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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2025** | **Duration** | **3hrs** |
| **Course Title** | **EMBEDDED SYSTEMS FOR BIOMEDICAL APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two examples of networked embedded systems. | | CO1 | R | 1 |
| 2. | Differentiate between small scale embedded systems and medium scale embedded systems. | | CO1 | An | 1 |
| 3. | Identify the tool that converts high level language code into low level programming language. | | CO2 | U | 1 |
| 4. | List two types of embedded system architectures. | | CO2 | R | 1 |
| 5. | Name the sensor used to measure temperature. | | CO3 | R | 1 |
| 6. | Identify the unit that fetches instructions from memory. | | CO3 | U | 1 |
| 7. | Differentiate between unit cost and NRE cost. | | CO4 | An | 1 |
| 8. | Define locator. | | CO4 | R | 1 |
| 9. | Name an input device used to control the operation of an output device. | | CO5 | R | 1 |
| 10. | List the three steps of ADC. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the building blocks of an embedded system. | | CO1 | An | 3 |
| 12. | Describe the challenges in the design of an embedded system. | | CO2 | U | 3 |
| 13. | Explain the concept of host and target approach. | | CO3 | An | 3 |
| 14. | Analyze the significance of three stage pipelining process. | | CO4 | An | 3 |
| 15. | Explain the five primary goals in the creation of the Java language. | | CO5 | An | 3 |
| 16. | Differentiate between state machine and state diagram. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the classification of embedded systems. | CO1 | U | 6 |
|  | b. | Describe the program layers in an embedded software system. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the issues related to embedded software development. | CO2 | An | 6 |
|  | b. | Analyze the key tools used in the development of embedded systems. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Describe the steps involved in loading embedded software into the target system. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the implementation of a keypad scanning program. | CO4 | U | 10 |
|  | b. | Differentiate between normally open and normally closed contact. | CO4 | An | 2 |
|  |  |  |  |  |  |
| 21. | a. | Explain the operators in C programming. | CO5 | An | 10 |
|  | b. | Analyze the challenges and benefits of Java based embedded system design. | CO5 | An | 2 |
|  |  |  |  |  |  |
| 22. | a. | Explain the impact of real time operating system services on system performance. | CO4 | An | 10 |
|  | b. | Illustrate the implementation of interrupt routines in an RTOS environment. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 23. |  | Analyze the process of interfacing a stepper motor with a microcontroller for bidirectional movement. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the implementation of a real time patient monitoring system. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Summarize embedded systems and its hardware units |
| **CO2** | Identify the various tools and development process of embedded system |
| **CO3** | Demonstrate the various I/O interfacing methods with microcontroller |
| **CO4** | Create the programming for embedded system design |
| **CO5** | Summarize the real time models, languages and operating systems |
| **CO6** | Design a real time embedded system for biomedical applications |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21BM3021** | **Duration** | **3hrs** |
| **Course Title** | **ERGONOMICS IN HEALTHCARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyze the major ergonomic challenges in patient safety, such as patient handling, hospital design, and medical device usability. | CO1 | An | 8 |
|  | b. | List the various human errors in hospital and explain how it can be overcome with the help of ergonomics. | CO1 | An | 8 |
|  |  |  |  |  |  |
| 2. |  | What is a Human machine system? What are its characteristics? With a neat diagram, explain the important components of a Human-machine system | CO2 | U | 16 |
|  |  |  |  |  |  |
| 3. |  | Explain the process for the design of individual workstations. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. | a. | Conclude the role of deep learning in EMG and EEG signal analysis. | CO4 | E | 6 |
|  | b. | How do musculoskeletal disorders (MSDs) relate to poor ergonomic design? Discuss the common symptoms and preventive measures. | CO4 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Outline the different types of simulation techniques used in ergonomic training. Provide real-world examples. | CO5 | U | 8 |
|  | b. | Illustrate the different types of data collected in ergonomic analysis and their significance. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Elaborate ergonomic workflow to reduce infection transmission among healthcare workers. | CO6 | C | 8 |
|  | b. | Design an ergonomics principle to be applied to redesign ICU workstations and workflows to reduce physical strain of nurses. | CO6 | C | 8 |
|  |  |  |  |  |  |
| 7. |  | List the key factors to be considered while designing an ergonomic computer worktable. | CO3 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Define Ergonomics and explain physical, cognitive and organizational ergonomics. | CO1 | U | 6 |
|  | b. | Illustrate the principle of ergonomics. | CO1 | U | 14 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the problems in posture and work efficiency |
| CO2 | Classify the workspace and related systems |
| CO3 | Choose the signal processing techniques for analysis and feature extraction |
| CO4 | Relate the anthropometric concepts to human system and environment |
| CO5 | Assess the methodologies in measurement systems and conditions |
| CO6 | Construct instrumentation techniques for development of user friendly systems. |

Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – April / May – 2025**

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|  |  |  |  |
| **Code :** | **21BM3031** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ADVANCED MEDICAL IMAGE PROCESSING** | **Max. Marks:** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome / Pattern** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the questions)** | | | | |
| 1. | a. | Describe what a CAD system is and how diagnostic data is obtained by measuring its performance. | CO1 / R | 05 |
|  | b. | Summarize the various components of digital image processing and provide a brief explanation of their significance in the context of medical imaging. | CO1 / A | 05 |
|  | c. | Describe the different stages of breast cancer and the role of mammographic imaging in its diagnosis | CO1 / A | 10 |
|  |  | **OR** |  |  |
| 2. | a. | Compare the features of Frost, Average and Median filters and explain their significance. | CO2 / An | 10 |
|  | b. | Relate how the image enhancement is achieved by spatial domain transformation methods. | CO2 / U | 10 |
|  |  |  |  |  |
| 3. | a. | Illustrate in depth the Self – similar Fractal Method and Histogram-based image segmentation. | CO4 / A | 10 |
|  | b. | Compare and illustrate the features of Inverse Filter, Wiener Filter and Constrained Least Squares filters in image restoration process. | CO3 / A | 10 |
|  |  | **OR** |  |  |
| 4. | a. | Explain how Super Resolution and Richardson –Lucy method help in restoration of degraded medical images. | CO3 / U | 10 |
|  | b. | Describe the methods used for point detection, line detection, and edge detection in digital images. Compare the strengths and limitations of these techniques in the context of image segmentation | CO4 / An | 10 |
|  |  |  |  |  |
| 5. | a. | Discuss the broad classification of image segmentation techniques. Explain how discontinuity-based and similarity-based methods differ in approach and application. | CO5 / U | 10 |
|  | b. | Illustrate the significance of shape related features in the analysis of medical images. | CO5 / R | 10 |
|  |  | **OR** |  |  |
| 6. | a. | What is k-means clustering, and how is it applied to image segmentation? Discuss the impact of choosing the correct value of 'k' and the limitations of this method in segmenting complex medical images. | CO4 / An | 10 |
|  | b. | Explain in detail about the systematic evaluation and validation of segmentation algorithms | CO4 / An | 10 |
|  |  |  |  |  |
| 7. | a. | Compare and contrast at least five image segmentation methods based on their computational complexity, robustness to noise, and applicability in real-world scenarios such as medical imaging or remote sensing. | CO4 / U | 10 |
|  | b. | Explain the various types of noise found in medical imaging and the filtering techniques employed to minimize or eradicate it. | CO2 / R | 10 |
|  |  | **OR** |  |  |
| 8 | a. | Formulate a tentative image processing model that incorporates all facets of image processing and is suitable for diagnosing cancer from a brain image using the appropriate imaging modalities. | CO6 /C | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | |
| 9. | a. | Utilise the Deep Learning technique for cancer detection in skin images and tumour detection in MRI images with diagrams | CO6 /A | 20 |
|  |  |  |  |  |

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize the concepts of digital image processing techniques. |
| CO2 | Identify the noise and apply filters for medical image applications |
| CO3 | Determine the restoration for medical images. |
| CO4 | Implement segmentation and evaluation techniques. |
| CO5 | Apply the Featuring engineering on medical images. |
| CO6 | Develop systems for medical image processing and analysis for diagnosis |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 |  | 15 |  | - | - | 20 |
| CO2 | 10 | 10 | - | 10 | - | - | 30 |
| CO3 | - | 10 | 10 | - | - | - | 20 |
| CO4 | - | 10 | 10 | 30 | - | - | 50 |
| CO5 | 10 | 10 | - | - | - | - | 20 |
| CO6 | - | - | 20 | - | - | 20 | 40 |
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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2002** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL ETHICS AND STANDARDS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the primary focus of the CMA Code of Ethics in the medical field? | | CO1 | R | 1 |
| 2. | According to the AMA Code of Ethics, which is considered as most important when a physician interacts with patients? | | CO1 | R | 1 |
| 3. | Name the ethical theory that emphasizes duties and rules over the consequences of actions. | | CO2 | R | 1 |
| 4. | The Principle of Justice in healthcare ethics advocates for what? | | CO2 | R | 1 |
| 5. | What does IEEE 11073 standardize? | | CO3 | R | 1 |
| 6. | DICOM stand for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 7. | Name the document or standard that is often used as a guideline during hospital accreditation in many countries. | | CO4 | R | 1 |
| 8. | Write the key function of JCAHO accreditation for hospitals. | | CO4 | R | 1 |
| 9. | Identify the type of waste that is classified as biohazardous in a hospital setting. | | CO5 | R | 1 |
| 10. | EMC stand for \_\_\_\_ in medical devices. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define medical ethics and state why it is important in healthcare. | | CO1 | R | 3 |
| 12. | Summarize the 4 principles of medical ethics. | | CO2 | U | 3 |
| 13. | List the benefits of using an Electronic Health Record (EHR) system in healthcare settings. | | CO3 | An | 3 |
| 14. | Illustrate the key objectives of healthcare organization management standards, and analyze how do they contribute to improving patient care? | | CO4 | U | 3 |
| 15. | Explain the role of fire safety standards in hospitals, and conclude how do they protect patients and staff? | | CO5 | E | 3 |
| 16. | Describe IEC 60601 standard, and why is it important in the medical device industry? | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | List the 9 principles of the AMA code of ethics. | CO1 | U | 9 |
|  | b. | Explain the ethical responsibility of doctors to maintain confidentiality in the doctor-patient relationship. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. |  | Discuss the ethical issues surrounding genetic testing and screening in humans. How do issues of autonomy, privacy, and discrimination arise in the context of genetic information, and how should healthcare professionals address these concerns? | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the significance of IEEE 11073 standards in healthcare and medical device interoperability and assess how do these standards help in ensuring the integration and communication between medical devices and health information systems? | CO3 | U | 6 |
|  | b. | Discuss the importance of data security and patient privacy in Electronic Patient Record (EPR) systems | CO3 | U | 6 |
| 20. |  | Explain the process involved in obtaining Joint Commission International (JCI) accreditation for hospitals. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Define Biohazardous materials. Why it is important to manage them properly in a healthcare? | CO5 | An | 6 |
|  | b. | How should fire safety and evacuation plans be designed in hospitals to protect patients, particularly those who are immobile or in critical care? | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Outline the general safety and performance requirements for electrical medical devices as per international standards. | CO6 | U | 6 |
|  | b. | Explain the significance of Electromagnetic Compatibility (EMC) in the design and operation of medical devices. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Outline the DICOM and its importance of DICOM (Digital Imaging and Communications in Medicine) standards in medical imaging. | CO3 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a comprehensive fire safety plan for a hospital that includes both proactive and reactive measures. Explain how the hospital can protect both the infrastructure and individuals from fire, smoke, and heat. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the scope of medical ethics |
| **CO2** | Illustrate the concepts of ethical theories and moral principles for the healthcare providers. |
| **CO3** | Paraphrase the purpose of medical standards |
| **CO4** | Acquire knowledge about hospital accreditation standards |
| **CO5** | Summarize the importance of hospital safety standards |
| **CO6** | Recommend the suitable principles of medical equipment safety standards in hospitals |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2003** | **Duration** | **3hrs** |
| **Course Title** | **HOSPITAL MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Clinical engineers are responsible for educating hospital staff on\_\_\_\_\_\_ | | CO1 | U | 1 |
| 2. | Mention one role of a clinical engineer in a hospital. | | CO1 | R | 1 |
| 3. | Name the state in India which has a separate Health and Family Welfare Corporation. | | CO2 | R | 1 |
| 4. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the key objective of the National Health Policy 2017. | | CO2 | R | 1 |
| 5. | Name one major difference between hospital and industrial management. | | CO3 | R | 1 |
| 6. | List the three levels of training in an organization. | | CO3 | R | 1 |
| 7. | State the purpose of conducting a pilot study. | | CO4 | R | 1 |
| 8. | Name the method used for medical waste disposal in hospitals. | | CO4 | R | 1 |
| 9. | State the primary function of a Hospital Information System (HIS). | | CO5 | R | 1 |
| 10. | List any one advantage of storing radiological images digitally using PACS. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the key skills required for a clinical engineer working in a hospital. | | CO1 | U | 3 |
| 12. | Summarize the role of the Ministry of Health and Family Welfare in India. | | CO2 | U | 3 |
| 13. | Outline the difference between a hospital and an industrial organization. | | CO3 | U | 3 |
| 14. | List the sources of hospital funding. | | CO4 | An | 3 |
| 15. | Define Electronic Health Records (EHR). | | CO5 | R | 3 |
| 16. | Define Telemedicine. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the various roles performed by the clinical engineer in hospital. | CO1 | An | 6 |
|  | b. | Illustrate the classification of hospitals. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Outline the primary function of the World Health Organization (WHO). | CO2 | U | 6 |
|  | b. | Summarize the Process of health insurance claim. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the steps involved in employee performance appraisal. | CO3 | U | 8 |
|  | b. | Summarize the benefits and limitations of training. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Assess the importance of conducting a pilot study before establishing a hospital. | CO4 | E | 6 |
|  | b. | Explain the process of obtaining a hospital license. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. |  | Explain the structure of a Hospital Information System (HIS) in detail. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Describe National Health Policy and its role in helping Government to improve quality of life. |  |  |  |
|  |  |  |  |  |  |
| 23. |  | Illustrate the various steps involved in designing a new hospital. | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24 | a. | Explain the components and benefits of the Picture Archiving and Communication System (PACS) in radiology. | CO6 | U | 6 |
|  | b. | Demonstrate the role of computer applications in ICU. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the need for clinical engineering in healthcare system |
| **CO2** | Summarize the use of various health policies. |
| **CO3** | Demonstrate how high quality training is delivered for technical staff. |
| **CO4** | Evaluate the hospital designing and disposal of medical waste. |
| **CO5** | Debate the needs of hospital information system |
| **CO6** | Apply the use of computer and information technology in medical data |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2006** | **Duration** | **3hrs** |
| **Course Title** | **BIOMATERIALS AND ARTIFICIAL ORGANS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Biomaterial interacts with \_\_\_\_\_\_\_\_\_\_\_\_\_ system. | | CO1 | R | 1 |
| 2. | Give examples for common crystalline metals used in healthcare. | | CO1 | U | 1 |
| 3. | Name the second stage of wound healing process. | | CO2 | R | 1 |
| 4. | List the types of cell-material interaction. | | CO2 | R | 1 |
| 5. | Dialysis membrane must be \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The direct contact procedure is recommended for \_\_\_\_\_\_\_\_\_\_\_\_\_ materials. | | CO3 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_\_ are implanted within the body that helps to monitor the state and improve the body function. | | CO4 | R | 1 |
| 8. | Explain the area of focus of immunogenicity assays. | | CO4 | U | 1 |
| 9. | List the parts of bubble oxygenators. | | CO5 | R | 1 |
| 10. | Explain the uses of dialyzer. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the types of biomaterials. | | CO1 | An | 3 |
| 12. | Describe the applications of radiation. | | CO2 | U | 3 |
| 13. | Analyze the most common complications associated with implantation of any biomaterial regardless of form or function. | | CO3 | An | 3 |
| 14. | Differentiate between protein-based studies and relative gene-based studies. | | CO4 | U | 3 |
| 15. | Describe the parts of external ear. | | CO5 | R | 3 |
| 16. | Write advantages and disadvantages of parallel plate dialyzer. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the role of immune cells in the biological response to biomaterials. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Select a non-surgical procedure and user injections to stimulate and enhance the body’s healing for a sports person who wants to heal his wound fast. | CO2 | E | 6 |
|  | b. | Explain the surgical procedure that involves trusted source removing skin from one area of the body and moving it to a different area of the body. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Evaluate the laboratory testing which involve the exposure of substances extracted from test material to cell culture lines. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the metallic implant material along with its advantages and disadvantages. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the working principle of bubble oxygenators. | CO5 | A | 12 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 22. | a. | Explain the two major mediators for sound conduction to the inner ear. | CO5 | An | 8 |
|  | b. | Sketch the functional block diagram of an audiometer. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 23. |  | Explain the crystalline nature of ceramics and metals. | CO1 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the function of hemodialysis machine and its types. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify and know the structural variations in biomaterials. |
| **CO2** | Determine and classify the various properties of biomaterials. |
| **CO3** | Explain the methods for testing implants with different aspects of biomaterials. |
| **CO4** | Recall the cell-biomaterial interactions for constructing artificial organs. |
| **CO5** | Assess the Interfacing materials and ethical implications. |
| **CO6** | Apply the biomaterials in healthcare sectors. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2007** | **Duration** | **3hrs** |
| **Course Title** | **CONTROL SYSTEM FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

Note: Semi log graph and Ordinary graph sheets to be provided.

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Describe the block diagram reduction rules to find the transfer function of the system. | | CO1 | R | 1 |
| 2. | State the characteristics of negative feedback. | | CO1 | R | 1 |
| 3. | List the time domain specifications. | | CO2 | R | 1 |
| 4. | Classify the II order system depending on the value of damping ratio. | | CO2 | U | 1 |
| 5. | Define phase cross over frequency. | | CO3 | R | 1 |
| 6. | List the frequency domain specifications. | | CO3 | R | 1 |
| 7. | Explain BIBO stability. | | CO4 | U | 1 |
| 8. | Define root locus. | | CO4 | R | 1 |
| 9. | Explain the steady state model of the chemical regulation of ventilation. | | CO5 | U | 1 |
| 10. | Describe the cardiac output curves. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the properties of signal flow graph. | | CO1 | R | 3 |
| 12. | The closed loop transfer function of second order system is C(s)/R(s) = 200/s2 +20s +200. Estimate the type of damping in the system. | | CO2 | U | 3 |
| 13. | Differentiate type and order of a system. | | CO3 | U | 3 |
| 14. | Identify the necessary condition for stability. | | CO4 | R | 3 |
| 15. | Explain the schematic diagram of the processes involved in the regulation of  glucose and insulin, | | CO5 | U | 3 |
| 16. | Define Starling law. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the transfer function of the system using block diagram reduction technique. | CO1 | A | 6 |
|  | b. | Explain the transfer function of armature controlled dc motor. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Determine the transfer function 𝐂/𝐑 for the signal flow graph using mason gain formula. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | A closed loop servo is represented by the differential equation:  64e. where ‘c’ is the displacement of the output shaft, ‘r’ is the displacement of the input shaft and e = r – c. Determine the undamped natural frequency, damping ratio and percentage maximum overshoot for unit step input. | CO2 | A | 6 |
|  | b. | Determine the type of input signal and the values of servo mechanisms that give rise to a constant steady state error. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Consider a unity feedback open loop transfer function  G(s) = 10/s(1+0.4s)(1+0.1s). Sketch the bode plot and find the phase and gain cross over frequencies. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the root locus of the system whose open loop transfer function is | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Estimate the range of K for stability of unity feedback system using Routh’s stability criterion. | CO4 | An | 6 |
|  | b. | Calculate the stability of the following system using Routh’s stability criterion. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Differentiate engineering and physiological control systems with suitable examples. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate the model of regulation of cardiac output. | CO6 | E | 6 |
|  | b. | Evaluate the linear model of respiratory mechanics. | CO6 | E | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Represent the system in various forms. |
| **CO2** | Interpret the response of the system in time domain. |
| **CO3** | Analyze the frequency response of any system. |
| **CO4** | Examine the stability of the system. |
| **CO5** | Compute the mathematical model of physiological systems. |
| **CO6** | Summarize the features of physiological system. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2011** | **Duration** | **3hrs** |
| **Course Title** | **SIGNAL CONDITIONING CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Explain the process of Sodium pumping | | CO1 | U | 1 |
| 2. | Describe the concept of hyperpolarization. | | CO1 | R | 1 |
| 3. | Differentiate between uA741 and uA741C. | | CO2 | U | 1 |
| 4. | Sketch an op-amp. | | CO2 | A | 1 |
| 5. | Describe the significance of an active filter. | | CO3 | U | 1 |
| 6. | Identify the practical examples of low pass filters. | | CO3 | U | 1 |
| 7. | List the benefits of a data acquisition system. | | CO4 | R | 1 |
| 8. | Define sampling. | | CO4 | R | 1 |
| 9. | Explain the process of biomedical transmission. | | CO5 | U | 1 |
| 10. | Describe the role of SMT in PCB design. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain polarization and depolarization. | | CO1 | A | 3 |
| 12. | Describe the practical characteristics of an operational amplifier. | | CO2 | U | 3 |
| 13. | Compare a band-stop filter and a notch filter. | | CO3 | E | 3 |
| 14. | Sketch the block diagram of a digital data acquisition system. | | CO4 | A | 3 |
| 15. | Describe the block diagram of biomedical transmission system. | | CO5 | R | 3 |
| 16. | Examine the significance of PCBs in the electronic device design process. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the types of bio-electrodes used in bio-potential measurement. | CO1 | A | 5 |
|  | b. | Analyze the electrode-skin interface and its significance in bio-signal acquisition. | CO1 | An | 7 |
|  |  |  |  |  |  |
| 18. | a. | **Explain** the working of an Op-Amp as a subtractor. | CO2 | An | 6 |
|  | b. | Write notes on differentiator circuit using Op-amp. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | **Explain the** two types of isolation amplifiers. | CO3 | An | 8 |
|  | b. | Identify the advantages of higher-order active filters. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate counter-type and flash-type analog-to-digital converters with a comparative analysis. | CO4 | E | 9 |
|  | b. | **Summarize** the applications of a comparator. | CO4 | E | 3 |
|  |  |  |  |  |  |
| 21. | a. | Discriminate frequency shift keying and amplitude shift keying. | CO5 | An | 6 |
|  | b. | Explain the working principle of a phase-locked loop. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | **Explain** the characteristics of first-order and second-order low-pass filters | CO3 | An | 8 |
|  | b. | Write a note on the second-order band-pass filter. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Write a note on transimpedance amplifier. | CO2 | A | 6 |
|  | b. | Write a note on the Non inverting amplifier | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | **Analyze** the steps involved in the fabrication of printed circuit boards (PCBs). | CO6 | An | 8 |
|  | b. | Explain the circuit design steps in NI Multisim. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the origin and characteristics of various biosignals and its acquisition. |
| **CO2** | Apply the signal conditioning circuits using operational amplifiers for biomedical field. |
| **CO3** | Analyze and design bio filters and isolation circuits used in medical signal conditioning. |
| **CO4** | Paraphrase the elements of data acquisition system with analog and digital circuits |
| **CO5** | Create the various circuits for designing medical equipments using different ICs |
| **CO6** | Recommend the various safety standards and circuit design for biomedical applications |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2012** | **Duration** | **3hrs** |
| **Course Title** | **MICROPROCESSORS AND MICROCONTROLLERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two examples of embedded system. | | CO1 | R | 1 |
| 2. | Differentiate between microprocessor and microcontroller. | | CO1 | An | 1 |
| 3. | Name the type of memory used to store permanent programs and data. | | CO2 | U | 1 |
| 4. | List six general purpose registers of 8085 microprocessor. | | CO2 | R | 1 |
| 5. | Name the register that holds the opcode of an instruction. | | CO3 | R | 1 |
| 6. | Identify the instruction that loads 16 bit data into the register pair specified in the operand. | | CO3 | U | 1 |
| 7. | Differentiate between DCR and DCX. | | CO4 | An | 1 |
| 8. | Define register. | | CO4 | R | 1 |
| 9. | Name the software tool used for testing purposes. | | CO5 | R | 1 |
| 10. | List three buses that act as communication channels in 8051 microcontroller. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the significance of Von-Neumann architecture. | | CO1 | An | 3 |
| 12. | Describe the Program Status Word and its role in a processor. | | CO2 | U | 3 |
| 13. | Explain the Power Control Register of 8051 microcontroller. | | CO3 | An | 3 |
| 14. | Analyze the ALU in 8051. | | CO4 | An | 3 |
| 15. | Explain the function of arithmetic instructions in the 8051 microcontroller. | | CO5 | An | 3 |
| 16. | Differentiate between assembler and compiler. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the function of pipelining in processor architecture. | CO1 | U | 6 |
|  | b. | Describe the significance of addressing modes in the 8085 microprocessor. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working of timers and counters in the 8051 microcontroller. | CO2 | An | 6 |
|  | b. | Analyze the role of the control unit in managing microprocessor operations. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Describe the different types of instruction sets in 8051 microcontroller. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the flag register of the 8051 microcontroller and its significance in instruction execution. | CO4 | U | 10 |
|  | b. | Differentiate between RAM and ROM. | CO4 | An | 2 |
|  |  |  |  |  |  |
| 21. | a. | Explain the Immediate addressing mode and Direct addressing mode in the 8051 microcontroller. | CO5 | An | 10 |
|  | b. | Analyze the role of arithmetic and logical instructions in 8051 microcontroller. | CO5 | An | 2 |
|  |  |  |  |  |  |
| 22. | a. | Explain the flow of execution for an 8 bit program using a flowchart. | CO4 | An | 10 |
|  | b. | Illustrate the working of the ADD and ADC instructions. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 23. |  | Analyze the working of the body temperature measurement system. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the process of LED interfacing with microcontroller. | CO6 | An | 6 |
|  | b. | Analyze the significance of ADC in sensor based embedded systems. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Summarize the microprocessor organization and its evolution. |
| **CO2** | Interpret the various instruction sets and programming language of 8085. |
| **CO3** | Analyze their knowledge in designing a system using 8051. |
| **CO4** | Compare controller / processor architecture and features. |
| **CO5** | Interface the peripheral devices with controller. |
| **CO6** | Simulate the real time system using integrated development environment. |



**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2013** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRON DEVICES AND CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the semiconductor material that you would recommend for a PN diode in high-temperature applications. | | CO1 | U | 1 |
| 2. | Name the diode that is constructed with n type semi-conductor material alone. | | CO1 | R | 1 |
| 3. | State the biasing method which ensures maximum stability and faithful amplification in a BJT. | | CO2 | R | 1 |
| 4. | Mention the type of special purpose diode that you would use for detecting light. | | CO2 | R | 1 |
| 5. | TRIAC is a bidirectional switch. Justify the answer. | | CO3 | U | 1 |
| 6. | Draw the schematic of a pi filter. | | CO3 | R | 1 |
| 7. | In a tuned amplifier, the bandwidth and stability is determined by ……… | | CO4 | U | 1 |
| 8. | Define CMRR. | | CO4 | R | 1 |
| 9. | List the diodes that exhibit negative resistance effect. | | CO5 | U | 1 |
| 10. | An oscillator circuit with two RC networks will provide …… degrees of phase shift. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Silicon is the preferred semiconductor material over Germanium. Justify the statement. | | CO1 | U | 3 |
| 12. | Differentiate between intrinsic and extrinsic semiconductors. How does doping alter their electrical properties and energy band diagrams? | | CO2 | U | 3 |
| 13. | Assess the performance of a Zener diode in voltage regulation compared to a regular PN junction diode. What makes the Zener diode more effective in certain applications? | | CO3 | U | 3 |
| 14. | The maximum collector current that a transistor can carry is 500mA. If β = 300 what is the maximum allowable base current of the device? | | CO4 | A | 3 |
| 15. | Compare the current gain and voltage gain of the common emitter (CE), common base (CB), and common collector (CC) configurations. How do these differences impact their applications? | | CO5 | U | 3 |
| 16. | Compare the characteristics of single-ended and double-ended output configurations in a differential amplifier. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Elaborate on the different methods of electron hole generation and recombination. | CO1 | R | 8 |
|  | b. | Compare n-type and p-type semiconductors with respect to doping materials, majority and minority carriers, and applications. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | Analyze how Zener diode maintains a constant output voltage in a voltage regulation circuit, even when the input voltage or load current varies. | CO1 | U | 8 |
|  | b. | Derive the representation of input impedance, output impedance, current gain and voltage gain in CE configuration. | CO1 | AN | 4 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the role of the Schottky diode in high-speed switching applications. How does its construction contribute to reduced switching time? | CO2 | U | 6 |
|  | b. | Examine the conditions under which a transistor ceases to provide faithful amplification. How do different types of biasing contribute to this failure? | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Analyze how a rectifier is designed with two diodes to rectify both positive and negative half cycles of a AC input and derive the expression for its efficiency, evaluating its advantages over other rectifiers. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the construction and working of an RC-coupled multistage amplifier in detail, and evaluate its performance characteristics and applications in signal amplification. | CO5 | U | 6 |
|  | b. |  | CO5 | U | 6 |
| 22. | a | Create a labeled diagram of a power supply system and justify the importance of voltage regulators in ensuring stable and reliable operation. | CO2 | U | 8 |
|  | b. | A bipolar NPN transistor has a DC current gain value , β = 100. Calculate the base current Ib required to switch a resistive load of 2mA. Also calculate current gain α | CO1 | An | 4 |
| 23. | a. | Evaluate the effectiveness of a differential amplifier in rejecting common-mode noise in real-world applications. | CO4 | U | 8 |
|  | b. | Evaluate the efficiency of a Class AB amplifier in comparison to a Class A amplifier. Which one is better suited for audio applications and why? | CO4 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design a three network RC phase shift oscillator for biomedical devices that require precise frequency control for defibrillators. | CO6 | AN | 10 |
|  | b. | Consider a 2-stage RC oscillator which has of equal resistors. Assume the capacitance value as 0.1pF capacitors. As the frequency of oscillation is given as 4kHz, calculate the value of the resistors. | CO6 | A | 2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Paraphrase the basic properties of solid state devices like diode, transistor and FET. |
| **CO2** | Identify and differentiate rectifiers, amplifiers and oscillators. |
| **CO3** | Analyze the amplitude and frequency response of general amplifier circuits. |
| **CO4** | Sketch the types of power amplifiers and their transfer characteristics. |
| **CO5** | Classify the power amplifiers to meet certain specifications. |
| **CO6** | Distinguish between amplifiers and oscillators. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2015** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL IMAGING TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Locate the position of collimator in an X-ray machine. | | CO1 | R | 1 |
| 2. | Identify the method of imaging, when a continuous X-ray beam is passed through the body part being examined. | | CO1 | R | 1 |
| 3. | Quote the importance of image reconstruction in computed tomography. | | CO2 | R | 1 |
| 4. | Write the merits of mammography. | | CO2 | A | 1 |
| 5. | Indicate the imaging method for detecting the brain tumor. | | CO3 | U | 1 |
| 6. | Infer the merits of thermal imaging camera. | | CO3 | An | 1 |
| 7. | Infer the importance of photon emission tomography. | | CO4 | An | 1 |
| 8. | List the application of ultrasound in biomedical diagnosis. | | CO4 | R | 1 |
| 9. | Justify the merits of using non-invasive diagnostic techniques. | | CO5 | E | 1 |
| 10. | Cite the hazards due to super conducting magnets. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the types of radiological equipment. | | CO1 | R | 3 |
| 12. | Infer the merits of x-rays diagnosis. | | CO2 | An | 3 |
| 13. | Organize various components of X-ray tube. | | CO3 | An | 3 |
| 14. | Explain the details on ultrasound probe in imaging system. | | CO4 | A | 3 |
| 15. | Explain the applications of radiological imaging system. | | CO5 | A | 3 |
| 16. | Justify the applications of functional CT in medical imaging. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the working of various components of mobile X-ray machine. | CO1 | An | 8 |
|  | b. | Infer the importance of bucky grid. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Determine the applications of dental radiography. | CO2 | A | 6 |
|  | b. | Interpret the medical applications of angiography. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Illustrate the image generation based on magnetic resonance. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the applications of emission tomography. | CO4 | An | 8 |
|  | b. | Explain various diagnostic aspects using color Doppler scanner. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate the applications of optical coherence tomography. | CO6 | E | 6 |
|  | b. | Infer various image reconstruction methods in tomography. | CO6 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Analyze the diagnostic method using Infrared imaging system. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the working of ultrasound imaging in medical field. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the architecture of picture archiving and communication system. | CO4 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Outline the various medical imaging techniques |
| CO2 | Paraphrase the principle of specific medical imaging techniques |
| CO3 | Interpret the imaging outputs |
| CO4 | Identify the suitable medical imaging techniques for specific pathology |
| CO5 | Sketch new ideas to solve certain issues in medical imaging |
| CO6 | Justify the impact of medical imaging system for diagnosis. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2016** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRICAL CIRCUIT ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Determine the type of the source presented in the given figure  What is Dependent Voltage Source? - Electrical Concepts | | CO1 | A | 1 |
| 2. | Analyze the relationship between the input voltage and output voltage of the VCVS to determine the output voltage when a 10V source is connected across resistor having a gain of 2. | | CO1 | An | 1 |
| 3. | Thevenin’s theorem replaces a complex network with \_\_\_\_\_\_\_\_\_\_\_\_ | | CO2 | U | 1 |
| 4. | Star to delta transformation is used to simplify \_\_\_\_\_\_\_\_\_\_\_\_ | | CO2 | A | 1 |
| 5. | Complex impedance is denoted by \_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 6. | Determine the time constant of a parallel RC circuit where R = 15 | | CO3 | A | 1 |
| 7. | Active power in AC circuits is measured using the \_\_\_\_\_\_\_\_\_\_\_ equation. | | CO4 | U | 1 |
| 8. | The RMS value of a sinusoidal voltage is \_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO4 | U | 1 |
| 9. | Poles of a transfer function determine the \_\_\_\_\_\_\_\_\_\_\_ System | | CO5 | R | 1 |
| 10. | Image parameters are used to describe\_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the concept of duality in electrical networks. | | CO1 | An | 3 |
| 12. | Evaluate the conditions for maximum power transfer in an electrical circuit and assess the power delivered to a 2-ohm load when the Thevenin voltage is 5 V, justifying your calculations. | | CO2 | An | 3 |
| 13. | List the initial conditions of a capacitor and an inductor in a circuit. | | CO3 | R | 3 |
| 14. | Define the root mean square (RMS) value of an AC waveform. | | CO4 | R | 3 |
| 15. | Evaluate the Pole Zero plot for given function  F(s) = S  (S+2) (S+3) | | CO5 | An | 3 |
| 16. | Define the term Hybrid Parameters. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the equation for current division, expressing the individual branch currents I1 and I2​ in terms of IT, R1 and R2. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Define the term Two Port Networks. | CO6 | R | 4 |
|  | b. | Analyze the given network to determine the current flowing through the 10 Ω resistor positioned between the point c and e, by employing Norton Theorem. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 19. | a. | Describe the term Impedance (Z) and Admittance (Y) in AC circuits. | CO4 | U | 04 |
|  | b. | Explain the term ideal transformer, and illustrate how it differs from a real transformer? | CO4 | A | 08 |
|  |  |  |  |  |  |
| 20. |  | Determine the Inverse Laplace transform for  i) F(s)= S+1  S(S+2)  ii) F(s) = 2S+1  (S+1) (S+2) (S+3) | CO5 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the following parameters for a parallel RLC circuit comprising a 50 Ω resistor, a 20 mH inductor, and a 5 µF capacitor, energized by a 50 V, 100 Hz AC source:  i)The total current drawn from the supply.  ii) The individual branch currents.  iii) The total equivalent impedance.  iv) The conductance.  v) The inductive and capacitive susceptance.  vi) The power factor. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | In the network shown in the figure, the switch S is closed and steady attained at t=0, the switch is opened, then evaluate the   1. Current through the inductor. 2. Voltage across the capacitor at t=0.5 s. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Analyze the circuit presented in Fig. Utilize node analysis to systematically derive branch currents and the voltage drop across the circuit. | CO1 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the admittance parameters of the T network shown in Fig. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Comprehend and design ac/dc circuits. |
| **CO2** | Develop and understand ac/dc circuits. |
| **CO3** | Evaluate ac/dc circuits. |
| **CO4** | Interpret electrical circuits |
| **CO5** | Apply circuit theorems in real time. |
| **CO6** | Analyze with network theorems on DC circuits |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **22BM2017** | **Duration** | **3hrs** |
| **Course Title** | **IMAGE PROCESSING FOR MEDICAL APPLICATIONS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the components used in the digital image processing. | | CO1 | R | 1 |
| 2. | Differentiate digital image and color image. | | CO1 | A | 1 |
| 3. | Define HSV in color models. | | CO2 | R | 1 |
| 4. | Define the Negative grey scale transformation. | | CO2 | R | 1 |
| 5. | Describe the purpose of Adaptive Bilateral filter. | | CO3 | U | 1 |
| 6. | List Differences between Spatial domain and frequency domain image processing. | | CO3 | R | 1 |
| 7. | List the purpose of Watershed Algorithm. | | CO4 | R | 1 |
| 8. | Describe the operation of Erosion in digital image processing. | | CO4 | U | 1 |
| 9. | Name one example of a lossless compression model. | | CO5 | R | 1 |
| 10. | Write the significance of Fourier Descriptors in shape recognition. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate discretization and quantization. | | CO1 | An | 3 |
| 12. | List the differences between Spatial domain and frequency domain. | | CO2 | R | 3 |
| 13. | List the significance of Band stop filter. | | CO3 | R | 3 |
| 14. | Explain the Significance of segmentation in medical images. | | CO4 | A | 3 |
| 15. | Describe how Run-Length Encoding (RLE) works and provide an example. | | CO5 | A | 3 |
| 16. | Explain the process of Template Matching and its applications in image recognition. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the components of digital image processing with neat block diagram. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the operation of Histogram processing. | CO2 | A | 6 |
|  | b. | Describe the operation of Logarithmic gray scale transformation on medical images. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the operation of various types of Adaptive filters. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the steps involved in the detection of discontinuities using image segmentation techniques. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Determine the Huffman coding for the given frequency table. Construct a Huffman Tree, assign binary codes to each character, and encode the string **"EDECEAB"** using Huffman Coding.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Character | A | B | C | D | E | | Frequency | 3 | 2 | 6 | 8 | 5 | | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate Speckle Noise and Poisson Noise. | CO3 | A | 6 |
|  | b. | Describe how the region based segmentation can be performed on the medical image. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write a short note on Run length encoding for image compression. | CO5 | An | 6 |
|  | b. | Explain the Ramer-Douglas-Peucker algorithm and its use in Polygonal Approximation for boundary representation. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the Chain Code method in detail, including its advantages and applications. | CO6 | An | 6 |
|  | b. | Describe the Fourier Descriptor technique and its advantages in shape recognition. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Paraphrase the digital image fundamentals for a given condition |
| **CO2** | Illustrate the effect of image enhancement techniques on images |
| **CO3** | Distinguish between image restoration filters |
| **CO4** | Summarize about the image segmentation procedure |
| **CO5** | Compute the level of compression achieved for the given image data |
| **CO6** | Evaluate the features useful for image representation and recognition |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2026** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL DIAGNOSTICS AND THERAPEUTIC EQUIPMENT I** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Sketch an ECG signal and label its segments. | | CO1 | A | 1 |
| 2. | Differentiate ECG and EEG electrodes. | | CO1 | U | 1 |
| 3. | Explain the pO2 electrode configuration. | | CO2 | R | 1 |
| 4. | Indicate the normal blood pH value. | | CO2 | R | 1 |
| 5. | **Describe** the role of an Apnoea monitor in detecting breathing abnormalities. | | CO3 | U | 1 |
| 6. | State Faraday’s law of electromagnetic induction. | | CO3 | R | 1 |
| 7. | Analyze the advantages of a DC defibrillator. | | CO4 | An | 1 |
| 8. | Describe the role of a pacemaker in regulating heart rhythm. | | CO4 | U | 1 |
| 9. | **Explain** the role of humidifiers in a ventilator. | | CO5 | U | 1 |
| 10. | Define electrotherapy. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Identify different types of PCG microphones. | | CO1 | U | 3 |
| 12. | Explain about heart rate measurement. | | CO2 | U | 3 |
| 13. | Sketch the block diagram of doppler ultrasound for blood flow measurement. | | CO3 | R | 3 |
| 14. | List the various types of pacemaker batteries. | | CO4 | R | 3 |
| 15. | Relate various mode of ventilators. | | CO5 | A | 3 |
| 16. | **Define** Faradic current therapy. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Evaluate EMG in the measurement of conduction velocity. | CO1 | E | 6 |
|  | b. | Explain with the help of a diagram the major building blocks of an EEG machine. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the working principle of a digital pH meter with supporting sketches. | CO2 | An | 6 |
|  | b. | **Explain** the working principle behind pCO2 electrode. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Assess the significance of various parameters acquired from a bedside patient monitor in patient care. | CO3 | E | 4 |
|  | b. | Illustrate in detail about the Fick’s method. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the functioning of a DC defibrillator, focusing on its electrical components. | CO4 | An | 8 |
|  | b. | Relate various modes of pacemakers. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | **Analyze** the mechanisms involved in the functioning of a mechanical ventilator. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the role of LASER in blood flow measurement. | CO3 | An | 9 |
|  | b. | Assess the advantages and disadvantages of using ear oximetry for monitoring oxygen saturation in patients. | CO3 | E | 3 |
|  |  |  |  |  |  |
| 23. | a. | **Apply** the use of a spirometer to assess a patient’s lung capacity in a clinical testing. | CO2 | A | 6 |
|  | b. | Describe any method for blood pressure measurement. | CO2 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | **Evaluate** the effectiveness of Functional Electrical Stimulator (FES) in pain management and rehabilitation. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the procedures for acquisition of physiological signals. |
| **CO2** | Demonstrate the methods for vital and biochemical parameters measurement. |
| **CO3** | Describe the functions of various non-invasive equipment. |
| **CO4** | Illustrate the techniques for cardiac equipment. |
| **CO5** | Assess the merits of the respiratory equipment based on its applications. |
| **CO6** | Analyse the behaviour of electrotherapy equipment. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22BM2031** | **Duration** | **3hrs** |
| **Course Title** | **3D PRINTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two advantages of 3D printing in the healthcare sector | | CO1 | R | 1 |
| 2. | State one key difference between traditional prototyping and 3D prototyping. | | CO1 | U | 1 |
| 3. | L**ist**any two benefits of 3D printing in product development | | CO2 | R | 1 |
| 4. | Identify one example of a technology related to 3D printing | | CO2 | U | 1 |
| 5. | List any two metal-based 3D printing systems. | | CO3 | R | 1 |
| 6. | State the significance of using layers in 3D printing processes. | | CO3 | U | 1 |
| 7. | List any two software tools commonly used for 3D modeling in medical applications. | | CO4 | R | 1 |
| 8. | State one advantage of using computer-based methods in dental implant planning | | CO4 | U | 1 |
| 9. | List two common medical applications where 3D printing is currently used. | | CO5 | R | 1 |
| 10. | State a reason why further development is needed in medical 3D printing. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate with examples how 3D printing has changed the approach to rapid prototyping. | | CO1 | A | 3 |
| 12. | Explain the generic process flow of a typical 3D printing operation. | | CO2 | U | 3 |
| 13. | Describe how hybrid 3D printing systems work and mention their industrial advantages. | | CO3 | A | 3 |
| 14. | Explain the process of converting medical scanner data into a 3D model using AutoCAD or Blender. | | CO4 | U | 3 |
| 15. | Describe the role of software in ensuring anatomical accuracy in 3D printed medical devices | | CO5 | A | 3 |
