the course, the student should be able to:
• Describe the different Types of Pattern Recognition.
• Implement statistical and syntactic approach of pattern recognition.
• Apply heuristic concepts to develop intelligent system
TEXT BOOKS:

REFERENCES:

MD8752 PHYSIOLOGICAL MODELING L T P C 3 0 0 3

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 9
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, linear models of physiological systems, the Laplace transform, Transfer functions and block diagram analysis.

UNIT II MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM 9
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 9

UNIT IV COMPARTMENTENTAL PHYSIOLOGICAL MODEL 9
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 9
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:

EC8791 EMBEDDED AND REAL TIME SYSTEMS L T P C
3 0 0 3

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  9
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  9

UNIT V  PROCESSES AND OPERATING SYSTEMS  9
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:
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:
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>Sl.No.</th>
<th>Departments for visit</th>
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<td>1.</td>
<td>Cardiology</td>
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<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>Obstetrics and Gynaecology</td>
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<td>Biomedical Engineering Department</td>
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<td>Histo Pathology</td>
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<td>22.</td>
<td>Medical Records / Telemetry</td>
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TOTAL: 60 PERIODS

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
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.

TOTAL: 300 PERIODS

OUTCOME:
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.

BM8071  BIO MEMS

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, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers
UNIT V  APPLICATIONS OF BIOMEMS  9
CAD for MEMS, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR), DNA sensor, MEMS based drug delivery, 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:

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  9
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  9
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:
OBJECTIVES:
The student should be made:
• To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
• To study about the electrical drive systems and sensors used in robotics for various applications
• To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
• To learn about various motion planning techniques and the associated control architecture
• To understand the implications of AI and other trending concepts of robotics

UNIT I FOUNDATION FOR BEGINNERS
Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

UNIT II BUILDING BLOCKS OF A ROBOT
Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars

UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS
Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study

UNIT IV NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE
Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

UNIT V AI AND OTHER RESEARCH TRENDS IN ROBOTICS
Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL:45 PERIODS

OUTCOMES:
The student should be able to:
• Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
• Examine different sensors and actuators for applications like maze solving and self driving cars.
• Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
• Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
• Describe the impact and progress in AI and other research trends in the field of robotics
TEXT BOOKS:

REFERENCES
5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000
7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005
8. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and Technology of Self–Organizing Machines (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004

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:

GE8074  HUMAN RIGHTS  
OBJECTIVE :
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I  

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 BIOSIGNAL PROCESSING

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.
- Analyse various biomedical signals through advanced techniques.

UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS
Biosignal 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  9
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  9

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:

MD8071  TELEHEALTH TECHNOLOGY  L  T  P  C  3 0 0 3

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
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
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
Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V  APPLICATIONS OF TELEMEDICINE
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:

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
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:
OBJECTIVES:
The course will focus strongly on expert systems, but will provide scope for the examination of other areas of interest important to course participants. More specifically, the course objectives include:

- To develop informed opinions about the present and past opinion leaders in the artificial intelligence debate.
- To develop a simple, informal expert system by performing an effort of knowledge engineering of a real, human expert.
- To develop a series of Web pages that will serve as a current "state of the art" review of the various AI application areas, areas which may be suggested by the instructor or brought to the course by participants.
- To experience some actual hands-on demonstration software while accomplishing the review of current applications areas in AI.

UNIT I  INTRODUCTION TO AI
Definition of AI – importance of AI – problem solving, searching, heuristic searching.

UNIT II  KNOWLEDGE REPRESENTATION

UNIT III  EXPERT SYSTEMS
Expert system architecture - non-production systems architecture– knowledge acquisition and validation - Knowledge system building tools.

UNIT IV  LEARNING & DECISION MAKING
Types of learning – general learning model – learning by induction – generalization & specialization – inductive bios – explanation based learning

UNIT V  CASE STUDY

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

- Explain the role of Artificial Intelligence, Expert Systems and Decision Models in managerial decision-making.
- Apply, build and modify decision models to solve real problems
- Design and develop Artificial Intelligence Based Decision Support Systems and discuss the role these systems play in the business environment.
- Explain Artificial Intelligence Technique.
- Build a prototype Artificial Intelligence Based Decision Support System.

TEXT BOOKS:

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

UNIT I  INTRODUCTION
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
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

UNIT IV  DIGITAL PRODUCTS AND LAW

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:

OBJECTIVES:
The student should be made to
- Understand the basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.
- Explore the use of Pattern and Neural Classifiers for classification applications.
- To introduce neural computing as an alternative knowledge acquisition/representation paradigm.
UNIT I  FROM BIOLOGY TO ARTIFICIAL NEURAL NETWORKS –INTRODUCTION  10
Brief History of Neural Networks, Biological Neural Networks, Components of Artificial Neural Networks – Connections, Propagation function and Network Inputs, Common Activation Functions, Threshold, Network Topologies, Bias Neuron, Fundamentals of Learning and Training – Supervised, Unsupervised, Reinforcement, Training Pattern and Teaching Input, Learning Curve and Error measurement.

UNIT II  SUPERVISED NETWORK LEARNING PARADIGMS  10
Perceptron and backpropagation – Single Layer Perceptron, Convergence theorem, delta rule, Linear Separability, Multilayer Perceptron, Backpropagation of error, variation and extension to backpropagation. Recurrent perceptron like networks.

UNIT III  ASSOCIATIVE NETWORK AND NETWORK BASED ON COMPETITION  9
Associative Memory – Different types of Pattern Association, Bidirectional Associative Memory, and Hopfield Memory. Self Organizing feature maps, Linear Vector Quantization, Counter Propagation Networks.