| 16. | Give insights on Bio-Inks | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Evaluate the impact of 3D printing across at least three different industries. Justify how it has transformed operations in each. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze how the benefits of 3D printing contribute to faster innovation in manufacturing. Include at least three distinct benefits. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Evaluate Selective Laser Sintering and Fused Deposition Modelling with respect to practical applications. (Illustrations needed). | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyse the usage of Direct Volume Rendering for 3D modelling of anatomical models. Discuss its impact on Dental implantology. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the limitations of current 3D printing technology in medical applications, especially in terms of regulation, biocompatibility, and cost. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Compare and analyse the pros and cons of the 3D printing technologies of the past, present and the future. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Differentiate and analyse the technologies of 3D printing and CNC Machining with required illustration. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a step-by-step digital workflow using Blender or AutoCAD to convert a CT scan into a 3D printable model. Include key stages such as dataset import, volume reduction, rendering, and orientation check. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the importance of 3D printing in Manufacturing |
| **CO2** | Design and document their design process |
| **CO3** | Identify how technology shifts throughout history have made 3D printing possible |
| **CO4** | Describe the advantages and limitations of each 3D printing technology |
| **CO5** | Design and print objects containing moving parts without assembly. |
| **CO6** | Evaluate the unique advantages of 3D printing to their designs. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **23BM3002** | **Duration** | **3hrs** |
| **Course Title** | **WEARABLE DEVICES FOR MEDICAL APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Categorize embedded systems based on their functional requirements. | CO1 | An | 8 |
|  | b. | Examine the design challenges faced in embedded systems. | CO1 | An | 8 |
|  |  |  |  |  |  |
| 2. | a. | **Illustrate** the sequential steps involved in **embedded software design.** | CO2 | A | 11 |
|  | b. | Analyze the steps involved in converting an Embedded C program into machine code. | CO2 | An | 5 |
|  |  |  |  |  |  |
| 3. | a. | Analyze programming in a high-level language. | CO3 | An | 10 |
|  | b. | Analyze the architecture of an Arduino Uno development board. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 4. | a. | Design an Arduino based DAQ. | CO4 | A | 12 |
|  | b. | Summarize the functions of timers and counters in embedded systems. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 5. | a. | Assess the clinical challenges in wearable device design and suggest engineering approaches to mitigate them. | CO5 | E | 10 |
|  | b. | Summarize the role of wearable technologies in daily life. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 6. | a. | Illustrate the design process of an embedded system with an example. | CO1 | An | 8 |
|  | b. | Outline the various design metrics considered in embedded systems. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | Design the program to interface 7 segment LED to an embedded system. | CO4 | C | 7 |
|  | b. | Design the embedded program to interface A/D converter to an embedded system. | CO4 | C | 9 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Analyze the architecture and functionality of a wearable patient monitoring system. | CO6 | An | 10 |
|  | b. | Design a wearable device for body temperature measurement. | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the basics of embedded systems and its hardware units. |
| CO2 | Identify the various tools and development process of embedded system. |
| CO3 | Create the programming for embedded system design. |
| CO4 | Demonstrate the various peripherals interfacing with microcontroller. |
| CO5 | Summarize the characteristics of wearable devices. |
| CO6 | Develop a real time embedded system for biomedical applications |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24BM2007** | **Duration** | **3hrs** |
| **Course Title** | **PATIENT AND DEVICE SAFETY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two causes for medical device failure. | | CO1 | R | 1 |
| 2. | List the types of system reliability. | | CO1 | R | 1 |
| 3. | List the classification of failures. | | CO2 | R | 1 |
| 4. | Write the data selection process for visual inspection. | | CO2 | U | 1 |
| 5. | Describe the ways in which the medical devices interact with the environment. | | CO3 |  | 1 |
| 6. | Name the standard to address complaint handling. | | CO3 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a device to quickly disconnect current to prevent serious harm from an ongoing electric shock. | | CO4 | U | 1 |
| 8. | The results from macro-shock lead to loss of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ at currents as low as 10mA. | | CO4 | R | 1 |
| 9. | Classify the regulations under which the European Union governs medical devices. | | CO5 | U | 1 |
| 10. | Explain the scope of EUCOMED. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the mechanical reliability with suitable graph. | | CO1 | U | 3 |
| 12. | List 4 symbol of connectors along with its features. | | CO2 | R | 3 |
| 13. | Describe the cost safety method with suitable graph. | | CO3 | U | 3 |
| 14. | Differentiate macroshock and microshock in electrical safety. | | CO4 | U | 3 |
| 15. | Define IRB with its features. | | CO5 | R | 3 |
| 16. | Explain the significance of Medical Device Directives in healthcare. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Analyze the factors that influence the reliability of medical devices and their effect on patient safety. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the risk management process in medical devices. | CO2 | An | 8 |
|  | b. | Explain the documentation process during visual inspection. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | Evaluate the factors affecting the environmental safety of medical devices. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyze the steps in the safety mechanisms of medical devices and their impact on patient safety. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the need for standards and regulations in medical devices. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the process of complaint handling procedure. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Write the importance of testing in medical devices. | CO2 | An | 6 |
|  | b. | Explain the need for device markings in testing of medical devices. | CO2 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the act related to diagnostic medical devices. | CO6 | A | 6 |
|  | b. | Explain the process involved in medical device directives. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Recall the principles of reliability testing and failure analysis in medical devices |
| **CO2** | Analyze the process of failure assessment and risk management in medical device safety |
| **CO3** | Evaluate the impact of medical devices on the environment and propose measures for mitigating ecological risks |
| **CO4** | Analyze the principles of mechanical and electrical safety in medical device design and operation |
| **CO5** | Apply knowledge of regulatory compliance to the development, testing, and marketing of medical  devices |
| **CO6** | Analyze the requirements and implications of medical devices directives in ensuring product  safety and market access |