UNIT IV  OTHER ADVANCE NEURAL NETWORKS  9

UNIT V  APPLICATION OF NEURAL NETWORKS  7
ANN in Computer-Aided Diagnosis, ANN as multivariate statistical model, ANN for medical Image segmentation, ANN as a predictive model, ANN as a optimizer.

TOTAL: 45 PERIODS

OUTCOMES
Upon successful completion of the course student should be able to

- Describe the neural network architecture and learning algorithms
- Implement Pattern and Neural Classifiers for various classification applications

TEXT BOOK

REFERENCES:
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

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 Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

TEXTBOOK:

TOTAL: 45 PERIODS
REFERENCES:

https://www.arduino.cc/

BM8078 SOFT COMPUTING TECHNIQUES

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
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

UNIT III GENETIC ALGORITHM
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
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  8

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  L T P C 3 0 0 3

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 into 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  9
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


TOTAL: 45 PERIODS

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:
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 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.

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, Scenarious 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

116
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:

BM8077 HOSPITAL WASTE MANAGEMENT L T P C 3 0 0 3

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

UNIT IV  FACILITY SAFETY

UNIT V  INFECTION CONTROL, PREVENTION AND PATIENT SAFETY

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:

REFERENCES:

BM8073  BIOMETRIC SYSTEMS
OBJECTIVES:
• To understand the technologies of fingerprint, iris, face and speech recognition
• To understand the general principles of design of biometric systems and the underlying trade-offs.
• To recognize personal privacy and security implications of biometrics based identification technology.
• To identify issues in the realistic evaluation of biometrics based systems.
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.

TOTAL : 45 PERIODS

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:
OBJECTIVES:
TO STUDY ABOUT:
- The optical properties of the tissues and the applications of laser in diagnosis and therapy.
- To familiarize about fiber optic lasers and applications.
- To gain knowledge of instrumentation in photonics.

UNIT I  OPTICAL PROPERTIES OF THE TISSUES  9
Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles - Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical-Thermal-Electromechanical – Photoablation processes.

UNIT II  OPTICAL FIBRES AND THEIR PROPERTIES  9

UNIT III  CLINICAL APPLICATIONS OF FIBER OPTIC LASER SYSTEMS  9
Properties and types of Laser, Clinical applications of laser, Fiber optic Laser system in cardiovascular disease, Gastroenterology, general and thoracic surgery, Neurosurgery, Oncology, Ophthalmology, Orthopedics, Otolaryngology, Urology..

UNIT IV  INSTRUMENTATION IN PHOTONICS  9
Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers, Optical filters, - optical detectors – Time resolved and phase resolved detectors.

UNIT V  HOLOGRAM AND MEDICAL APPLICATIONS  9

TOTAL : 45 PERIODS

OUTCOMES:
Students will be able to:
- Discuss the properties of optics fibers and relate with tissues
- Explain the clinical application of fiber optic lasers
- Analyze the fiber optic techniques with medical applications

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- 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

OUTCOMES:

- 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:
BM8076  ELECTRICAL SAFETY AND QUALITY ASSURANCE  L T P C
3 0 0 3

OBJECTIVE:
To provide electrical protection and maintenance in working environment and ensure that electrical
safety.

UNIT I  ELECTRICAL HAZARDS  12
leakage – Clearance and insulation– Current surges – Electrical causes of fire and explosion –
Human interface with electricity – Human resistance to electricity

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
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:

MD8004 BODY AREA NETWORKS L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
• Learn about body area networks’ and different hardware’s related to it
• Provide knowledge in the applications of Body Area Networks.

UNIT I INTRODUCTION

UNIT II HARDWARE FOR BAN
Wireless communication - RF communication in Body, Antenna design and testing, Matching Network, Propagation, Materials, Base Station, Power considerations, Wireless communication technologies for wearable systems, Body Area Network – Human Applications.

UNIT III NETWORK TOPOLOGIES, PROTOCOLS AND STANDARDS

UNIT IV COEXISTENCE ISSUES WITH BAN
Interferences – Intrinsic - Extrinsic, Effect on transmission, Regulatory issues-Medical Device regulation in Asia, Security and Self protection-Bacterial attacks, Virus infection, secured protocols, Self protection.

UNIT V APPLICATIONS OF BAN
Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhymias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Smart Garments, Electronic pill

OUTCOMES:
At the end of the course, student will be able to:
• Comprehend technical information and challenges in body area networks (BAN)
• Describe the hardware requirements of BAN
• Review the network topologies, protocols and standards used for BAN
• Understand various issues during implementation of BAN
• Discuss various applications of BAN.

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:

BM8075 BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS L T P C
3 0 0 3

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:

MD8005 WEARABLE SYSTEMS

OBJECTIVES:
The student should be made to:
- Study about sensors and its application in wearable systems
- Learn about applications of wearable systems

UNIT I SENSORS
Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS –Based Biosensors, E-Textiles, Bio compatibility

UNIT II SIGNAL PROCESSING
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES
Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.
UNIT IV  WIRELESS HEALTH SYSTEMS
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics

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

- Explain need of wireless health systems and the application of wearable systems

TEXT BOOKS:

REFERENCES:
1. Hang, Yuan-Ting, "wearable medical sensors and systems", Springer-2013

GE8073 FUNDAMENTALS OF NANOSCIENCE L T P C 3 0 0 3

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: