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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18EI2002 / 09EI219 / 10EI205 / EI203 / 14EI2005** | **Duration** | **3hrs** |
| **Course Title** | **CONTROL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the equivalent electrical component of the dashpot using the force-voltage analogy. | | CO1 | U | 1 |
| 2. | Give an example of a closed-loop control system. | | CO1 | U | 1 |
| 3. | Define rise time. | | CO2 | R | 1 |
| 4. | Identify the order of the following closed-loop transfer function  . | | CO2 | U | 1 |
| 5. | Define controllability. | | CO3 | R | 1 |
| 6. | Identify the state matrix of the given state space equation. | | CO3 | U | 1 |
| 7. | Determine the stability of the system whose transfer function . | | CO4 | A | 1 |
| 8. | Calculate the corner frequency (rad/sec) of a transfer function . | | CO4 | A | 1 |
| 9. | State the transfer function of the Proportional Integral Controller. | | CO5 | R | 1 |
| 10. | Define a non-linear control system. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the free-body diagram and write the differential equation of the given mechanical system. | | CO1 | A | 3 |
| 12. | Calculate the resonant frequency of a plant whose sinusoidal transfer function . | | CO2 | A | 3 |
| 13. | Compare the transfer function model with the state space model. | | CO3 | U | 3 |
| 14. | Calculate the final value of the step response of the negative feedback closed-loop control system whose transfer function . | | CO4 | A | 3 |
| 15. | Describe the importance of a Lead compensator in the design of a control system. | | CO5 | U | 3 |
| 16. | Compare the linear control system with the non-linear control system. | | 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. | a. | Determine the transfer function of the given mechanical system. | CO1 | A | 6 |
|  | b. | Determine the transfer function of the given block diagram. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Explain the impact of the undamped system with a real-time example and derive the time domain response of the undamped second-order electrical system subjected to the unit step input signal. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Examine the controllability and observability of a control system for the given state space model. | CO3 | A | 6 |
|  | b. | Determine the stability of the system whose state matrix and calculate the eigen values of the system. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Sketch the bode plot for a unity feedback control system that has an open loop transfer function . Determine gain margin and phase margin from the bode plot. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | A cruise control system for an automobile employs a PID controller to maintain a constant vehicle speed.  i. Derive the transfer function of the PID controller.  ii. Analyze the role of each component (Proportional, Integral, and Derivative) in the PID controller and how they collectively influence the system's stability and performance. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Sketch the root locus of a unity feedback control system whose open loop transfer function . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Examine the stability of a system using the R-H array for the given characteristic equation s3+8s2+22s+20=0. | CO4 | A | 6 |
|  | b. | A unity feedback control system has an open loop transfer function G . Calculate i) Rise time ii) Peak Time iii)Settling Time. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the applications of optimal control systems across various fields and explain how they enhance performance, efficiency, and reliability in each area. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Develop mathematical models of physical systems. |
| **CO2** | Analyze the various linear models in time domain and frequency domain. |
| **CO3** | Outline the basics of state space representation of systems. |
| **CO4** | Examine the stability of systems. |
| **CO5** | Design an appropriate controller for the given specifications. |
| **CO6** | Acquire knowledge of Optimal and Non-linear control. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 2 | 15 | - | - | - | 17 |
| **CO2** | 1 | 1 | 27 | - | - | - | 29 |
| **CO3** | 1 | 4 | 12 | - | - | - | 17 |
| **CO4** | - | - | 29 | - | - | - | 29 |
| **CO5** | 1 | 3 | - | 12 | - | - | 16 |
| **CO6** | 1 | 3 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18BM2004** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL DIAGNOSTICS AND THERAPEUTIC EQUIPMENT I** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the electrodes used for ECG. | | CO1 | A | 1 |
| 2. | What is meant by lead? | | CO1 | U | 1 |
| 3. | What is the primary function of the respiration system? | | CO2 | U | 1 |
| 4. | List the type of electrode used to measure the partial pressure of oxygen. | | CO2 | U | 1 |
| 5. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_refers to the determination of the percentage of oxygen saturation of the circulating arterial blood. | | CO3 | R | 1 |
| 6. | What is meant by cardiac output? | | CO4 | U | 1 |
| 7. | Identify the type of pacemaker used for patients having permanent heart blocks. | | CO4 | An | 1 |
| 8. | How to determine the life of a pacemaker? | | CO5 | E | 1 |
| 9. | Classify the ventilators. | | CO6 | An | 1 |
| 10. | List the applications of Electrotherapy. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Summarize the Action Potential and Resting Potential. | | CO1 | U | 3 |
| 12. | Illustrate the transmittance method to detect pulse rate. | | CO2 | U | 3 |
| 13. | State the principle of electromagnetic type blood flow meter. | | CO3 | U | 3 |
| 14. | Outline the defibrillator analyzer. | | CO4 | A | 3 |
| 15. | Explain the Artificial ventilator. | | CO5 | E | 3 |
| 16. | List the types of electrodes used for Electrotherapy. | | 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. | Identify the type of electrodes used for EEG. | CO1 | A | 3 |
|  | b. | Explain the placement of electrodes to measure EMG waveform and recording procedure. | CO1 | U | 9 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the schematic diagram of a pH electrode. How to measure pH values of blood using pH electrode, and explain. | CO2 | U | 10 |
|  | b. | What is a body mass index (BMI)? | CO2 | U | 2 |
|  |  |  |  |  |  |
| 19. | a. | With a neat diagram, explain Doppler shift blood flowmeter. | CO3 | U | 9 |
|  | b. | Summarize the Apnea condition. | CO3 | U | 3 |
|  |  |  |  |  |  |
| 20. | a. | Explain about DC defibrillator with synchronizer. | CO4 | U | 6 |
|  | b. | Summarize the Power sources for implantable pacemakers. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Interpret the principle of nebulizers. | CO5 | E | 6 |
|  | b. | Examine the typical faults and maintenance procedures for ventilators. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Draw the function block diagram of the diagnostic/therapeutic stimulating unit and explain. | CO6 | An | 8 |
|  | b. | List the advantages of constant current therapy. | CO6 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain about ventricular synchronous demand pacemaker. | CO4 | U | 9 |
|  | b. | Illustrate the types of electrodes used in defibrillators. | CO4 | U | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the Schematic diagram of an ECG machine. | CO1 | U | 10 |
|  | b. | List the electrodes used for EMG. | CO1 | U | 2 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the procedures for the 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 | Analyze the behavior of electrotherapy equipment |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 25 | 4 |  |  |  | 29 |
| CO2 |  | 17 |  |  |  |  | 17 |
| CO3 | 1 | 15 |  |  |  |  | 16 |
| CO4 |  | 25 | 3 | 1 |  |  | 29 |
| CO5 |  |  |  |  | 16 |  | 16 |
| CO6 |  |  |  | 17 |  |  | 17 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18BM2010** | **Duration** | **3hrs** |
| **Course Title** | **BIOSIGNAL PROCESSING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What does Electrocorticogram signify? | | CO1 | U | 1 |
| 2. | Name the bioelectric signal related to the muscle activity. | | CO1 | R | 1 |
| 3. | List the two types of analogue filters used for IIR Filter design. | | CO2 | R | 1 |
| 4. | Justify choosing poles on the left side of the S-plane while designing a Butterworth filter. | | CO2 | R | 1 |
| 5. | What is flicker noise? | | CO3 | U | 1 |
| 6. | List the two types of methods used for IIR Filter design | | CO3 | R | 1 |
| 7. | Map the different values of h(n) if N=8 | | CO4 | U | 1 |
| 8. | FIR filters have \_\_\_\_\_\_\_\_ impulses. | | CO4 | R | 1 |
| 9. | Name one method for event detection in an ECG wave | | CO5 | U | 1 |
| 10. | State an abnormal condition in an ECG wave. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe what happens when we do not select a proper sampling frequency. | | CO1 | An | 3 |
| 12. | Substantiate digital response of a Butterworth filter using impulse invariant method. | | CO2 | U | 3 |
| 13. | Chebyshev vs Butterworth, Comment on which is advantageous? Give example. | | CO3 | An | 3 |
| 14. | Justify the usage of L’Hopital’s rule in finding the discrete time domain response of the FIR filter. | | CO4 | U | 3 |
| 15. | List the QRS detection algorithms and mention a few of their respective disadvantages. | | CO5 | An | 3 |
| 16. | Mention the importance of cardio-respiratory interactions | | 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. |  | For X(k)={8,0,0,0,0,0,0,0}  Find x(n) using Decimation in Frequency FFT Algorithm. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | For the given digital filter specifications   1. Find the Analogue specifications of the filter and illustrate them. 2. Find the cut off frequency and the order of the digital filter 3. Find the poles of the analogue filter | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the digital transfer function of the following analogue transfer function using Bilinear Transformation | CO3 | E | 6 |
|  | b. | Differentiate Impulse invariance and Bilinear Transformation | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Plot the magnitude frequency response for N=7 in an ideal low pass FIR filter using Fourier Series method with | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the signal characteristics of ECG waveform | CO5 | An | 4 |
|  | b. | Discuss the Pan Tompkins method for QRS complex detection in Electrocardiogram. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. |  | Determine the transfer function H(z) for N=9 in an ideal bandpass filter using Hanning Window with | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | For the given filter specifications   1. Find the analogue specifications for the Chebyshev filter design and illustrate the filter. 2. Find the analogue poles of Chebyshev filter with diagrammatic representation using bilinear transformation method. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | For an ECG of a **Supraventricular Tachycardia** condition, describe the various blocks of signal processing units used to detect the patient’s condition | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the fundamentals of signal processing |
| CO2 | Identify the effect of IIR Digital filter design |
| CO3 | Illustrate the various applications of IIR filter |
| CO4 | Discuss about the FIR Filter design and applications |
| CO5 | Show the various methods to analyze biosignals |
| CO6 | Explain the biosignal processing concepts for real time applications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO2 | 2 | 3 | 12 | - | - | - | 17 |
| CO3 | 1 | 1 | 12 | 8 | 7 | - | 29 |
| CO4 | 1 | 4 | - | - | 24 | - | 29 |
| CO5 | - | 1 | - | 15 | - | - | 16 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **18BM2013 / 17BM2013 / 15EI2017** | **Duration** | **3hrs** |
| **Course Title** | **MODELING OF PHYSIOLOGICAL SYSTEMS** | **Max.Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Justify the usage of Ohm’s Law. | | CO1 | U | 1 |
| 2. | In a mechanical system, how is capacitance otherwise known as? | | CO1 | R | 1 |
| 3. | State the significance of Starling’s law. | | CO2 | U | 1 |
| 4. | What does Systemic vasodilation signify? | | CO2 | U | 1 |
| 5. | Mention the anticoagulant used in Cardiopulmonary Bypass. | | CO3 | U | 1 |
| 6. | Give any one goal of cardiopulmonary bypass. | | CO3 | R | 1 |
| 7. | What does effector response signify? | | CO4 | U | 1 |
| 8. | The range of the core body temperature is \_\_\_\_\_\_\_\_\_ | | CO4 | R | 1 |
| 9. | Mention the blood vessel which carries pure blood inside the kidney. | | CO5 | R | 1 |
| 10. | The \_\_\_\_\_\_\_\_ pressure influences filtration process in the kidney | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Mention the formula associated with chemical system for compliance. | | CO1 | R | 3 |
| 12. | Illustrate the linear model of knee jerk mechanics. | | CO2 | U | 3 |
| 13. | Mention the use of any one cannula in CPB. | | CO3 | U | 3 |
| 14. | List the various ways in which heat is lost through the skin. | | CO4 | R | 3 |
| 15. | List the composition of Glomerular filtrate. | | CO5 | U | 3 |
| 16. | Write down the factors affecting disassociation in Oxygen/Carbondioxide transport? | | 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. |  | Develop a mathematical model to predict the cardiac output (Qc) in patients with varying degrees of myocardial damage. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Derive the venous return volume Qr for patient undergoing Blood transfusion and plot the curve. Give Inferences in relation mean systemic pressure. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Write short notes on the various factors affecting blood flow. | CO3 | An | 6 |
|  | b. | List out indications and contraindications of Hemodynamic monitoring. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Discuss in detail the various effects of general and regional anesthesia on the response thresholds of the thermoregulatory system. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain in detail the two reabsorptions related to the nephron with neat diagrams. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Design and evaluate a comprehensive model of blood glucose regulation in the bloodstream. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Tabulate the various formulae associated with resistance and compliance of various physiological systems with suitable illustrations | CO1 | U | 6 |
|  | b. | Explain and derive the working of muscle stretch reflex with block diagram | CO1 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design and develop a comprehensive model illustrating the transport mechanisms of oxygen and carbon dioxide in the human body, including the role of hemoglobin, blood flow, and respiratory dynamics. | CO6 | C | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Analyze the concepts of modelling |
| CO2 | Differentiate the dynamics and static characteristics of physiological systems |
| CO3 | Assemble the various concepts in modelling of circulatory system |
| CO4 | Design and perform the modelling for physio thermo regulatory systems |
| CO5 | Create various models for human filtration system |
| CO6 | Evaluate the mass-balance concept for biological system |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | - | 12 | - | - | 17 |
| CO2 | - | 5 | 12 | 24 | - | - | 41 |
| CO3 | 1 | 4 | 6 | 6 | - | - | 17 |
| CO4 | 4 | 1 | 12 | - | - | - | 17 |
| CO5 | 1 | 4 | - | 12 | - | - | 17 |
| CO6 | - | 3 | - | - | - | 12 | 15 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18BM2015** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL DIAGNOSTICS AND THERAPEUTIC EQUIPMENT II** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Differentiate macroshock and microshock. | | CO1 | U | 1 |
| 2. | Comment on the significance of lancet in glucometer. | | CO1 | R | 1 |
| 3. | Quote some common anesthetic agents used in anesthesia machine. | | CO2 | R | 1 |
| 4. | State the significance of soda lime use in anesthesia machine. | | CO2 | R | 1 |
| 5. | Justify the need for dialysis in humans. | | CO3 | U | 1 |
| 6. | State the working principle of short-wave diathermy. | | CO3 | R | 1 |
| 7. | Therapeutic microwaves use ------- frequency and ---- wavelength. | | CO4 | U | 1 |
| 8. | Nature of wave used for extra-corporeal lithotripsy is \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_\_\_ is a small electronic device that you wear in or behind your ear for hearing disorders. | | CO5 | U | 1 |
| 10. | \_\_\_\_\_\_\_\_\_ pumps are used to deliver medium to large volume therapeutic fluids. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare holter monitor and event monitor. | | CO1 | An | 3 |
| 12. | State the clinic use of entonox apparatus. | | CO2 | U | 3 |
| 13. | Differentiate fistula and graft. | | CO3 | An | 3 |
| 14. | Comment on the different methods of application of ultrasonic waves for therapy. | | CO4 | U | 3 |
| 15. | Brief the significance of biofeedback instrumentation. | | CO5 | U | 3 |
| 16. | Comment on cryogenic therapy. | | 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. | a. | Outline the features of holter monitor. | CO1 | U | 9 |
|  | b. | Enumerate how chromatograph works with a neat sketch. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Portray an anesthesia machine with a clear layout and explain its pneumatic system in detail. | CO2 | U | 9 |
|  | b. | Comment on the significance of Entonox apparatus. | CO2 | U | 3 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the clinical functioning of Hemodialysis machine with a neat sketch. | CO3 | U | 9 |
|  | b. | Relate hemodialysis and peritoneal dialysis. | CO3 | An | 3 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the characteristics of LASER and describe the working principle of LASER with relevant sketches. | CO4 | U | 8 |
|  | b. | Illustrate the major milestones of LASER applications in biomedicine. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | With a neat circuit, explain the working of tonometer. | CO5 | U | 6 |
|  | b. | List and discuss the types of ophthalmoscopes. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Portray a lithotripter and explain its working principle. | CO4 | U | 8 |
|  | b. | Describe various types of lithotripsy. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the clinical working principle of microwaves in diathermy equipment for treating musculoskeletal disorders. | CO5 | U | 6 |
|  | b. | Discuss implantable infusion pump in detail. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Depict endoscope equipment and explain its working principle. | CO6 | U | 8 |
|  | b. | Compare SXA and DXA. | CO6 | U | 4 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the principle involved in clinical and optical equipment. |
| **CO2** | Identify the various therapeutic devices for pulmonary diseases. |
| **CO3** | Apply the appropriate therapeutic device related to kidney ailment. |
| **CO4** | Demonstrate the functions and applications of electrotherapy and lasers |
| **CO5** | Assess the merits and demerits of the diagnostic equipment for basic senses. |
| **CO6** | Design new therapeutic devices for particular application based on given specifications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 13 | - | 3 | - | - | 17 |
| **CO2** | 2 | 15 | - | - | - | - | 17 |
| **CO3** | 1 | 10 | - | 6 | - | - | 17 |
| **CO4** | 1 | 24 | - | 4 | - | - | 29 |
| **CO5** | - | 28 | - | - | - | - | 28 |
| **CO6** | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2006** | **Duration** | **3hrs** |
| **Course Title** | **GRAPHICAL SYSTEM DESIGN FOR BIOMEDICAL ENGINEERS** | **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. | Interpret Polymorphism. | | CO1 | U | 1 |
| 2. | Mention that palette that is available only in the front panel. | | CO1 | R | 1 |
| 3. | Identify the block. | | CO2 | R | 1 |
| 4. | Define data constructs. | | CO2 | R | 1 |
| 5. | Name the components present in an error cluster. | | CO3 | R | 1 |
| 6. | Identify the variable that is used to access front panel objects in several places in the block diagram of VI. | | CO3 | R | 1 |
| 7. | Give the other representation for producer and consumer. | | CO4 | R | 1 |
| 8. | State VI properties. | | CO4 | U | 1 |
| 9. | List any two loop operations. | | CO5 | R | 1 |
| 10. | Comment on the type of data present in an array and a cluster. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss the three phases of graphical system design model. | | CO1 | U | 3 |
| 12. | Describe the working of property node with an example. | | CO2 | U | 3 |
| 13. | Differentiate between global variable and shared variable. | | CO4 | U | 3 |
| 14. | Summarize the benefits of implementing a simple state machine in an application. | | CO3 | U | 3 |
| 15. | Describe the tools for identifying memory and performance issues. | | CO5 | U | 3 |
| 16. | Demonstrate the role of LabVIEW in controlling a wheelchair. | | 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. |  | Explain the step by step procedure to create an application in LabVIEW. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the working of different types of case structures with necessary examples. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the working mechanism of Queues with an example. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the processes involved in establishing a TCP connection in a client server application. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the functionality of error handling VIs. | CO3 | U | 6 |
|  | b. | Discuss the tools and techniques involved in debugging. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the creation and editing of an icon and building of connector pane. | CO2 | U | 8 |
|  | b. | Discuss the data structure design methodology. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of profile memory and its performance. | CO5 | U | 8 |
|  | b. | Describe the working of user interface event handler. | CO3 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a VI to display and monitor the respiratory rate of a patient. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of LabVIEW programming |
| CO2 | Interface with real time signals |
| CO3 | Analyzing the application of VIs in medical instrumentation in developing medical instruments |
| CO4 | Interpret the concepts of data communication and synchronization |
| CO5 | Perform signal processing operations using virtual instrumentation |
| CO6 | Apply virtual instrumentation for biomedical applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 2 | 15 | 12 |  |  |  | 29 |
| CO3 | 2 | 19 |  |  |  |  | 21 |
| CO4 | 1 | 28 |  |  |  |  | 29 |
| CO5 | 1 | 12 |  |  |  |  | 13 |
| CO6 |  | 3 | 12 |  |  |  | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2007** | **Duration** | **3hrs** |
| **Course Title** | **BIOMEMS TEECHNOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two applications of microsystem in healthcare industries. | | CO1 | U | 1 |
| 2. | List the typical MEMS and microsystem products. | | CO1 | R | 1 |
| 3. | Define MOEMS. | | CO2 | R | 1 |
| 4. | List the advantages of grating light valve. | | CO2 | U | 1 |
| 5. | List the various properties of fluid. | | CO3 | R | 1 |
| 6. | Define thermocapillary effect with one application. | | CO3 | U | 1 |
| 7. | Name the types of microneedles. | | CO4 | R | 1 |
| 8. | Write the expansion of mTAS. | | CO4 | A | 1 |
| 9. | List the two types of lithography technique. | | CO5 | U | 1 |
| 10. | Give examples for 1-D and 2-D materials. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the elements of MEMS system. | | CO1 | An | 3 |
| 12. | Summarize the types of optical switch. | | CO2 | U | 3 |
| 13. | Compare electrowetting with optoelectrowetting. | | CO3 | An | 3 |
| 14. | Analyze the use of software in designing biomedical devices. | | CO4 | An | 3 |
| 15. | Write the basic approaches of micromachining. | | CO5 | A | 3 |
| 16. | Analyze the need for nanomaterial characterization. | | 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 working principle of any one microsystem with neat sketches. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the structure of microlens. | CO2 | A | 6 |
|  | b. | Explain the principle of micromirror with applications. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Classify the microfluidic actuations. | CO3 | An | 6 |
|  | b. | Analyze the dielectroporosis actuation. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain the working of E-tongue with relevant diagrams. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the lithography technique with neat sketches. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the various software tools for the design of MEMS devices. | CO4 | An | 4 |
|  | b. | Prepare the design process of a piezoelectric sensor using COMSOL software. | CO4 | C | 8 |
|  |  |  |  |  |  |
| 23. |  | Classify the nanomaterial characterization for biomedical applications. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the working principle of SEM with relevant diagrams. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the principles of sensors and actuators. |
| CO2 | Summaries the optical devices and applications. |
| CO3 | Classify the performances of microfluidic devices to the environment. |
| CO4 | Use the software tools for designing and analyzing the sensors. |
| CO5 | Recommend the suitable principles of testing for biomedical conditions. |
| CO6 | Create simple systems for medical applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 12 | 3 | - | - | 17 |
| **CO2** | 1 | 4 | 12 | - | - | - | 17 |
| **CO3** | 1 | 1 | - | 15 | - | - | 17 |
| **CO4** | 1 | - | 1 | 15 | - | - | 17 |
| **CO5** | - | 1 | 15 | 4 | 8 | - | 28 |
| **CO6** | - | 1 | 12 | 15 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2008** | **Duration** | **3hrs** |
| **Course Title** | **MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define hypothesis. | | CO1 | R | 1 |
| 2. | State the approximate number of neurons in the human brain. | | CO1 | R | 1 |
| 3. | Identify the formula for finding entropy. | | CO2 | R | 1 |
| 4. | State the formula for Euclidean distance. | | CO2 | R | 1 |
| 5. | Define Pruning. | | CO3 | R | 1 |
| 6. | Summarize the types of neural networks. | | CO3 | U | 1 |
| 7. | Explain BAM. | | CO4 | A | 1 |
| 8. | List the types of associative memory networks. | | CO4 | R | 1 |
| 9. | State the commutative property. | | CO5 | R | 1 |
| 10. | List the key operators of genetic algorithm. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain version space. | | CO1 | A | 3 |
| 12. | Explain the structure of decision tree. | | CO2 | U | 3 |
| 13. | Interpret the term LDA. | | CO3 | A | 3 |
| 14. | Illustrate adaptive resonance theory network. | | CO4 | An | 3 |
| 15. | Write notes on fuzzification. | | CO5 | A | 3 |
| 16. | Explain the concept of evolutionary principles in genetic programming. | | 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. | Evaluate the Find - S algorithm for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Origin** | **Manufacturer** | **Color** | **Decade** | **Type** | **Example Type** | | Japan | Honda | Blue | 1980 | Economy | Positive | | Japan | Toyota | Green | 1970 | Sports | Negative | | Japan | Toyota | Blue | 1990 | Economy | Positive | | USA | Chrysler | Red | 1980 | Economy | Positive | | Japan | Honda | White | 1980 | Economy | Positive | | Japan | Toyota | Green | 1980 | Economy | Positive | | Japan | Honda | Red | 1990 | Economy | Negative | | CO1 | E | 8 |
|  | b. | Summarize the various learning approaches in Machine Learning. | CO1 | E | 4 |
|  |  |  |  |  |  |
| 18. |  | Predict glucose level using linear regression based on the following data.   |  |  |  | | --- | --- | --- | | **Sample** | **Age (X)** | **Glucose Level (Y)** | | 1 | 43 | 99 | | 2 | 25 | 66 | | 3 | 25 | 79 | | 4 | 42 | 53 | | 5 | 57 | 87 | | 6 | 59 | 71 | | 7 | 55 | ? | | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Solve AND logic gate using Hebb rule. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the steps involved in the training and testing of an Auto-Associative Memory Network. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the steps involved in fuzzy logic architecture. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the various types of adaptive resonance theory network. | CO4 | An | 6 |
|  | b. | Differentiate between fuzzification and defuzzification. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain clustering and its types. | CO2 | An | 6 |
|  | b. | Distinguish between biological neural network and artificial neural network. | CO3 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the concept of selection, fitness and crossover in GA. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe features that can be used for a particular machine learning approach. |
| **CO2** | Classify contrast pros and cons of various machine learning techniques. |
| **CO3** | Infer various machine learning approaches and paradigms. |
| **CO4** | Interpret various neural networks and fuzzy logic method. |
| **CO5** | Illustrate the fuzzy logic concepts using examples. |
| **CO6** | Interrelate genetic algorithm concepts for the given problem. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | - | 3 | - | 12 | - | 17 |
| **CO2** | 2 | 3 | - | 6 | 12 | - | 23 |
| **CO3** | 1 | 1 | 3 | - | 6 | 12 | 23 |
| **CO4** | 1 | - | 1 | 21 | - | - | 23 |
| **CO5** | 1 | - | 3 | 18 | - | - | 22 |
| **CO6** | 1 | - | 13 | 3 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2009** | **Duration** | **3hrs** |
| **Course Title** | **TELEMEDICINE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the dataflow methods in communication technologies. | | CO1 | R | 1 |
| 2. | Interpret the objective of telemedicine. | | CO1 | U | 1 |
| 3. | List two security points at which data can be at risk. | | CO2 | R | 1 |
| 4. | Identify two examples of malware. | | CO2 | R | 1 |
| 5. | List two applications of microwaves. | | CO3 | R | 1 |
| 6. | Expand PSTN. | | CO3 | R | 1 |
| 7. | Name two display systems. | | CO5 | R | 1 |
| 8. | List two applications of holographic display. | | CO5 | R | 1 |
| 9. | Expand DICOM. | | CO4 | R | 1 |
| 10. | Apply Shift Cipher and encrypt the word “hospital” (Assume encryption key = 3) | | CO4 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the delivery modes in telemedicine. | | CO1 | U | 3 |
| 12. | Interpret the key conditions to be satisfied by a patentable item. | | CO2 | A | 3 |
| 13. | Illustrate the line-of-sight propagation with an example. | | CO3 | A | 3 |
| 14. | Analyze the data acquisition systems used for patient data collection. | | CO5 | An | 3 |
| 15. | Distinguish between symmetric and asymmetric key cryptography. | | CO4 | An | 3 |
| 16. | Explain the application of telemedicine in surgery. | | 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 functional diagram and essential parameters of telemedicine with necessary diagrams. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze the ethical and legal aspects of telemedicine in terms of Patient Rights and Consent. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain satellite communication and the different types of satellites along with its application. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Examine the different types of storage devices used for securing healthcare information. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the significance of HL7 standard in standardizing healthcare systems. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the measures incorporated in ensuring privacy and security of medical data in a hospital. | CO2 | A | 8 |
|  | b. | Interpret the benefits and limitations of telemedicine with examples. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 23. |  | Analyze the different layers of OSI model in data transmission along with the protocols used. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the significance of telemedicine in health education, self-care and remote healthcare services, exploring its impact, opportunities and limitations. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the concepts of telemedicine |
| **CO2** | Interpret the legal aspects of telemedicine |
| **CO3** | Illustrate multimedia technologies in telemedicine |
| **CO4** | Use protocols behind encryption techniques for secure transmission of data |
| **CO5** | Explain the data acquisition and the data storage devices |
| **CO6** | Apply telehealth in healthcare |

|  |  |  |  |  |  |  |  |
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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 | 16 | - | - | - | 21 |
| **CO2** | 2 | - | 11 | 12 | - | - | 25 |
| **CO3** | 2 | - | 15 | - | - | - | 17 |
| **CO4** | 1 | - | 1 | 27 | - | - | 29 |
| **CO5** | 2 | - | 12 | 3 | - | - | 17 |
| **CO6** | - | - | 15 | - | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2010** | **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. | Classify various types of biomaterials. | | CO1 | U | 1 |
| 2. | List some examples for metals used in implants. | | CO1 | R | 1 |
| 3. | …………is the second stage of wound healing process. | | CO2 | R | 1 |
| 4. | Observe the importance of Derjaguin–Landau–Verwey–Overbeek (DLVO) theory. | | CO2 | R | 1 |
| 5. | Heart valve leaflet must be …………..and………….. | | CO3 | U | 1 |
| 6. | Tendon material must be …………..and………….. | | CO3 | U | 1 |
| 7. | Measurements of viability are one way of determining ………….in response to a material. | | CO4 | U | 1 |
| 8. | Indicate the features of PBMC. | | CO4 | U | 1 |
| 9. | Microporous membrane oxygenators are made up of………… | | CO5 | U | 1 |
| 10. | List the valves of the heart. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define the process of tissue regeneration. | | CO1 | U | 3 |
| 12. | Write notes on grafting. | | CO2 | A | 3 |
| 13. | List the classification of evaluation laboratory. | | CO3 | R | 3 |
| 14. | Differentiate between protein-based studies and relative gene-based studies. | | CO4 | U | 3 |
| 15. | Define masking. | | CO5 | R | 3 |
| 16. | Explain the causes and symptoms of CKD. | | 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. | a. | Evaluate the properties of polymers in detail. | CO1 | E | 6 |
|  | b. | Describe the significance of crystalline Nature of Metals. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the process of wound healing in detail. | CO2 | E | 6 |
|  | b. | Estimate different properties of protein in detail. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the method involved in Hemocompatibility evaluation laboratory. | CO3 | E | 6 |
|  | b. | Compare the results of cytotoxicity tests and hemocompatibility assays. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the process of in vitro assays for inflammatory response due to biomaterial implantation. | CO4 | A | 8 |
|  | b. | Examine viability studies technique. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Sketch the functional block diagram of an audiometer. | CO5 | A | 4 |
|  | b. | Differentiate between air and bone conduction. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. | a. | Formulate the process involved in biological response to biomaterials | CO1 | C | 8 |
|  | b. | Indicate the maturation phase in wound healing. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Deduce the method involve in Histopathology evaluation laboratory. | CO3 | An | 8 |
|  | b. | Write notes on fibrous encapsulation of healing process. | CO4 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discriminate the mechanism of gaseous exchange in lungs. | CO6 | An | 6 |
|  | b. | Explain the working principle of hemodialysis machine. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **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** | Remember the Interfacing materials and ethical implications. |
| **CO6** | Apply the biomaterials in the healthcare sectors. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 10 | - | - | 6 | 8 | 25 |
| **CO2** | 2 | 7 | - | - | 12 | - | 21 |
| **CO3** | 3 | 2 | 14 | - | 6 | - | 25 |
| **CO4** | - | 5 | 16 | - | - | - | 21 |
| **CO5** | 3 | 1 | 4 | 8 | - | - | 16 |
| **CO6** | 1 | 3 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2011 / 17BM2026 / 15EI2029** | **Duration** | **3hrs** |
| **Course Title** | **PATIENT AND DEVICE SAFETY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two reasons for medical device failure. | | CO1 | R | 1 |
| 2. | Write down the reason for systematic failure. | | CO1 | R | 1 |
| 3. | What is risk management? | | CO2 | R | 1 |
| 4. | Define enclosure. | | CO2 | R | 1 |
| 5. | **True or False**  Oxygen makes fire burn easier, quicker and hotter………… | | CO3 | U | 1 |
| 6. | What is meant by electrostatic discharge? | | CO3 | R | 1 |
| 7. | Define Electrical safety. | | CO4 | R | 1 |
| 8. | What is meant by touch current? | | CO4 | U | 1 |
| 9. | Surgical Implants comes under which act? | | CO5 | U | 1 |
| 10. | Expand IVDMDD. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe about Mechanical reliability with suitable graph. | | CO1 | R | 3 |
| 12. | Write down the concept of device business card. | | CO2 | U | 3 |
| 13. | Describe about cost safety method with suitable graph. | | CO3 | R | 3 |
| 14. | Explain about earth leakage current. | | CO4 | An | 3 |
| 15. | Define IRB and its features. | | CO5 | R | 3 |
| 16. | List out the countries comes under COCIR. | | 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 the goal of specific device safety in user’s life and patient’s life. | CO1 | C | 6 |
|  | b. | What is meant by testing? Write the importance of testing in medical devices. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18 | a. | Describe in detail about Visual inspection and any one of its types. | CO2 | R | 6 |
|  | b. | Write about measurements and safety parameters. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | With suitable diagram, explain the concept of Micro and Macro Shock. | CO3 | An | 6 |
|  | b. | Illustrate the inference with the environment related to safety measures. | CO3 | Cr | 6 |
|  |  |  |  |  |  |
| 20. |  | Report the steps involved in safety mechanics. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Elucidate about Good laboratory and Manufacturing process | CO5 | An | 6 |
|  | b. | Explain in detail about levels and procedure involved in Medical standards and Regulations. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 22. | a. | Write the importance of device markings. | CO2 | U | 6 |
|  | b. | Write the limitations of leakage current under normal and single fault conditions | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Write a case study about manufacturers and physicians responsibilities in safety and risk management. | CO3 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Elucidate about directive on active Implantable Medical Devices | CO6 | An | 6 |
|  | b. | Illustrate the act related to diagnostic medical devices | CO6 | U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the mechanical and electrical safety standards of medical equipment |
| CO2 | Understand device specific safety goals |
| CO3 | Interpret reasonable, acceptable and effective remedies. |
| CO4 | Access the clinical suitability to under the impact of the device on the environment |
| CO5 | Device more reliable medical equipment incorporating safety goals |
| CO6 | Suggest new techniques for device management |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 11 | - | - | - | - | 6 | 17 |
| CO2 | 8 | 9 | - | 6 | - | - | 23 |
| CO3 | 4 | 1 | - | 6 | - | 18 | 29 |
| CO4 | 1 | 7 | - | 15 | - | - | 23 |
| CO5 | 9 | 1 | - | 6 | - | - | 16 |
| CO6 | 11 | 6 | - | 6 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2012** | **Duration** | **3hrs** |
| **Course Title** | **ROBOTS IN HEALTHCARE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The left and right motion of the robot wrist is termed as ……………….. | | CO1 | U | 1 |
| 2. | List the two types of manipulator joint motions. | | CO2 | U | 1 |
| 3. | Mention the three degrees of freedom of Robot Wrist | | CO2 | U | 1 |
| 4. | Name the first ever Surgical Robot. | | CO1 | R | 1 |
| 5. | Define workspace in Robots. | | CO3 | R | 1 |
| 6. | When was the first Help Mate mobile autonomous robot used in hospitals? | | CO3 | R | 1 |
| 7. | Name the types of fiber optic cable that is classified based on the mode of propogation. | | CO4 | A | 1 |
| 8. | How does Laser range finder help in locating objects? | | CO5 | U | 1 |
| 9. | When is velocity planning required in autonomus robots? | | CO6 | R | 1 |
| 10. | List the different consoles of a surgical robot. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish open loop system and closed loop system and justify the need of closed loop system. | | CO1 | U | 3 |
| 12. | Comment on the term spatial manipulator. | | CO2 | R | 3 |
| 13. | Differentiate structured and unstructured environment in robot path planning. | | CO1 | U | 3 |
| 14. | Give the steps involved in image processing and analysis in computer vision. | | CO3 | A | 3 |
| 15. | List the challenges in developing a mobile robot. | | CO4 | U | 3 |
| 16. | Mention the design considerations of a gripper. | | 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. | a. | Define the three laws of robotics formulated by Issac Asimov. | CO1 | R | 2 |
|  | b. | With the help of the neat diagram explain the Anatomy of Robot and the four most common configurations of Robot | CO2 | U | 10 |
| 18. | a. | Differentiate between work space and joint space. | CO2 | U | 2 |
|  | b. | Derive the reverse transformation of a 2-Degree of freedom Robotic Arm with the vector for link 1 and link 2 defined as:  r1=[L1Cos Ɵ1 , L1Sin Ɵ1]  r2=[L2Cos (Ɵ1 + Ɵ2 ) , L1Sin (Ɵ1 + Ɵ2 ) ] | CO1 | An | 10 |
| 19. | a. | With necessary diagram discuss about the different types of manipulator joints. | CO2 | U | 6 |
|  | b. | Elaborate on the three different types of actuators and discuss its advantages and disadvantages. | CO3 | U | 6 |
| 20. |  | Discuss in detail how an image is sensed and processed by a computer for image classification and identification | CO3 | U | 12 |
| 21. | a. | Differentiate a continuous controller from discrete controller. | CO4 | A | 2 |
|  | b. | Using Dijisktra Algorithm determine the shortest path from the source A to all vertices in the given graph to reach the destination F. | CO4 | An | 10 |
| 22. | a. | Discuss about the dynamic characteristics of a sensor. | CO5 | U | 2 |
|  | b. | Elaborate on inductive type and capacitive type proximity sensors with specific to robotic applications. | CO5 | A | 10 |
| 23. |  | List the four common path planning algorithms and elaborate on A\* algorithm and compare the same with D\* algorithm, | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe in detail the Da Vinci Surgical robot and also its various field of application. | CO6 | A | 6 |
|  | b. | Discuss about the application of touch sensor and force sensor in manipulator design. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the concepts of robotics, motion, joints |
| CO2 | Summarize the principles of sensors and actuators for robots |
| CO3 | Use the software tools for designing and analyzing the robot motion |
| CO4 | Analyze the performance of various sensors |
| CO5 | Recommend the suitable design for specific robotic application |
| CO6 | Create simple robots for surgical applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 7 | - | 10 |  |  | 20 |
| CO2 | 3 | 20 | - |  |  |  | 23 |
| CO3 | 2 | 18 | 3 |  |  |  | 23 |
| CO4 | - | 3 | 1 | 10 |  |  | 14 |
| CO5 | - | 2 | 22 |  |  |  | 24 |
| CO6 | 2 | 4 | 12 |  |  |  | 18 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2013** | **Duration** | **3hrs** |
| **Course Title** | **RADIOLOGICAL IMAGING TECHNIQUES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Application of X-rays in patient diagnosis is \_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | The application of C-Arm is \_\_\_\_\_\_\_\_\_\_ | | CO1 | R | 1 |
| 3. | Radiation can be quantified using \_\_\_\_\_\_\_\_\_\_\_\_\_ units. | | CO2 | R | 1 |
| 4. | Choose the Radiotracer that is sent to human body. | | CO2 | A | 1 |
| 5. | Identify the molecule present in human exhibits magnetic property. | | CO3 | A | 1 |
| 6. | Write the hazardous effects of radiations in humans at primary level. | | CO3 | R | 1 |
| 7. | Applications of echocardiography is \_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO4 | U | 1 |
| 8. | Multicrystal gamma camera has the advantage of using in \_\_\_\_\_\_\_\_\_\_ | | CO4 | R | 1 |
| 9. | Defend the applications of Dopplar ultrasound scanner. | | CO5 | U | 1 |
| 10. | Assess the system used for storing, analyzing and retrieving digital image. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Interpret the applications of bucky grid. | | CO1 | U | 3 |
| 12. | Contrast between PET and CT scanners. | | CO2 | An | 3 |
| 13. | List the common hazards of magnetic resonance imaging techniques. | | CO3 | R | 3 |
| 14. | Explain the principle of generating ultrasound. | | CO4 | U | 3 |
| 15. | Outline the merits of infrared imaging systems. | | CO5 | U | 3 |
| 16. | Explain medical hazards in clinical settings. | | 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. |  | Explain the principles and production of X-rays. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Develop the evolution of CT machines. | CO2 | C | 6 |
|  | b. | Propose the applications of computed tomography system. | CO2 | C | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the process of pulse echo in magnetic resonance techniques. | CO3 | C | 8 |
|  | b. | Explain Larmour frequency. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Discover the principles of PET scanner in radio diagnostic techniques. | CO4 | An | 8 |
|  | b. | List out the medical applications of emission tomography. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 21. |  | Discuss the principles of image acquisition in magnetic resonance scanner. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Formulate the working of thermography imaging systems. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 23. |  | Criticize the salient functions of picture archiving and communication systems. | CO6 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the various operating modes of ultrasound scanning techniques. | CO6 | C | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | List out the various medical imaging techniques |
| **CO2** | Explain the principle of specific medical imaging techniques |
| **CO3** | Interpret the imaging outputs |
| **CO4** | Identify the suitable medical imaging techniques for specific pathology |
| **CO5** | Devise new ideas to solve certain issues in medical imaging |
| **CO6** | Justify the impact of medical imaging system for diagnosis |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 |  |  | 12 |  | 17 |
| **CO2** | 1 |  | 1 | 3 |  | 12 | 17 |
| **CO3** | 4 | 4 | 1 |  |  | 8 | 17 |
| **CO4** | 1 | 4 |  | 8 |  |  | 13 |
| **CO5** |  | 4 |  | 4 |  | 24 | 32 |
| **CO6** |  | 3 |  |  | 13 | 12 | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2014** | **Duration** | **3hrs** |
| **Course Title** | **BIOMECHANICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Describe the purpose of studying biomechanics. | | CO1 | U | 1 |
| 2. | Identify one example of sliding friction. | | CO1 | R | 1 |
| 3. | Review the functions of the elbow. | | CO2 | U | 1 |
| 4. | List different mechanical properties of bone, | | CO3 | R | 1 |
| 5. | Name the joints of the shoulder. | | CO3 | R | 1 |
| 6. | List various types of bones. | | CO3 | R | 1 |
| 7. | Define Newtonian viscous fluid, | | CO4 | R | 1 |
| 8. | A soccer ball is rolling down a field. At t = 0, the ball has an instantaneous velocity of 4 m/s. If the acceleration of the ball is constant at - 0.3 m/s2, how long will it take the ball to come to a complete stop? | | CO5 | A | 1 |
| 9. | Describe the common injuries of the hip. | | CO5 | U | 1 |
| 10. | How much compression acts on the hip during two-legged standing, given that the joint supports 250 N of body weight and the abductor muscles are producing 600 N of tension? | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the impact and coefficient of restitution. | | CO1 | An | 3 |
| 12. | Two children sit on opposite sides of a playground seesaw as shown in Figure. B.1. If Joey, weighing 200 N, is 1.5 m from the seesaw’s axis of rotation, and Susie, weighing 190 N, is 1.6 m from the axis of rotation, predict the end of the seesaw that will drop.    **Figure. B.1** | | CO2 | E | 3 |
| 13. | The tibia is the major weight-bearing bone in the lower extremity. If 88% of body mass is proximal to the knee joint, how much compressive force acts on each tibia when a 600 N person stands in anatomical position? How much compressive force acts on each tibia if the person holds a 20 N sack of groceries? | | CO3 | An | 3 |
| 14. | State Newton’s law of viscosity and write the equation. | | CO4 | R | 3 |
| 15. | Explain the roles assumed by muscles. | | CO5 | An | 3 |
| 16. | Sketch the anatomy of shoulder and name the parts | | 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. | With a neat diagram, explain the coordinate planes and direction terminologies of a human body in standing position. | CO1 | A | 8 |
|  | b. | As illustrated in Figure C.1, consider a person standing on a uniform, horizontal beam that is resting on frictionless knife-edge (wedge) and roller supports. Let A and B be two points where the knife-edge and roller supports contact the beam, C be the center of gravity of the beam, and D be a point on the beam directly under the center of gravity of the person. Assume that the length of the beam (the distance between A and B) is l = 5m, the distance between points A and D is d = 3m, the weight of the beam is W1= 900 N, and the mass of the person is m = 60 kg. Calculate the reactions on the beam at points A and B.    Figure C.1, | CO1 | E | 4 |
|  |  |  |  |  |  |
| 18. | a. | The coefficient of static friction between a sled and the snow is 0.18, with a coefficient of kinetic friction of 0.15. A 250 N boy sits on the 200 N sled. How much force directed parallel to the horizontal surface is required to start the sled in motion? How much force is required to keep the sled in motion? | CO2 | E | 8 |
|  | b. | Summarize the three laws of mechanics introduced by Sir Isaac Newton. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Sketch the bone structure and discuss each part. | CO3 | A | 8 |
|  | b. | As illustrated in Figure C.2, consider a block of mass m = 50 kg which is being pulled on a rough, horizontal surface by a person using a rope. Assume that the person is applying a constant force of T = 150 N on the block, the rope makes an angle θ = 30° with the horizontal, and the coefficient of kinetic friction between the block and the horizontal surface is μ = 0.2. Determine the acceleration of the block if the bottom surface of the block remains in full contact with the floor throughout the motion.    Figure C.2. | CO3 | E | 4 |
|  |  |  |  |  |  |
| 20. |  | Examine the following with neat diagrams: Flotation, Skin Friction/surface drag, Form drag, Wave Drag, Lift Force and Magnus Effect. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Interpret the 3-Element Hill model of muscle contraction and the behavioral properties of the musculotendinous unit. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Determine the factors affecting muscular force generation with relationships: Force Vs Velocity, Length vs Tension and Stretch Vs Shortening Cycle. | CO5 | A | 9 |
|  | b. | Illustrate the skeletal muscle function with neat diagrams. | CO5 | A | 3 |
|  |  |  |  |  |  |
| 23. |  | In detail, explain the regions of spine with a neat diagram and the forces acting on the spine. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Categorize the bony structure of the hip. | CO6 | An | 4 |
|  | b. | Distinguish the various movements that can be carried out at the hip joint and the various ligaments of the hip joint. | CO6 | An | 8 |

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

|  |  |
| --- | --- |
| **COURSE OUTCOMES** | |
| The Student will be able to | |
| CO1 | Recognize the concepts of mechanics and kinematics for human movements. |
| CO2 | Interpret the human factors that affect the environmental conditions. |
| CO3 | Apply the engineering techniques in human physiological applications. |
| CO4 | Analyze the properties and functions for effective performance. |
| CO5 | Evaluate the methods, solutions to human problems for specific needs. |
| CO6 | Design the advanced system concepts implement solutions to human factors problem. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 8 | 3 | 4 | - | 17 |
| CO2 | - | 5 | - | - | 11 | - | 16 |
| CO3 | 3 | - | 8 | 3 | 4 | - | 18 |
| CO4 | 4 | - | 12 | - | - | - | 16 |
| CO5 | - | 1 | 25 | 3 | - | - | 29 |
| CO6 | - | - | 16 | 12 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2016** | **Duration** | **3hrs** |
| **Course Title** | **SIGNALS AND SYSTEMS FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Expand sin (2nπ). | | CO1 | U | 1 |
| 2. | State the condition for a causal signal. | | CO1 | R | 1 |
| 3. | State the formula for cosine Fourier series expansion. | | CO2 | R | 1 |
| 4. | How is the frequency response of a filter represented? | | CO2 | R | 1 |
| 5. | What is the use of wavelet transform? | | CO3 | U | 1 |
| 6. | State the transform applied for non-stationary signals. | | CO3 | R | 1 |
| 7. | State the way to find the number of poles in Laplace transform. | | CO4 | U | 1 |
| 8. | Give substantiation for frequency shifting property in Laplace transform. | | CO4 | R | 1 |
| 9. | How is Z transform related to Laplace transform? | | CO5 | U | 1 |
| 10. | State the Z transform of a unit ramp function. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Give expressions for unit impulse and unit ramp function with examples. | | CO1 | R | 3 |
| 12. | List the conditions for the existence of Fourier series. | | CO2 | U | 3 |
| 13. | List any three joint time frequency analysis algorithms. | | CO3 | R | 3 |
| 14. | What is region of convergence in Laplace transform? How is it calculated? | | CO4 | U | 3 |
| 15. | State the z transform of unit impulse and unit step function. | | CO5 | R | 3 |
| 16. | List the properties of nonlinear systems. | | 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. |  | Explain in detail classifications of signals. | CO1 | R | 12 |
| 18. |  | Find the Fourier Series for the periodic signal with the function | CO2 | E | 12 |
| 19. |  | Illustrate and explain how joint time-frequency analysis is applied to ECG signals to diagnose arrythmia. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find the Laplace transform of the function: | CO4 | E | 6 |
|  | b. | Find inverse Laplace transform of the function : | CO4 | E | 6 |
| 21. |  | Using long division , determine the inverse Z transform of the function for both causal and anti-causal signal: | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Find the Fourier transform of the following and sketch the magnitude and phase spectrum: | CO2 | E | 12 |
| 23. | a. | Compute the cosine Fourier series of the function:  where the fundamental period is π | CO2 | E | 8 |
| b. | Compute the Laplace Transform of the function :  x(t) = sin Ω0t | CO4 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss about the physical factors in determining the dynamic behavior of physiological signal. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the nature of biomedical signals |
| CO2 | Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis. |
| CO3 | Classify systems based on their properties and determine the response of LTI system using Laplace transform. |
| CO4 | Apply Laplace transform and Z- transform to analyze continuous-time and discrete-time signals and systems |
| CO5 | Analyze system properties based on impulse response by FIR, IIR filtering techniques. |
| CO6 | Demonstrate mathematical tools in characterization of physiological system. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 16 | 1 | - | - | - | - | 17 |
| CO2 | 4 | 3 | 2 | - | 28 | - | 37 |
| CO3 | 4 | 7 | - | 6 | - | - | 17 |
| CO4 | 1 | 4 | - | - | 16 | - | 21 |
| CO5 | 4 | 5 | - | - | 8 | - | 17 |
| CO6 | 3 | - | - | 12 | - | - | 15 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2020** | **Duration** | **3hrs** |
| **Course Title** | **SIGNAL CONDITIONING CIRCUITS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Interpret ‘Hyperpolarization’ in your own words. | | CO1 | U | 1 |
| 2. | Describe ‘Diffusion potential’. | | CO1 | U | 1 |
| 3. | Differentiate uA741C and uA741. | | CO2 | U | 1 |
| 4. | List the pin configuration of the uA741 IC. | | CO2 | R | 1 |
| 5. | Summarize the applications of filters. | | CO3 | U | 1 |
| 6. | Indicate the significance of an active filter. | | CO3 | U | 1 |
| 7. | Define sampling. | | CO4 | R | 1 |
| 8. | Cite the disadvantages of a data acquisition system. | | CO4 | U | 1 |
| 9. | Interpret ‘biomedical transmission’ | | CO5 | U | 1 |
| 10. | Discuss SMT. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between polarization and depolarization. | | CO1 | U | 3 |
| 12. | List the ideal characteristics of an Op-amp. | | CO2 | R | 3 |
| 13. | Discriminate a band-stop filter and a notch filter. | | CO3 | An | 3 |
| 14. | Sketch the block diagram digital data acquisition system. | | CO4 | A | 3 |
| 15. | Sketch the block diagram of biomedical transmission system. | | CO5 | A | 3 |
| 16. | Evaluate the significance of the soldering process in PCB assembly. | | 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. | Explain the ‘Transimpedance amplifier’ configuration of OpAmp | CO2 | An | 8 |
|  | b. | Construct a preamplifier. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Write a note on the ‘Instrumentation amplifier’. | CO3 | A | 7 |
|  | b. | Explain the second-order band-pass filter. | CO3 | An | 5 |
|  |  |  |  |  |  |
| 19. | a. | Explain amplitude shift keying and phase shift keying | CO5 | An | 6 |
|  | b. | Write a note on the phase-locked loop. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Write a note on counter-type and flash-type analog-to-digital converters. | CO4 | A | 9 |
|  | b. | Summarize the disadvantages of weighted resistor ADCs. | CO4 | U | 3 |
|  |  |  |  |  |  |
| 21. | a. | Explain ‘Electrode skin interface’. | CO1 | An | 8 |
|  | b. | Describe several key characteristics of bio-amplifiers. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the Op-Amp as a ‘Subtractor’. | CO2 | An | 6 |
|  | b. | Construct an Op-amp based Integrator circuit. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain first-order and second-order high-pass filters. | CO3 | An | 8 |
|  | b. | Describe the advantages of higher-order active filters. | CO3 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Identify the various electrical interface problems encountered in printed circuit boards. | CO6 | U | 9 |
|  | b. | Summarize the steps involved in the fabrication of printed circuit boards (PCBs), highlighting the significance of each step in ensuring the reliability and functionality of the final product. | CO6 | U | 3 |

**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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 9 | - | 8 | - | - | 17 |
| **CO2** | 4 | 1 | 10 | 14 | - | - | 29 |
| **CO3** | - | 6 | 7 | 16 | - | - | 29 |
| **CO4** | 1 | 4 | 12 | - | - | - | 17 |
| **CO5** | - | 1 | 9 | 6 | - | - | 16 |
| **CO6** | - | 13 | - | 3 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2022** | **Duration** | **3hrs** |
| **Course Title** | **CONTROL SYSTEM FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

Polar graph sheet, Semi-log graph sheet and ordinary graph sheet is to be provided.

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Mason’s gain formula. | | CO1 | R | 1 |
| 2. | Define transfer function. | | CO1 | R | 1 |
| 3. | Recall Steady state error. | | CO2 | R | 1 |
| 4. | Tabulate the time domain specifications. | | CO2 | R | 1 |
| 5. | Define bandwidth. | | CO3 | R | 1 |
| 6. | Give examples for non-minimum phase transfer function. | | CO3 | U | 1 |
| 7. | Define BIBO stability. | | CO4 | U | 1 |
| 8. | Write the formula to determine centroid. | | CO4 | R | 1 |
| 9. | Sketch the schematic illustration of muscle stretch reflex. | | CO5 | A | 1 |
| 10. | List the unit for ventilator flow rate. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain Order of a system with suitable examples. | | CO1 | U | 3 |
| 12. | A second order system has a damping ratio of 0.6 and natural frequency of oscillation is 10 rad/sec. Calculate the damped frequency of oscillation. | | CO2 | A | 3 |
| 13. | Indicate the advantages of frequency response analysis. | | CO3 | U | 3 |
| 14. | Discover the root locus on real axis. | | CO4 | A | 3 |
| 15. | Sketch the simplified model of cardiac output regulation. | | CO5 | A | 3 |
| 16. | Illustrate the electrical analog of lung mechanics. | | 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. | Compare open loop and closed loop control systems based on different aspects. | CO1 | U | 6 |
|  | b. | Explain the properties of signal flow graph. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Using mason gain formula, calculate the transfer function C/R for the signal flow graph shown in figure. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | A closed loop servo is represented by the differential equation: . Where ‘c’ is the displacement of the output shaft, ‘r’ is the displacement of the input shaft and e = r – c. Compute undamped natural frequency, damping ratio and percentage maximum overshoot for unit step input. | CO2 | A | 6 |
|  | b. | Determine the expressions for Rise time. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | For servo mechanisms with open loop transfer function given below, calculate the constant steady state error. | CO2 | A | 6 |
|  | b. | Express the expression for resonant frequency. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Sketch the Bode plot for the system having the following transfer function | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Sketch the polar plot for the open loop transfer function of a unity feedback system is given by  .  Determine Gain Margin and Phase Margin. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Sketch the root locus of the system whose open loop transfer function is . | CO4 | A | 8 |
|  |  | With the help of Routh’s stability criterion evaluate the stability of the following system represented by the characteristic equations: | CO4 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Differentiate engineering and physiological control systems with suitable examples. | CO6 | An | 6 |
|  | b. | Analyze physiological control system representation for muscle reflex. | CO5 | An | 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. | | | | | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| **CO1** | 2 | 15 |  | 12 |  |  | 29 | |
| **CO2** | 2 |  | 21 |  |  |  | 23 | |
| **CO3** | 1 | 10 | 24 |  |  |  | 35 | |
| **CO4** | 1 | 1 | 15 |  |  |  | 17 | |
| **CO5** |  |  | 4 | 6 |  |  | 10 | |
| **CO6** | 1 |  | 3 | 6 |  |  | 10 | |
|  | | | | | | | | **124** | |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2023** | **Duration** | **3hrs** |
| **Course Title** | **IMAGE PROCESSING FOR MEDICAL APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the color model used for color printers. | | CO1 | R | 1 |
| 2. | Recall the sensor responsible for the detection of intensity. | | CO1 | R | 1 |
| 3. | Define image. | | CO2 | R | 1 |
| 4. | Locate the representation of 4 neighbors of pixel. | | CO2 | R | 1 |
| 5. | Write the two primary components of the human visual system. | | CO3 | A | 1 |
| 6. | Memorize the different hardware oriented models. | | CO3 | R | 1 |
| 7. | Identify the principal categories of digital storage. | | CO4 | R | 1 |
| 8. | Differentiate between sampling and quantization. | | CO4 | U | 1 |
| 9. | Give examples of high level computerized process. | | CO5 | U | 1 |
| 10. | Write the advantages of digital image. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain histogram with example. | | CO1 | U | 3 |
| 12. | Differentiate between pseudo color image processing and full color image processing. | | CO2 | U | 3 |
| 13. | Examine the process of segmentation. | | CO3 | R | 3 |
| 14. | List the applications of edge detection. | | CO4 | A | 3 |
| 15. | Discuss the advantages and disadvantages of lossy compression. | | CO5 | U | 3 |
| 16. | State the general representation of image compression. | | 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. |  | Describe the typical general purpose system used for digital image processing. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze the relationships between pixels. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the types of smoothing frequency filter. | CO3 | U | 6 |
|  | b. | Illustrate the types of sharpening spatial filter. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Discuss the fundamental steps in digital image processing. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Summarize the types of grey level discontinuities. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Interpret the procedure of region growing, region splitting and merging. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain some of the boundary descriptors in an image. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discriminate the classification of redundancy in an image. | CO6 | An | 6 |
|  | b. | Describe the signature based boundary representation. | CO6 | R | 6 |

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

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| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe 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** | Discuss about the image segmentation procedure. |
| **CO5** | Compute the level of compression achieved for the given image data. |
| **CO6** | Explain and compute features useful for image representation and recognition. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 14 | 3 | - | - | - | - | 17 |
| **CO2** | 2 | 3 | - | 12 | - | - | 17 |
| **CO3** | 4 | 12 | 1 | - | - | - | 17 |
| **CO4** | 1 | 13 | 3 | - | - | - | 17 |
| **CO5** | - | 16 | 12 | - | - | - | 28 |
| **CO6** | 9 | 12 | 1 | 6 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **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. | Identify the tool used for converting high level language into the machine language. | | CO1 | U | 1 |
| 2. | List the generations of embedded systems in chronological order. | | CO1 | R | 1 |
| 3. | Write an assembly language to add two numbers. | | CO2 | A | 1 |
| 4. | List the elements of user interface design. | | CO2 | R | 1 |
| 5. | Differentiate between linker and locator. | | CO3 | U | 1 |
| 6. | Classify the types of ROM. | | CO3 | U | 1 |
| 7. | Define switch. | | CO4 | R | 1 |
| 8. | Sketch the state diagram of task. | | CO4 | A | 1 |
| 9. | Give an example of simple state diagram. | | CO5 | U | 1 |
| 10. | State the services of operating system. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the requirements of software for embedded system. | | CO1 | An | 3 |
| 12. | Classify the embedded systems based on their complexity and performance. | | CO2 | U | 3 |
| 13. | Describe the characteristics of embedded system. | | CO3 | R | 3 |
| 14. | Interpret the design metrics for embedded system design. | | CO4 | U | 3 |
| 15. | Sketch the components of data acquisition system. | | CO5 | A | 3 |
| 16. | Interpret the bit level operation in C. | | 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. |  | Discriminate between the different types of embedded system architectures. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Examine the issues related to embedded software development. | CO2 | R | 6 |
|  | b. | Analyze the development process and tools of embedded software. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Discuss the design process of embedded system. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the process of analog to digital converter and digital to analog converter. | CO4 | R | 6 |
|  | b. | Differentiate between analog and digital signal. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Develop a program to interface a keypad with a microcontroller. | CO5 | A | 6 |
|  | b. | Explain the steps involved in interfacing seven segment display with microcontroller. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Describe the structure of basic embedded C program. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the functions of RTOS. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Interpret the interrupt routine in RTOS. | CO6 | U | 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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | - | 3 | 12 | - | 17 |
| **CO2** | 7 | 3 | 1 | 6 | - | - | 17 |
| **CO3** | 3 | 14 | - | - | - | - | 17 |
| **CO4** | 7 | 9 | 1 | - | - | - | 17 |
| **CO5** | 12 | 1 | 9 | 6 | - | - | 28 |
| **CO6** | 1 | 27 | - | - | - | - | 28 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV/DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2028** | **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)** | | | | | |
| 1. | Identify the applications of x-ray. | | CO1 | U | 1 |
| 2. | Criticize the merits of fluoroscopy. | | CO1 | R | 1 |
| 3. | List the functions of radio frequency coils used in magnetic resonance system. | | CO2 | R | 1 |
| 4. | Interpret the working frequency of ultrasound scanner. | | CO2 | R | 1 |
| 5. | Infer CT number in x-ray system. | | CO3 | U | 1 |
| 6. | Identify the principle of piezoelectricity. | | CO3 | R | 1 |
| 7. | Choose the imaging system for breast cancer. | | CO4 | U | 1 |
| 8. | Relate the applications of functional MRI. | | CO4 | R | 1 |
| 9. | Interpret health hazards for medical radiography. | | CO5 | U | 1 |
| 10. | Infer the merits of optical imaging system. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Criticize the importance of rotating anode in x-rays machine. | | CO1 | E | 3 |
| 12. | Analyze the applications of x-ray diagnosis. | | CO2 | An | 3 |
| 13. | Interpret the principle of image generation in magnetic resonance system. | | CO3 | R | 3 |
| 14. | Infer the components of medical ultrasonic probe. | | CO4 | U | 3 |
| 15. | Outline the merits of liquid crystal thermography. | | CO5 | U | 3 |
| 16. | Identify the advantages of radiotracer in medical imaging system. | | 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. |  | Elaborate the working of x-ray generating system. | CO1 | C | 12 |
|  |  |  |  |  |  |
| 18. |  | Propose the medical imaging methodology for diagnosing fracture in human bone. | CO2 | C | 12 |
|  |  |  |  |  |  |
| 19. |  | Construct the methodology of imaging for brain tumor. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the methodology of positron emission tomography system. | CO4 | An | 6 |
|  | b. | Compile the medical applications of magnetic resonance system. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the applications of Doppler ultrasonography. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the medical applications of single photon emission tomography. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Identify the merits of computer in medical imaging system. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the architecture of medical data management system. | CO6 | C | 6 |
|  | b. | Inspect the radiological hazards that occur in medical field. | CO6 | An | 6 |

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

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 |  |  | 3 | 12 | 17 |
| **CO2** | 2 |  |  | 3 |  | 12 | 17 |
| **CO3** | 4 | 1 | 12 |  |  |  | 17 |
| **CO4** | 1 | 4 |  | 6 | 12 | 6 | 29 |
| **CO5** |  | 4 | 12 |  | 12 |  | 28 |
| **CO6** |  | 1 | 3 | 6 |  | 6 | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2029 / 15EI2025** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL EQUIPMENT MAINTENANCE AND TROUBLESHOOTING** | **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. | Name a power analyzer that is used for testing AC/DC supply. | | CO1 | R | 1 |
| 2. | State the importance of ‘Breakout box’. | | CO1 | R | 1 |
| 3. | State the benefits of calibrating the sensor probes. | | CO2 | R | 1 |
| 4. | Indicate the merits of using Fluke calibration’s baths over other calibration methods. | | CO2 | U | 1 |
| 5. | Indicate how often preventive maintenance is to be carried out in Heart Lung machine. | | CO3 | U | 1 |
| 6. | List the 3 modes used in ProSIM8 software. | | CO3 | R | 1 |
| 7. | State how to resolve ‘automatic restart’ problem in X ray machine. | | CO4 | R | 1 |
| 8. | List what are all packages does comprehensive maintenance cover. | | CO4 | R | 1 |
| 9. | Interpret PEST analysis in your own words. | | CO5 | U | 1 |
| 10. | Express in words the need for testing the reliability of medical equipment. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the importance of ‘Guarding’ technique. | | CO1 | U | 3 |
| 12. | Discuss the steps involved in classical troubleshooting of PCB. | | CO2 | U | 3 |
| 13. | Discuss about the ‘wave form test’ process carried out in ventilators. | | CO3 | U | 3 |
| 14. | Describe about how to resolve ‘printer issues’ in ECG machine. | | CO4 | U | 3 |
| 15. | List the tools used in decision making. | | CO5 | R | 3 |
| 16. | Differentiate MTBF and MTTR techniques. | | 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. | a. | Write a detailed note on Insulation resistance measurement process. | CO1 | A | 6 |
|  | b. | Explain the various methods used for testing the circuit breakers. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discriminate the types of cables used in medical equipment. | CO2 | An | 7 |
|  | b. | Write a note on parameters used in DC power supply testing. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 19. | a. | Explain how to troubleshooting a dialyzer. | CO3 | An | 7 |
|  | b. | Write a note on troubleshooting the surgical lights and the tips to maintain them. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. | a. | Explain the troubleshooting techniques infusion pumps. | CO4 | An | 8 |
|  | b. | Prioritize Safety standards of medical equipment. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | Appraise the factors that influence the maintenance cost of a company. | CO5 | E | 9 |
|  | b. | Explain how to obtain optimal benefit from medical equipment from its lifecycle. | CO5 | A | 3 |
|  |  |  |  |  |  |
| 22. | a. | Explain about troubleshooting of electro cardiogram machines. | CO4 | An | 7 |
|  | b. | Write a brief note on troubleshooting of infant warmers. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 23. | a. | Explain how quality assurance is achieved through IEEE standards. | CO6 | An | 5 |
|  | b. | Discriminate Markov method and cause failure analysis. | CO6 | An | 7 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain any 2 tools used for reliability assurance. | CO6 | An | 6 |
|  | b. | Write a note on human errors in healthcare system. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the reasons for equipment failure. |
| CO2 | Interpret the need for grounding aspects, maintenance and troubleshooting |
| CO3 | Construct the test bench, tools and methods for troubleshooting |
| CO4 | Compare various standards and specifications |
| CO5 | Decide quality and safety standards |
| CO6 | Formulate advanced methods to solve critical problems |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | 6 | 6 | - | - | 17 |
| CO2 | 1 | 4 | 5 | 7 | - | - | 17 |
| CO3 | 1 | 4 | 5 | 7 | - | - | 17 |
| CO4 | 2 | 3 | 5 | 19 |  |  | 29 |
| CO5 | 3 | 1 | 3 | - | 9 | - | 16 |
| CO6 | - | 4 | 6 | 18 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2033** | **Duration** | **3hrs** |
| **Course Title** | **PYTHON PROGRAMMING FOR BIOMEDICAL APPLICATIONS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name any two numeric datatypes in python. | | CO1 | R | 1 |
| 2. | State the purpose of input function. | | CO1 | R | 1 |
| 3. | Define Loop body. | | CO2 | U | 1 |
| 4. | List any two comparison operators. | | CO2 | R | 1 |
| 5. | Name the method for writing a text into a file in Python. | | CO3 | R | 1 |
| 6. | Define substring. | | CO3 | R | 1 |
| 7. | Name the operator that determines the presence or absence of an element in a list. | | CO4 | R | 1 |
| 8. | Interpret Dictionaries in python. | | CO4 | U | 1 |
| 9. | List the benefits of function in a python code. | | CO5 | R | 1 |
| 10. | What is polymorphism? | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the steps to be followed to compose and execute a python program. | | CO1 | U | 3 |
| 12. | Write a Python program using a while loop to count from 1 to 10 and print each number. | | CO2 | A | 3 |
| 13. | Write the values of the following expressions:   1. data[2] (ii) data[-1] (iii) len(data)   [Assume that the variable data refers to the string “pythonfile.exe”] | | CO3 | A | 3 |
| 14. | Illustrate the methods used to insert elements into a list and remove elements from a list. | | CO4 | A | 3 |
| 15. | Explain the processes involved in solving a problem, using the concept of Top-down design. | | CO5 | A | 3 |
| 16. | Examine the libraries used in python programming for patient health monitoring. | | 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. | Illustrate the different arithmetic expressions along with its precedence. | CO1 | An | 9 |
|  | b. | Explain the type conversion functions in python programming. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Explain the different conditional statements in python programming with its syntax and semantics. | CO2 | A | 8 |
|  | b. | Write a Python script that checks if the number is positive, negative, or zero using an if-elif-else statement and print an appropriate message based on the input. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Write a python program to convert cipher text to plain text. | CO3 | A | 6 |
|  | b. | Illustrate the string operators with suitable examples. | CO3 | A | 4 |
|  | c. | Write a python program to read text from a file. | CO3 | A | 2 |
|  |  |  |  |  |  |
| 20. | a. | Explain the dictionary operators with example programs. | CO4 | A | 6 |
|  | b. | Examine the concept of aliasing and side effect with suitable examples. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Develop a Python program by defining the objects and methods needed to design a class for appointment scheduling in a hospital. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain how functions act as abstraction mechanism in eliminating redundancy and hiding complexity. | CO5 | A | 8 |
|  | b. | Interpret lifetime of variables in a program. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the different escape sequences with python codes. | CO1 | An | 10 |
|  | b. | Write a Python program that uses a ‘for’ loop to print all numbers from 1 to 20. | CO2 | A | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the functionality and steps involved in predictive analysis in healthcare. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Outline the structure and components of a Python program |
| **CO2** | Explain loops and decision statements in Python |
| **CO3** | Illustrate class inheritance in Python for reusability |
| **CO4** | Choose lists, tuples, and dictionaries in Python programs |
| **CO5** | Assess object‐oriented programs with Python classes |
| **CO6** | Develop simple code for biomedical applications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | - | 19 | - | - | 24 |
| **CO2** | 1 | 4 | 17 | - | - | - | 22 |
| **CO3** | 2 | - | 15 | - | - | - | 17 |
| **CO4** | 1 | 1 | 15 | - | - | - | 17 |
| **CO5** | 1 | 1 | 27 | - | - | - | 29 |
| **CO6** | - | - | 3 | 12 | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2034** | **Duration** | **3hrs** |
| **Course Title** | **DATA ANALYTICS FOR BIOMEDICAL ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the applications of Ad-Hoc analysis. | | CO1 | R | 1 |
| 2. | Define Big Data Analytics. | | CO1 | R | 1 |
| 3. | Identify the type of ML algorithm that is typically used for making predictions. | | CO2 | U | 1 |
| 4. | Differentiate between standardizing and matching. | | CO2 | An | 1 |
| 5. | State the key features of data visualization. | | CO3 | R | 1 |
| 6. | Identify the function used to find the factor length. | | CO3 | U | 1 |
| 7. | Predict the output of the following code.  A <- c(17, 2, 8, 13, 1, 22)  B <- c("Jan", "feb", "Mar", "Apr", "May", "Jun")  barplot(A, names.arg = B, xlab ="Month",          ylab ="Articles", col ="green",          main ="GeeksforGeeks-Article chart") | | CO4 | E | 1 |
| 8. | Interpret the syntax of boxplot() function. | | CO4 | A | 1 |
| 9. | Differentiate between slope and intercept. | | CO5 | An | 1 |
| 10. | List the applications of linear regression. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the purpose of each stage in the big data life cycle. | | CO1 | An | 3 |
| 12. | Analyze the factors that make traditional computing systems ineffective for big data management. | | CO2 | An | 3 |
| 13. | Describe the process involved in Homogenization. | | CO3 | U | 3 |
| 14. | Differentiate between median and range. | | CO4 | An | 3 |
| 15. | Explain the steps to determine a standard deviation. | | CO5 | An | 3 |
| 16. | Discover the accessing of Data frame. | | 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. |  | Describe the six phases of the CRISP-DM methodology. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the following functions using R programming.   1. Calling a function 2. Calling a function without an argument 3. Calling a function with argument values 4. Calling a function with Default argument | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the plot() function in R programming with an appropriate example. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Develop a program that can create a Grouped bar chart based on user input data. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Write a program to create a multiple Box plot using R programming. | CO5 | C | 6 |
|  | b. | Develop a program to plot a vertical bar chart. | CO5 | C | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain the features of Histogram with example. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe the applications of chi-square test. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the impact of Big Data Medical Imaging. | CO6 | An | 6 |
|  | b. | Explain the sources of Big Data in diagnostics. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate fundamental knowledge of Big data analytics. |
| **CO2** | Explore different types of data from different sources. |
| **CO3** | Write R script to analyse data from data interface. |
| **CO4** | Develop and generate different types of charts and graphs. |
| **CO5** | Perform various statistical analysis using R packages for given data set. |
| **CO6** | Apply knowledge of big data analytics on bioinformatics and health care data set. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 12 | - | 3 | - | - | 17 |
| **CO2** | - | 1 | - | 16 | - | - | 17 |
| **CO3** | 1 | 16 | - | - | - | - | 17 |
| **CO4** | - | - | 1 | 3 | 1 | 12 | 17 |
| **CO5** | - | - | - | 16 | - | 12 | 28 |
| **CO6** | 1 | 12 | 3 | 12 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20BM2001** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL PHYSICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | **List** two types of non-ionizing radiation. | | CO1 | R | 1 |
| 2. | **Mention** one advantage of thermography over traditional diagnostic methods. | | CO1 | U | 1 |
| 3. | **Define** the term “ultrasound”. | | CO2 | R | 1 |
| 4. | **State** the principle of the Doppler effect in ultrasound imaging. | | CO2 | U | 1 |
| 5. | Write one difference between an electron capture reaction and an internal conversion reaction. | | CO3 | R | 1 |
| 6. | Identify the reason behind beta-minus decays. | | CO3 | U | 1 |
| 7. | Define the term ‘pair production’ in nuclear physics. | | CO4 | R | 1 |
| 8. | Identify an environment in which the inelastic scattering of neutrons occurs. | | CO4 | U | 1 |
| 9. | List one non-stochastic effect of ionizing radiation. | | CO5 | R | 1 |
| 10. | Define the term “effective dose” in the measuring of nuclear radiation. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | The energy of an electromagnetic radiation is 1.9878 x 10-19 J. Calculate the energy in eV. Infer whether this is ionizing radiation or non-ionizing radiation. | | CO1 | A | 3 |
| 12. | The intensity of sound in a street during heavy traffic is 10-4 W m-2. Calculate the relative intensity in decibel. | | CO2 | A | 3 |
| 13. | Calculate the kinetic energies of alpha particles and daughter nuclei if the Q value of the alpha decay process is 4 MeV. (Assume parent nucleus’s A=200) | | CO3 | A | 3 |
| 14. | Explain the effects of energy on the range of emitted radiations in an air medium. | | CO4 | A | 3 |
| 15. | Calculate the activity of a radioactive sample if it is marked as a 10 μCi source in Becquerel. | | CO5 | A | 3 |
| 16. | Illustrate the effective use of thermogram in detection of cancer at earlier stages. | | 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 principles of Near Infrared Spectroscopy (NIR) in non-invasive medicine with suitable examples. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze the effects of clarity, uniformity, loudness, and reverberation time on the acoustic quality of an auditorium and suggest suitable remedial measures. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Determine the relationship that gives the value of Q in an alpha decay process and an electron capture process. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyze the critical differences between the following ways in which gamma rays interact with matter:   1. Photoelectric effect. 2. Compton scattering. 3. Pair production. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the key differences between stochastic and non-stochastic effects of ionizing radiation. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the low frequency effects of non-ionizing radiation with suitable examples. | CO1 | A | 8 |
|  | b. | A quartz crystal with a thickness of 2 mm is vibrating at resonance. Calculate the first and second excited frequencies. [Given that Y for quartz = 7.9 x 1010 N/m2 and ρ = 2650 kg m-3 and f1=1.36 MHz]. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Determine a way to calculate the Q value of a nuclear reaction and apply it to calculate Q value of a beta minus decay. | CO3 | A | 8 |
|  | b. | Distinguish between Bremsstrahlung and Cherenkov radiation in a beta minus decay process. | CO4 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the concept of a linear accelerator in the field of nuclear medicine with a block diagram. | CO6 | A | 8 |
|  | b. | Differentiate between gamma ray sources and x-ray sources in medical physics. | CO6 | An | 4 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the fundamentals of light. |
| **CO2** | Assess the significance of sound in medicine. |
| **CO3** | Comprehend radioactive nuclides. |
| **CO4** | Outline the interaction of radiation with matter. |
| **CO5** | Comprehend basic quantities of radiation. |
| **CO6** | Understand the applications of light, sound and radiation in medicine. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 23 | - | - | - | 25 |
| **CO2** | 1 | 1 | 7 | 12 | - | - | 21 |
| **CO3** | 1 | 1 | 23 | - | - | - | 25 |
| **CO4** | 1 | 1 | 3 | 16 | - | - | 21 |
| **CO5** | 1 | 1 | 15 | - | - | - | 17 |
| **CO6** | - | - | 11 | 4 | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20BM2002** | **Duration** | **3hrs** |
| **Course Title** | **BIOCHEMISTRY FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The most abundant organic molecules in nature and are also referred to as\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Glucose-6-phosphate is isomerised into\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Which lipid facilitates cell–cell interactions? | | CO6 | R | 1 |
| 4. | What enzyme regulates cholesterol synthesis? | | CO6 | R | 1 |
| 5. | Amino acids with the aliphatic ‘R’ group are\_\_\_\_\_\_. | | CO4 | U | 1 |
| 6. | Amino acids are mostly synthesised from\_\_\_\_. | | CO2 | U | 1 |
| 7. | A DNA segment contains 100 Adeniene and 100 cytosines, how many neuclotides are present the segment. | | CO4 | U | 1 |
| 8. | RNA contains repeating units of \_\_\_. | | CO2 | R | 1 |
| 9. | **Which nutrient deficiency causes megaloblastic anaemia?** | | CO3 | U | 1 |
| 10. | **Which mineral deficiency may result into impaired growth and development, skin lesions and loss of appetite?** | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify Monosaccharaides based on the presence of functional group. | | CO6 | U | 3 |
| 12. | What is mean by derived lipids? | | CO1 | R | 3 |
| 13. | What is mean by amide linkage? Write with its molecular structure. | | CO4 | U | 3 |
| 14. | Write the Chargaff’s rule on DNA. | | CO2 | R | 3 |
| 15. | Describe the vitamin deficiency is associated with egg white injury. | | CO3 | R | 3 |
| 16. | Describe the term integration of metabolism. | | CO5 | 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. |  | Explain in detail about the Glycolysis process. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Describe the function of fatty acids, its structure and its classification. | CO6 | R | 8 |
|  | b. | What is the main function of complex lipids and derived lipids? | CO6 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | What are the four levels of protein structure? Explain each levels with pictorial representation. | CO2 | U | 8 |
|  | b. | Illustrate the significance of Ramar plot. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 20. |  | Reproduce the structure of mRNA, rRNA and tRNA with suitable diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain in detail about Vitamin A structure, its sources and its function. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 22. |  | Describe the mechanism of Urea cycle. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the structure, classification and properties of oligo and polysaccharides. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write down the benefits of the minerals to our body. | CO3 | U | 6 |
|  | b. | Tabulate the functions of micro minerals. | CO3 | R | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Acquire knowledge on structure, properties and biological functions of carbohydrates, lipids and proteins which help them to understand the significance of biomolecules in bioprocesses and biotechnology |
| CO2 | Acquire knowledge on nucleic acids structure, properties and functions of nucleic acids |
| CO3 | Assess the significance of Vitamins and mineral functions |
| CO4 | Help them to analyze industrial-market value of these biomolecules and relate them with the scope of biotechnology |
| CO5 | Justify the clinical and biological significance of these biomolecules |
| CO6 | Understand the complexes of different biomolecules and their biomedical significance |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 25 | - | - | - | - | 29 |
| CO2 | 8 | 9 | - | - | - | - | 17 |
| CO3 | 21 | 7 | - | - | - | - | 28 |
| CO4 | 0 | 17 | - | - | - | - | 17 |
| CO5 | 1 | 3 | - | - | - | - | 4 |
| CO6 | 14 | 15 | - | - | - | - | 29 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20BM2004** | **Duration** | **3hrs** |
| **Course Title** | **CANCER BIOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Identify the purpose of cancer screening test. | | CO1 | U | 1 | |
| 2. | List the different forms of cancer. | | CO1 | R | 1 | |
| 3. | Write an example of carcinogens. | | CO2 | A | 1 | |
| 4. | List the types of receptors. | | CO2 | R | 1 | |
| 5. | Differentiate between EGF and FCF. | | CO3 | U | 1 | |
| 6. | Classify the types of gene. | | CO3 | U | 1 | |
| 7. | Define cell. | | CO4 | R | 1 | |
| 8. | Sketch the structure of EGF. | | CO4 | A | 1 | |
| 9. | Give an example of gatekeepers. | | CO5 | U | 1 |
| 10. | Recall the functions of Proto Oncogene. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Explain the general sequence of cell signaling. | | CO1 | An | 3 | |
| 12. | Identify the methods for detecting oncogenes. | | CO2 | U | 3 | |
| 13. | Describe the role of carcinogen metabolism in human cancers. | | CO3 | R | 3 | |
| 14. | Interpret the activation of kinases. | | CO4 | U | 3 | |
| 15. | Sketch the schematic illustration of the different proteomic techniques for detection. | | CO5 | A | 3 | |
| 16. | Interpret the life cycle of retrovirus. | | 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. |  | Discriminate between the different phases of cell cycle. | CO1 | E | 12 | |
|  |  |  |  |  |  | |
| 18. | a. | Examine the mutations affecting apoptosis. | CO2 | R | 6 | |
|  | b. | Analyze the detection using biochemical assays. | CO2 | An | 6 | |
|  |  |  |  |  |  | |
| 19. |  | Discuss the early detection of cancer. | CO3 | U | 12 | |
|  |  |  |  |  |  | |
| 20. | a. | Describe the mutations that cause changes in signal molecules. | CO4 | R | 6 | |
|  | b. | Interpret the mechanisms of radiation carcinogenesis. | CO4 | U | 6 | |
|  |  |  |  |  |  | |
| 21. | a. | Explain the key steps of the cascade. | CO5 | A | 6 | |
|  | b. | Analyze the three step theory of Invasion. | CO5 | An | 6 | |
|  |  |  |  |  |  | |
| 22. |  | Describe the molecular tools in early detection of cancer. | CO5 | R | 12 | |
|  |  |  |  |  |  | |
| 23. |  | Illustrate the theories of carcinogenesis. | CO6 | U | 12 | |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Interpret the different forms of therapy. | CO6 | U | 12 | |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Describe the molecular and cellular mechanisms that lead to cancer. |
| **CO2** | Analyze the primarily focus on the role of growth factors that leads to cancer |
| **CO3** | Evaluate the role of gene mutation in the development of cancer |
| **CO4** | Discuss on oncogenes, tumor suppressor genes, angiogenesis and signal transduction mechanisms in tumor formation. |
| **CO5** | Understand the fundamental principles behind cancer diagnosis and prevention. |
| **CO6** | Explain the various therapeutic management system for cancer biology. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | - | 3 | 12 | - | 17 |
| **CO2** | 7 | 3 | 1 | 6 | - | - | 17 |
| **CO3** | 3 | 14 | - | - | - | - | 17 |
| **CO4** | 7 | 9 | 1 | - | - | - | 17 |
| **CO5** | 12 | 1 | 9 | 6 | - | - | 28 |
| **CO6** | 1 | 27 | - | - | - | - | 28 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20BM2005** | **Duration** | **3hrs** |
| **Course Title** | **ENTREPRENEURSHIP FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two opportunities of a biomedical entrepreneur. | | CO1 | U | 1 |
| 2. | Classify the types of entrepreneur based on the area of expertise. | | CO1 | U | 1 |
| 3. | Define benchmarking. | | CO2 | R | 1 |
| 4. | Write the environmental factors influencing entrepreneurship. | | CO2 | R | 1 |
| 5. | State the importance of patenting. | | CO3 | U | 1 |
| 6. | Identify capitals required for company operation. | | CO3 | U | 1 |
| 7. | Define selling. | | CO4 | U | 1 |
| 8. | Describe marketing ethics and legal compliance. | | CO4 | R | 1 |
| 9. | List the four P’s of marketing. | | CO5 | U | 1 |
| 10. | Differentiate between nebulizer and vaporizer. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Express the challenges in pharmaceutical industry. | | CO1 | An | 3 |
| 12. | Differentiate between entrepreneur and intrapreneur. | | CO2 | U | 3 |
| 13. | List the importance of patenting. | | CO3 | An | 3 |
| 14. | Classify the types of budget. | | CO4 | U | 3 |
| 15. | State the uses of ventilators. | | CO5 | An | 3 |
| 16. | List four innovations during COVID-19. | | 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. | a. | Write the opportunities and challenges of a biomedical engineer. | CO1 | A | 6 |
|  | b. | Infer the growth and development of pacemaker industry. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the benefits of entrepreneurship evaluation. | CO2 | An | 6 |
|  | b. | Evaluate the need for practicing entrepreneurship. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the importance of safety and effectiveness of medical devices. | CO3 | A | 6 |
|  | b. | Determine the role of FDA regulation in forming a company. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the concept of procurement and outsourcing of a company. | CO4 | A | 8 |
|  | b. | Sketch the financial management blocks. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the healthcare system in China. | CO5 | E | 6 |
|  | b. | Explain the expectation of customer in buying the products. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Categorize the medical devices used during COVID-19. | CO6 | An | 6 |
|  | b. | Examine the challenges of global marketing. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Analyze the steps to start a business in India. | CO3 | An | 8 |
|  | b. | Explain the strategies to be followed to check the availability of the invention in the market. | CO2 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain any two inventions in various fields of biomedical engineering. | CO6 | An | 6 |
|  | b. | Write short notes on the devices developed during pandemic situation. | CO6 | A | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Study the Technologies in Medical Industry |
| **CO2** | Understand the concepts of Entrepreneurship |
| **CO3** | Analyze the need in building an organization, patenting and FDA |
| **CO4** | Understand the Financial Management and Product Manufacturing |
| **CO5** | Familiarize Marketing and Business Globalization |
| **CO6** | Apply the concepts of Biomedical Engineering for inventions and device development |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | R | U | A | An | E | C | Total |
| **CO1** | - | 2 | 6 | 9 | - | - | 17 |
| **CO2** | 2 | 3 | 4 | 12 | - | - | 21 |
| **CO3** | - | 2 | 12 | 11 | - | - | 25 |
| **CO4** | 1 | 4 | 12 | - | - | - | 17 |
| **CO5** | - | 1 | 12 | 3 | 6 | - | 22 |
| **CO6** | - | 4 | 6 | 12 | - | - | 22 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3001** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL INSTRUMENTATION DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Articulate the process of digestion, from ingestion to absorption, highlighting the roles of various organs. | CO1 | A | 10 |
|  | b. | Assess the importance of filtration, reabsorption, and secretion in achieving homeostasis. | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the phases involved in the generation and propagation of action potential along a neuron. | CO2 | U | 8 |
|  | b. | Illustrate the brain electrical activity with the help of a block diagram. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 3. | a. | Compare the static and dynamic characteristics of measurement system. | CO3 | An | 10 |
|  | b. | Design a case study report showing the hypothetical setup, data flow, and decision-making process in an IoT-based system. | CO3 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Examine the functioning of heart-lung machines in ECMO therapy. | CO4 | A | 12 |
|  | b. | Assess the overall impact of AI algorithms on patient outcomes and healthcare efficiency. | CO4 | E | 8 |
|  |  |  |  |  |  |
| 5. | a. | Assess the importance of each type of artificial respiration in patient care. | CO5 | E | 10 |
|  | b. | Articulate the challenges in ventilator management, patient selection criteria, and any modifications made to standard ventilator protocols during the pandemic. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe the key design considerations for implantable cardiac pacemakers. | CO4 | C | 10 |
|  | b. | Analyze the efficacy of cardiovascular instrumentation interfaces. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Determine the role of lung compliance and airway resistance in breathing mechanics. | CO5 | A | 8 |
|  | b. | Estimate the overall efficacy of the ventilator interface system based on quantitative and qualitative data. | CO5 | An | 12 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the neurophysiological pathways involved in sensory processing. | CO6 | U | 10 |
|  | b. | Evaluate the ethical considerations involved in neurophysiological research using AI and deep learning. | CO6 | E | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Design a case study where wireless EEG systems are used for remote patient monitoring. | CO6 | C | 12 |
|  | b. | Predict the reliability of BIS in assessing brain function and the challenges in interpreting BIS scores in critically ill patients. | CO6 | A | 8 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the basic functions of various human physiological systems |
| CO2 | Demonstrate an interfacing circuit for real time bio signal acquisition |
| CO3 | Construct the suitable instrumentation technique for a specific illness |
| CO4 | Categorize the medical devices based on its biomedical applications |
| CO5 | Assess the various parameters, constraints in methodology for effective diagnosis |
| CO6 | Design of advanced biomedical equipments for various diseases and ensure patient safety |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 10 | - | 10 | - | 20 |
| CO2 | - | 20 | - | - | - | - | 20 |
| CO3 | - | - | - | 10 | - | 10 | 20 |
| CO4 | - | - | 12 | 10 | 8 | 10 | 40 |
| CO5 | - | - | 18 | 12 | 10 | - | 40 |
| CO6 | - | 10 | 8 | - | 10 | 12 | 40 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3002** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED BIOMEDICAL SIGNAL PROCESSING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Estimate the 8-point DFT of the sequence  x(n)={1,1,2,1,1,2,1,1} using the Radix-2 DIT-FFT approach. | CO1 | An | 10 |
|  | b. | Explain the process of Sampling and Alising with mathematical equation. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Illustrate the process of EEG signal Acquisition system. | CO2 | A | 10 |
|  | b. | Explain the types of portable ECGs and its usage. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the working of IIR filter and list its significance. | CO3 | An | 10 |
|  | b. | Explain the design of Butterworth filters with mathematical equation in detail. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a detail note on RLS algorithm and its benefits in adaptive filtering. | CO4 | A | 10 |
|  | b. | Explain How does powerline interference show in an ECG, and how might it affect the accuracy of readings. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the steps involved in Differentiation Based QRS Detection Technique. | CO5 | A | 10 |
|  | b. | Estimate R-R interval for the detection of Arrhythmia with its function block diagram. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write the importance of Artificial Intelligence. | CO1 | A | 10 |
|  | b. | Differentiate the working of VMG and VAG signals. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain High Speed QRS detection Algorithm used in ECG with mathematical Expression. | CO5 | A | 10 |
|  | b. | Explain How does Maternal interference show in an ECG, and how might it affect the accuracy of readings. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the role of Deep learning in bio signal analysis. | CO5 | A | 10 |
|  | b. | Illustrate the Operation of Analog to Digital converter in detail. | CO1 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the steps involved in Detection of Coronary Artery Disease using AI models. | CO6 | An | 10 |
|  | b. | Illustrate the process involved for the Analysis of Ectopic ECG beats. | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Summarize the basic concepts of digital signal processing techniques. |
| CO2 | Identify the nature of Biomedical signals. |
| CO3 | Apply the Filtering Techniques. |
| CO4 | Analyze the Noise Cancellation Techniques for Biosignals. |
| CO5 | Understand various Techniques for Detection of Events. |
| CO6 | Develop systems for Biosignal Acquisition and Analysis. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 30 | 10 | - | - | 40 |
| CO2 | - | - | 20 | 10 | - | - | 30 |
| CO3 | - | - | - | 20 | - | - | 20 |
| CO4 | - | - | 10 | 20 | - | - | 30 |
| CO5 | - | - | 30 | 10 | - | - | 40 |
| CO6 | - | - | 10 | 10 | - | - | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **21BM3002** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED BIOMEDICAL SIGNAL PROCESSING** | **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. | Estimate the 8-point DFT of the sequence  x(n)={0,1,2,3,4,5,6,7} using the Radix-2 DIT-FFT approach. | CO1 | An | 10 |
|  | b. | Explain the process of Sampling and Aliasing with mathematical equation. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 2. | a. | Illustrate the process of ECG signal Acquisition system and its wave pattern. | CO2 | A | 10 |
|  | b. | Differentiate Evoked potentials and event related potentials. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 3. | a. | Illustrate the design of moving average filters with mathematical equation in detail. | CO3 | A | 8 |
|  | b. | Explain the operation of Infinite Impulse Response filter and its significance. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 4. | a. | Write a detail note on the LMS algorithm and its benefits in adaptive filtering. | CO4 | A | 8 |
|  | b. | Explain how does powerline interference show in an ECG, and how it might affect the accuracy of readings? | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explain High Speed QRS detection Algorithm used in ECG with mathematical Expression. | CO5 | An | 8 |
|  | b. | Estimate ST segment for the detection of Arrhythmia with its function block diagram. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain Signal conditioning circuit and its operation in biomedical signal analysis with its functional diagram. | CO1 | An | 8 |
|  | b. | Differentiate the operation of EMG and VMG and list its application. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Estimate the order of the Butterworth filter which has atleast 66 dB attenuation at 2000 π rad/sec and 3 dB attenuation at 1000 π rad/sec. | CO3 | An | 8 |
|  | b. | Explain the application of Deep learning in bio signal analysis. | CO5 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain the steps involved in Detection of Coronary Artery Disease using AI models. | CO6 | An | 10 |
|  | b. | Illustrate the process involved for the Analysis of Ectopic ECG beats. | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Summarize the basic concepts of digital signal processing techniques. |
| CO2 | Identify the nature of Biomedical signals. |
| CO3 | Apply the Filtering Techniques. |
| CO4 | Analyze the Noise Cancellation Techniques for Biosignals. |
| CO5 | Understand various Techniques for Detection of Events. |
| CO6 | Develop systems for Biosignal Acquisition and Analysis. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 24 | - | - | 24 |
| CO2 | - | - | 10 | 14 | - | - | 24 |
| CO3 | - | - | 8 | 16 | - | - | 24 |
| CO4 | - | - | 8 | 8 | - | - | 16 |
| CO5 | - | - | 8 | 16 | - | - | 24 |
| CO6 | - | - | 10 | 10 | - | - | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3010** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL SENSORS AND MEMS TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Compare each sensor type by examining their underlying principles, as well as factors like sensitivity, range, and environmental limitations. | CO1 | An | 10 |
|  | b. | Analyze the challenges and benefits of integrating multiple sensor types into a unified monitoring system. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Compare the properties of dielectrics that influence the performance and reliability of MEMS applications. | CO2 | E | 10 |
|  | b. | Extend the design considerations for MEMS-based tactile sensors used in robotic applications. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Analyze the micromachining techniques followed in various industries. | CO3 | An | 12 |
|  | b. | Interpret the use of artificial intelligence (AI) to predict material characteristics for MEMS applications. | CO3 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Examine the key safety protocols and procedures to be followed in a clean room environment. | CO4 | A | 8 |
|  | b. | Analyze the process of fabricating MEMS accelerometer, detailing each step and the techniques used. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 5. | a. | Illustrate the working principle of piezoelectric sensors and actuators. | CO5 | U | 10 |
|  | b. | Assess the design considerations, applications and advantages of microneedles in biomedical MEMS. | CO5 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe the process of photolithography and its importance in patterning for MEMS and microfabrication. | CO4 | U | 10 |
|  | b. | Compare vapor-phase epitaxy, molecular beam epitaxy, and liquid-phase epitaxy. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Evaluate the factors affecting the sensitivity and performance of beam and cantilever structures used in mechanical actuators. | CO5 | E | 8 |
|  | b. | Determine the role of software simulations in optimizing the design of MEMS devices before fabrication and discuss the challenges associated with simulation accuracy. | CO5 | A | 12 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Interpret the use of MATLAB for simulating and analyzing the performance of a pressure sensor. | CO6 | E | 10 |
|  | b. | Evaluate the use of machine learning algorithms in MEMS testing. | CO6 | E | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Assess the factors affecting the performance of thermal actuators and discuss how they are modeled in computational software. | CO6 | E | 10 |
|  | b. | Describe the process followed in real-time calibration of MEMS devices to reduce device-to-device variability. | CO6 | U | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the principle of medical sensors and its interfacing circuits |
| CO2 | Classify the micro sensor materials, synthesis, fabrication and its characterization |
| CO3 | Choose the design tools to test and develop products to required specifications |
| CO4 | Infer the most relevant challenges facing in the fabrication process |
| CO5 | Judge a sensor based on standard performance criteria and environmental impact |
| CO6 | Construct the micro system for appropriateness for an application and user. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 20 | - | - | 20 |
| CO2 | - | 10 | - | - | 10 | - | 20 |
| CO3 | - |  | 8 | 12 | - | - | 20 |
| CO4 | - | 10 | 8 | 22 | -- | - | 40 |
| CO5 | - | 10 | 12 | - | 18 | - | 40 |
| CO6 | 10 | - | - | - | 30 | -- | 40 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **21BM3012** | **Duration** | **3hrs** |
| **Course Title** | **HUMAN ASSISTIVE DEVICES** | **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. |  | Explain the functioning of the heart-lung machine, detailing its components and their roles in supporting cardiovascular and respiratory functions during surgery. | CO1 | An | 16 |
|  |  |  |  |  |  |
| 2. |  | Summarize the functions of the Right Ventricular Assist Device. | CO2 | E | 16 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate the membranes function in hemodialysis. | CO3 | E | 8 |
|  | b. | Analyze the different types of dialyzers utilized in hemodialysis treatment. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 4. |  | Explain the operation of Upper Limb Orthosis in detail. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 5. |  | Evaluate the effectiveness of different types of hearing aids in addressing various types of deafness. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 6. | a. | Summarize the role of rehabilitation in successfully adapting hand and arm replacements. | CO4 | E | 8 |
|  | b. | Evaluate the mock test setup for assessing its functions in a cardiac assistive device. | CO1 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | Evaluate the process of testing biomaterials. | CO2 | E | 8 |
|  | b. | Analyze the monitoring systems in hemodialysis that contribute to patient safety and treatment efficacy. | CO3 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Evaluate the potential limitations of visual augmentation technologies in real-world applications. | CO6 | E | 10 |
|  | b. | Design a prototype for an IoT-based assistive device that helps visually impaired users to navigate complex environments. | CO6 | C | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the requirements for human assist devices |
| CO2 | Classify the systems based on applications |
| CO3 | Relate soft tools for analysis and design of devices for specific applications |
| CO4 | Infer the merits of human assist system and its influence to environment. |
| CO5 | Choose the methodologies in measurement systems and conditions |
| CO6 | Combine instrumentation techniques for development of assist devices to human needs |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 16 | 16 | - | 32 |
| CO2 | - | - | - | - | 24 | - | 24 |
| CO3 | - | - | - | 16 | 8 | - | 24 |
| CO4 | - | - | - | 16 | - | - | 16 |
| CO5 | - | - | - | - | 16 | - | 16 |
| CO6 | - | - | - | - | 10 | 10 | 20 |
|  | | | | | | | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21BM3015** | **Duration** | **3hrs** |
| **Course Title** | **REHABILITATION ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the principles and benefits of community-based rehabilitation (CBR) in providing healthcare services to individuals with disabilities. | CO1 | An | 10 |
|  | b. | Justify how can biomedical engineers leverage technology to mitigate the challenges faced by individuals with disabilities and improve their quality of life. | CO1 | C | 6 |
|  |  |  |  |  |  |
| 2. | a. | Develop an IoT-based rehabilitation system to empower amputees to regain independence and lead a normal life by providing real-time monitoring, personalized therapy, and seamless integration with assistive devices. | CO2 | C | 12 |
|  | b. | Differentiate between Linear and Angular Displacement Transducer. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 3. | a. | Explain the key components, design considerations, and advancements in prosthetic technology for both upper and lower limbs, highlighting their role in improving the quality of life for individuals with limb loss. | CO3 | An | 10 |
|  | b. | Explain the parameters that are used to design the prosthetic device to maximize their functionality, comfort, and aesthetic appeal. | CO3 | U | A |
|  |  |  |  |  |  |
| 4. | a. | Design and develop innovative robotic systems to enhance the effectiveness and efficiency of rehabilitation therapy, leading to improved patient outcomes and reduced therapy time. | CO4 | C | 10 |
|  | b. | Explain rehabilitation robotics and its role in enhancing the functional recovery and quality of life for individuals with disabilities. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 5. | a. | Develop innovative smart wheelchair systems that enhance the mobility, independence of individuals with disabilities, considering factors such as user needs and technological advancements. | CO5 | C | 10 |
|  | b. | Evaluate the effectiveness of software tools in enhancing rehabilitation training and assessment processes. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 6. | a. | Illustrate the underlying physiological mechanisms of neuroplasticity and neural regeneration to optimize rehabilitation in individuals with neurological impairments. | CO4 | A | 10 |
|  | b. | Explain how rehabilitation engineers contribute to improving the quality of life for individuals with disabilities. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 7. | a. | Explain the term accelerometer and discuss the working principle of ADXL345 3-axis MEMS accelerometer. | CO2 | An | 8 |
|  | b. | Explain the term Velocity Strain sensor and its application in the view of rehabilitation engineering. | CO1 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Design a modular and reconfigurable exoskeleton platform that can be easily customized for different tasks and user needs. | CO6 | C | 14 |
|  | b. | Explain the potential of using advanced materials and manufacturing techniques to create lightweight, durable, and energy-efficient exoskeletons. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic terminology in rehabilitation and models for societal applications |
| CO2 | Classify the sensors and actuators for particular applications |
| CO3 | Discover the new methodology and systems for societal needs related to disability |
| CO4 | Compare the devices and methods under various environmental conditions |
| CO5 | Criticize the design, performance, cost, user need and affordability |
| CO6 | Develop the products based on cost effectiveness, user needs, environment friendly |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  |  | 24 |  | 6 | 30 |
| CO2 |  |  |  | 12 |  | 12 | 24 |
| CO3 |  |  | 6 | 10 |  |  | 16 |
| CO4 |  |  | 10 | 6 |  | 10 | 26 |
| CO5 |  |  | 6 |  |  | 10 | 16 |
| CO6 |  |  | 6 |  |  | 14 | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3017** | **Duration** | **3hrs** |
| **Course Title** | **ROBOTICS IN SURGERY** | **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. | Illustrate the functions of probabilistic roadmap with suitable applications. | CO1 | A | 10 |
|  | b. | Write the key differences between first to fourth-generation robots in terms of capabilities and features. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 2. | a. | Design an optimized machine vision system architecture that incorporates real-time processing for applications in healthcare field. | CO2 | C | 12 |
|  | b. | Prioritize the role of path planning in robotics surgery field. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 3. | a. | Negotiate a case study on uses of programmable controller in robotics surgery. | CO3 | C | 12 |
|  | b. | Explain the concept of stand-alone method in embedded systems. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 4. | a. | Justify the human factors involved in motor interactions. | CO4 | E | 8 |
|  | b. | Prepare a flow diagram related to taxonomy of failure. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the strengths and limitations of using robotics in diagnostics compared to traditional methods. | CO5 | E | 8 |
|  | b. | Explain the concept of micro robots and its application in healthcare field. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Analyze the sensor for vision and motion in robotics. | CO2 | An | 12 |
|  | b. | Summarize the functions of tactile sensor. | CO2 | E | 4 |
|  |  |  |  |  |  |
| 7. | a. | Prepare a case study on IoT based robot control. | CO5 | C | 10 |
|  | b. | Illustrate the Machine learning based path tracking in healthcare field. | CO4 | An | 6 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Apply the characteristics of smart materials to improve the durability of wearable devices. | CO6 | A | 10 |
|  | b. | Write the steps involved in laparoscopic robotic surgery. | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the fundamental concepts in robotic systems. |
| CO2 | Interpret the types of sensors and actuators for its applications. |
| CO3 | Choose the design tools to develop artificial intelligence techniques. |
| CO4 | Classify the conditions required for testing and control of autonomous robots. |
| CO5 | Judge the safety aspects to human and environment. |
| CO6 | Construct the robots for assisting in surgery. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 16 | - | - | - | 16 |
| CO2 | - | - | - | 16 | 4 | 12 | 32 |
| CO3 | - | - | 4 | - | - | 12 | 16 |
| CO4 | - | - | 8 | 6 | 8 | - | 22 |
| CO5 | - | 8 | - | - | 8 | 10 | 26 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3023** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS IN HEALTHCARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Categorize the internet concept capability and limitations. | CO1 | An | 10 |
|  | b. | Explain the OSI layers related to communication technology. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Elaborate the network security issues with respect to medical data processing. | CO1 | E | 20 |
|  |  |  |  |  |  |
| 3. | a. | Simplify the IoT design methodology specification integrations. | CO2 | A | 10 |
|  | b. | Differentiate between IoT and M2M technology. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain the enabling technologies in internet of things. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Explain the types of sensors and actuators. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Summarize ethical framework and guideline in digital health | CO4 | E | 10 |
|  | b. | Explain ethical framework with respect to privacy, confidentiality and security of personal health data. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Classify the IoT based healthcare ecosystem. | CO5 | An | 10 |
|  | b. | Predict and evaluate the future challenges in healthcare ecosystem using IoT. | CO5 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Design an embedded based healthcare system for elderly people. | CO3 | C | 10 |
|  | b. | Analyze the power aware protocols for IoT in healthcare system. | CO5 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS) COMPULSORY QUESTION** | | | | | |
| 9. | a. | Evaluate the strategies that can be employed to address potential usability challenges in healthcare for senior residents. | CO6 | E | 10 |
|  | b. | Summarize the significance of social network analysis in social support and care. | CO6 | E | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Acquire the knowledge and concept of IoT |
| CO2 | Explain the basic concepts of IoT protocol |
| CO3 | Illustrate the concepts of embedded system for healthcare applications |
| CO4 | Categorize the importance of digital health |
| CO5 | Criticize the ethical issues in healthcare |
| CO6 | Develop an application based IoT in healthcare |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 10 | 10 | 20 | - | 40 |
| CO2 | - | - | 10 | 30 | - | - | 40 |
| CO3 | - | - | 20 | - | - | 10 | 30 |
| CO4 | - | - | - | 10 | 10 | - | 20 |
| CO5 | - | - | - | 20 | 10 | - | 30 |
| CO6 | - | - | - | - | 20 | - | 20 |
|  | | | | | | | **180** |



**END SEMESTER EXAMINATION – NOV/DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21BM3031** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED MEDICAL IMAGE PROCESSING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** |  | **Questions** | **CO** | **BL** | **M** |
| 1. | a. | Elaborate on the significance of Magnetic Resonance Imaging Modality and compare it with CT modality | CO1 | A | 10 |
|  | b. | Analyse the stages of breast cancer and explain how mammographic imaging is used for diagnosis. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the spatial domain filters used for Noise reduction in medical images. | CO2 | A | 10 |
|  | b. | Analyze the features of Frost, Average and Median filters specific to its application in imaging. | CO2 | AN | 10 |
|  |  |  |  |  |  |
| 3. | a. | Create a super Resolution and Richardson –Lucy model to restore degraded medical images. | CO3 | C | 10 |
|  | b. | Compare and illustrate the features of Inverse Filter, Wiener Filter and Constrained Least Squares filters in image restoration process. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Analyze the performance of Topological Derivative based and histogram-based image segmentation techniques. | CO4 | AN | 10 |
|  | b. | Illustrate the significance of MSE, RMSE, PSNR and Entropy in medical image analysis. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain in detail about different features used in medical images. | CO5 | A | 10 |
|  | b. | Illustrate the significance of shape related features in the analysis of medical images. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Infer on image segmentation methods based on the grayscale values' dissimilarity. | CO4 | AN | 10 |
|  | b. | Explain in detail about the systematic evaluation and validation of segmentation algorithms | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Outline how image segmentation is carried out using Self Similar Fractal and Watershed methods and analyze its performance with other segmentation methods. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8 |  | Analyze how CAD systems are used in Medical Imaging applications and elaborate on how their diagnostic capabilities are evaluated. | CO2 | AN | 20 |
| **Compulsory Question** | | | | | |
| 9. | a. | Create a deep learning model for cancer detection in skin images and nodule detection in lung imaging. | CO6 | C | 10 |
|  | b. | Using the relevant imaging modalities, develop a preliminary image processing model that encompasses all aspects of image processing to be used to diagnose cancer from a brain image. | CO6 | C | 10 |

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

|  |  |
| --- | --- |
|  | **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 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / BL | **R** | **U** | **A** | **AN** | **C** | **E** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | 10 | 30 | - | - | 40 |
| CO3 | - | 10 | - | - | 10 | - | 20 |
| CO4 | - | - | 20 | 20 | - | - | 40 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | - | - | - | 40 | - | 40 |
|  | | | | | | | **180** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **22BM2001** | **Duration** | **3hrs** |
| **Course Title** | **BIOSIGNAL PROCESSING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What does PCG signify? | | CO1 | U | 1 |
| 2. | Name the bioelectric signal related to the muscle activity. | | CO1 | R | 1 |
| 3. | List the two types of analogue filters used for IIR Filter design. | | CO2 | R | 1 |
| 4. | Write the formula to obtain the order of the filter using Butterworth approximation. | | CO2 | R | 1 |
| 5. | Write the characteristic features of rectangular window. | | CO3 | U | 1 |
| 6. | Name a commonly used method for removing powerline interference from ECG signals. | | CO3 | R | 1 |
| 7. | Give an example for 2D and 3D signal. | | CO4 | U | 1 |
| 8. | FIR filters are exhibiting linear phase response – True/False. | | CO4 | R | 1 |
| 9. | List the common types of Artifacts in ECG. | | CO5 | U | 1 |
| 10. | Ectopic beats are generated by ------------------------ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe aliasing effect with a neat diagram | | CO1 | U | 3 |
| 12. | Explain the mapping of s-plane to z-plane in bilinear transformation. | | CO2 | U | 3 |
| 13. | Write the procedure for designing FIR filter using windows. | | CO3 | U | 3 |
| 14. | What is an adaptive filter, and where is it commonly used? | | CO4 | U | 3 |
| 15. | Illustrate how the template matching method is used to detect QRS complex in ECG waves. | | CO5 | U | 3 |
| 16. | Mention the importance of cardio-respiratory interactions | | 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. |  | Given an discrete sequence x(n)= { 2, 1, 2, 1, 1, 2, 1, 2 }, Find X(k) using Decimation in Frequency FFT Algorithm. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Design a Butterworth digital IIR low pass filter using bilinear transformation by taking T =0.1 second, to satisfy the following specifications.    . | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the Bilinear transformation method for converting an analog filter to a digital filter. Apply the transformation formula to convert an analog low-pass filter with the transfer function H(s) =​ into its digital equivalent with T=1 Sec. | CO3 | A | 6 |
|  | b. | Discuss the nature of biomedical signals with suitable diagrams and mention the use of filters in acquisition. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | **Demonstrate** the use of an adaptive filter in removing noise from a signal, and compare its performance to a fixed filter. | CO3 | A | 8 |
|  | b. | **Explain how synchronized averaging improves signal-to-noise ratio (SNR) in periodic signal analysis.** | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain how the derivative based method of an ECG signal enhances the detection of QRS complexes. | CO5 | U | 4 |
|  | b. | Deduce the Pan Tompkins method for QRS complex detection in Electrocardiogram. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. | a. | **Indicate the key parameters typically evaluated in an exercise ECG test and relate it to detect Arrhythmia.** | CO4 | U | 6 |
|  | b. | **Correlate the relationship between heart sounds in a phonocardiogram and the phases of the cardiac cycle.** | CO6 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Design a linear phase FIR low pass filter using rectangular window by taking 7 samples of window sequence and with a cutoff frequency, Wc = 0.2π rad/sample. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | For an EEG of an Epileptic patient, describe the various blocks of signal processing units used to detect the patient’s condition. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the fundamentals of signal processing |
| CO2 | Identify the effect of IIR Digital filter design |
| CO3 | Illustrate the various applications of IIR filter |
| CO4 | Discuss about the FIR Filter design and applications |
| CO5 | Show the various methods to analyze biosignals |
| CO6 | Explain the biosignal processing concepts for real time applications |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO2 | 2 | 3 | - | 12 | - | - | 17 |
| CO3 | 1 | 10 | 26 | - | - | - | 37 |
| CO4 | 1 | 14 | - | - | - | - | 15 |
| CO5 | - | 8 | - | 8 | - | - | 16 |
| CO6 | - | 4 | - | 18 | - | - | 22 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define bioethics. | | CO1 | R | 1 |
| 2. | Identify the key difference between virtue theory and the other ethical theories. | | CO1 | U | 1 |
| 3. | Name the types of misconduct carried out in medical research. | | CO2 | R | 1 |
| 4. | Classify the types of utilitarianism. | | CO2 | U | 1 |
| 5. | Identify any two benefits of computerized physician order entry (CPOE). | | CO3 | U | 1 |
| 6. | List the divisions of LOINC. | | CO3 | R | 1 |
| 7. | Name any two accreditation bodies to approve medical standards. | | CO4 | R | 1 |
| 8. | Indicate the use of JCI Accreditation. | | CO4 | U | 1 |
| 9. | State the methods for extinguishing a fire. | | CO5 | R | 1 |
| 10. | Give examples of class II medical devices. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Summarize the moral rights of the patients in medical ethics. | | CO1 | U | 3 |
| 12. | Compare virtue theory and casuist theory. | | CO2 | U | 3 |
| 13. | Differentiate between electronic medical record and electronic health record. | | CO3 | U | 3 |
| 14. | Sketch the overview of Picker’s eight principles of patient care. | | CO4 | A | 3 |
| 15. | Identify the safety measures during an emergency situations of fire accident in hospitals. | | CO5 | U | 3 |
| 16. | List the benefits of IEC 60601 standards. | | 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. |  | Explain in detail about the fundamental principles of CMA code of medical ethics. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Summarize the features of various ethical principles used in medical ethics. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the Health Level Seven (HL7) standard for exchanging healthcare data between computer systems. | CO3 | An | 6 |
|  | b. | Describe the functions of various levels of evidence-based medicine. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the role of JCAHO Accreditation and highlight its policies. | CO4 | A | 8 |
|  | b. | Write down the significance of accreditation. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain the features of fire safety equipment and highlight the procedure for maintaining and testing the operation of these equipment. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the ethical issues in biomedical research. | CO2 | U | 8 |
|  | b. | Classify the various types of predictive genetic tests and highlight its features. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Categorize the packages in domain information model of IEEE 11073. | CO3 | An | 9 |
|  | b. | Write down the benefits of healthcare standards organizations. | CO3 | A | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the various steps involved in EMC radiation protection. | CO6 | U | 6 |
|  | b. | Enumerate the functional elements of a programmable medical device system. | CO6 | R | 6 |

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

|  |  |
| --- | --- |
|  | **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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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | - | - | - | 17 |
| CO2 | 1 | 24 | - | 4 | - | - | 29 |
| CO3 | 1 | 10 | 3 | 15 | - | - | 29 |
| CO4 | 1 | 1 | 15 | - | - | - | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 9 | 7 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is the role of a hospital administrator? | | CO1 | R | 1 |
| 2. | Name the term for hospitals funded and operated by the government. | | CO1 | R | 1 |
| 3. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ programs designed to increase public awareness about health issues | | CO2 | R | 1 |
| 4. | What type of health organization works on disease prevention and health promotion at the state level? | | CO2 | R | 1 |
| 5. | Show the basic managerial functions of HRM. | | CO3 | U | 1 |
| 6. | ------- is the systematic, periodic and impartial rating of an employee excellence in matters pertaining to his present job and his potential for a better job. | | CO3 | R | 1 |
| 7. | Write the purpose of autoclaving in hospital waste management. | | CO4 | U | 1 |
| 8. | What is the role of the quality committee in a hospital? | | CO4 | R | 1 |
| 9. | Which key factor should be considered first when selecting HIS software? | | CO5 | R | 1 |
| 10. | What is the primary benefit of using computers in laboratory administration? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the criteria that should be considered while classifying the hospital. | | CO1 | U | 3 |
| 12. | Write the vision of Eleventh five-year plan. | | CO2 | U | 3 |
| 13. | Classify the different types of training. | | CO3 | U | 3 |
| 14. | Conclude the different types of Biomedical waste. | | CO4 | E | 3 |
| 15. | Justify how does a Hospital Information System (HIS) helps to improve patient care. | | CO5 | E | 3 |
| 16. | Define Electronic Health Record. | | 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. |  | Explain in detail about the organization and staff structure of Hospital. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss the key features of the National Health Policy (NHP) 2017 in India. What are its objectives and how does it aim to improve public health? | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the advantages of employee training. | CO3 | U | 5 |
|  | b. | Illustrate the steps involved in employee performance appraisal. | CO3 | U | 7 |
|  |  |  |  |  |  |
| 20. |  | Explain the different stages in promoting and building a new hospital. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the components of Hospital information system. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the main components of Picture Archiving and Communication System (PACS). | CO6 | E | 6 |
|  | b. | List the advantages of PACS in radiology. | CO6 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain how an HIS contributes to hospital administration and management. | CO5 | U | 7 |
|  | b. | Summarize the key features to consider when selecting Hospital Information System (HIS) software. | CO5 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Identify the various medical waste in hospital and suggest the treatment and disposal of that waste. | CO4 | A | 12 |

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

|  |  |
| --- | --- |
|  | **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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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 15 |  |  |  |  | 17 |
| **CO2** | 2 | 15 |  |  |  |  | 17 |
| **CO3** | 1 | 16 |  |  |  |  | 17 |
| **CO4** | 1 | 1 | 12 |  | 15 |  | 29 |
| **CO5** | 1 | 12 |  | 12 | 3 |  | 28 |
| **CO6** | 1 | 3 |  |  | 12 |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | For the system in the given figure, the transfer function C(*s*)/R(*s*) is http://www.indiabix.com/_files/images/electronics-and-communication-engineering/automatic-control-systems/12-21.png | | CO1 | U | 1 |
| 2. | Classify the different types of nodes in a signal flow graph. | | CO1 | R | 1 |
| 3. | State ‘Type Number’ of the system with suitable examples. | | CO2 | R | 1 |
| 4. | Define poles and zeroes of a system. | | CO2 | R | 1 |
| 5. | Define Bandwidth. | | CO3 | R | 1 |
| 6. | Find the corner frequency of the unity feedback control system has an open loop transfer function, | | CO3 | U | 1 |
| 7. | Write the formula to calculate the angle of asymptotes. | | CO4 | R | 1 |
| 8. | Define BIBO stability. | | CO4 | R | 1 |
| 9. | Sketch the schematic illustration of muscle stretch reflex. | | CO5 | U | 1 |
| 10. | State the concept of neuro muscular motion. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Distinguish between open loop and closed loop system. | | CO1 | U | 3 |
| 12. | Give the formula for the error constants. | | CO2 | R | 3 |
| 13. | Sketch the polar plot of G(s) = 1/(1+sT) | | CO3 | An | 3 |
| 14. | State Nyquist Stability criterion. | | CO4 | R | 3 |
| 15. | Define Starlings law. | | CO5 | R | 3 |
| 16. | Sketch the simplified model of cardiac output regulation. | | 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. | a. | Inspect the transfer function of field controlled DC motor. | CO1 | U | 6 |
|  | b. | Use Mason’s gain formula for determining the overall transfer function of the system shown in the figure given below. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | A unity feedback system has a open loop transfer function of  G(s) = 10/(s+1)(s+2). Determine the steady state error for unit step input. | CO2 | U | 6 |
|  | b. | A Unity feedback control system has an open loop transfer function G(s)=10/(s(s+2)). Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | The open loop transfer function of a unity feedback system is given by G(s) = 1/s(1+s)(1+2s). Sketch the polar plot and determine the gain margin and phase margin. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | The characteristic polynomial of a system is s5+ s4+ 2s3+ 2s2+ 3s + 5 = 0. Determine the location of roots on the s-plane and hence the stability of the system. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Using Block diagram reduction technique find the closed loop transfer function. | CO1 | U | 6 |
|  | b. | Explain the model of chemical regulation of ventilation. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | A unity feedback control system has an open loop transfer function  G(s) = K/s(s2 + 4s +13). Sketch the root locus. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Sketch bode plot for the following transfer function  G(s) = Ks 2 /(1+0.2s)(1+0.02s) | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Differentiate engineering and physiological control systems with suitable examples. | CO6 | U | 6 |
|  | b. | Explain the linear model of respiratory mechanics. | CO6 | U | 6 |

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

|  |  |
| --- | --- |
|  | **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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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 22 |  |  |  |  | 23 |
| **CO2** | 5 | 12 |  |  |  |  | 17 |
| **CO3** | 1 | 1 | 24 | 3 |  |  | 29 |
| **CO4** | 5 |  | 12 | 12 |  |  | 29 |
| **CO5** | 3 | 13 |  |  |  |  | 16 |
| **CO6** |  | 10 |  |  |  |  | 10 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2008** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO BIOMEDICAL ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Mention the recent advances in biomedical engineering. | | CO1 | U | 1 |
| 2. | Differentiate between beneficence and nonmaleficence. | | CO1 | U | 1 |
| 3. | List two important factors that determine the design of medical instrument. | | CO2 | U | 1 |
| 4. | Indicate the various sources of biomedical signals. | | CO2 | U | 1 |
| 5. | State the principle of thermography. | | CO3 | R | 1 |
| 6. | Quote the characteristics of Xrays. | | CO3 | R | 1 |
| 7. | Identify the applications of dialysis machine. | | CO4 | U | 1 |
| 8. | Summarize the need for humidifier. | | CO4 | U | 1 |
| 9. | Identify the role of institutional review boards. | | CO5 | U | 1 |
| 10. | Define the term ‘ethics’. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the professional status of biomedical engineers. | | CO1 | An | 3 |
| 12. | Describe the general constraints in design of medical instruments. | | CO2 | U | 3 |
| 13. | Identify the applications of PET. | | CO3 | R | 3 |
| 14. | Differentiate between internal and external defibrillators. | | CO4 | U | 3 |
| 15. | Express the principles of good laboratory practices. | | CO5 | U | 3 |
| 16. | Explain ethical issues in emergency use. | | 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. | a. | Apply the functions of biomedical societies. | CO1 | A | 6 |
|  | b. | Administer the role of biomedical engineers in various domains. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Categorize the types of anatomy and physiology. | CO2 | An | 6 |
|  | b. | Sketch the intelligent medical instrumentation system. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the principle of production of X-rays. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the working principle of ECG machine. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Compare codes with standards and regulations of medical device development. | CO5 | A | 6 |
|  | b. | Represent the good manufacturing practices in medical research labs. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Assess the risks and benefits of nuclear imaging in medical diagnosis. | CO3 | E | 6 |
|  | b. | Summarize the differences between thermal imaging and other forms of imaging. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Analyze the various modes of ventilation and their suitability for different patient conditions. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Examine the code of ethics for biomedical engineers. | CO6 | A | 6 |
|  | b. | Analyze the ethical issues in the treatment process of humans. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Interpret the role of biomedical engineering in society |
| **CO2** | Demonstrate the principles of various diagnostic devices. |
| **CO3** | Identify the various techniques used in diagnosis though imaging. |
| **CO4** | Describe the working principles of various therapeutic and assist devices. |
| **CO5** | Understand device specific safety goals and standards. |
| **CO6** | Illustrate the concepts of ethical theories and moral principles for the health professionals. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 2 | 12 | 3 | - | - | 17 |
| **CO2** | - | 5 | - | 12 | - | - | 17 |
| **CO3** | 2 | 6 | 12 | 3 | 6 | - | 29 |
| **CO4** | - | 5 | - | 12 | 12 | - | 29 |
| **CO5** | - | 13 | - | 3 | - | - | 16 |
| **CO6** | - | 1 | 9 | 6 | - | - | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2008** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO BIOMEDICAL ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the concept of stem cell research. | | CO1 | U | 1 |
| 2. | State the applications of electron microscope. | | CO1 | R | 1 |
| 3. | Define resolution. | | CO2 | R | 1 |
| 4. | List the key parameters in an A/D converter. | | CO2 | R | 1 |
| 5. | Name the most commonly used radioactive tracer in human body. | | CO3 | R | 1 |
| 6. | List two applications of positron emission tomography. | | CO3 | U | 1 |
| 7. | List the physiological properties of cardiac cell. | | CO4 | R | 1 |
| 8. | Define defibrillation. | | CO4 | R | 1 |
| 9. | Classify the standards for medical devices. | | CO5 | An | 1 |
| 10. | Define morality. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the applications of telemetry devices. | | CO1 | U | 3 |
| 12. | Sketch the typical configuration of PC based medical instrument. | | CO2 | A | 3 |
| 13. | Explain the principle of positron emission tomography. | | CO3 | U | 3 |
| 14. | Sketch the normal ECG waveform. | | CO4 | A | 3 |
| 15. | Explain the term ‘Ínformed Consent’. | | CO5 | U | 3 |
| 16. | Classify the experiments involving human subjects. | | 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. | Explain the role of professional societies in biomedical engineering. | CO1 | U | 6 |
|  | b. | Analyze the growth of modern health care system. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Analyze the general constraints in design of medical instrumentation systems. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the working principle of Magnetic Resonance Imaging system. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the functions of various modules of a ventilator. | CO4 | An | 6 |
|  | b. | Classify the types of defibrillators. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. |  | Explain the objectives and principles of good laboratory practices. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the roles played by the biomedical engineers. | CO1 | A | 6 |
|  | b. | Describe the recording of ECG hardware unit. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23 |  | Sketch the block diagram of an intelligent instrumentation system. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the ethical issues in feasibility studies. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Interpret the role of biomedical engineering in society |
| **CO2** | Demonstrate the principles of various diagnostic devices. |
| **CO3** | Identify the various techniques used in diagnosis though imaging. |
| **CO4** | Describe the working principles of various therapeutic and assist devices. |
| **CO5** | Understand device specific safety goals and standards. |
| **CO6** | Illustrate the concepts of ethical theories and moral principles for the health professionals. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 4 | 7 | 6 | 6 | - | - | 23 |
| **CO2** | 2 | - | 15 | 12 | - | - | 29 |
| **CO3** | 1 | 16 | - | - | - | - | 17 |
| **CO4** | 2 | - | 9 | 12 | - | - | 23 |
| **CO5** | - | 3 | 12 | 1 | - | - | 16 |
| **CO6** | 1 | - | - | 15 | - | - | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define ‘Diffusion potential’. | | CO1 | R | 1 |
| 2. | Describe ‘Hyperpolarization’. | | CO1 | R | 1 |
| 3. | Sketch the pin configuration of the uA741 IC. | | CO2 | A | 1 |
| 4. | Distinguish between uA741 and uA741C. | | CO2 | U | 1 |
| 5. | List few applications of filters. | | CO3 | R | 1 |
| 6. | Review the significance of an active filter. | | CO3 | U | 1 |
| 7. | Define sampling. | | CO4 | R | 1 |
| 8. | Summarize the disadvantages of a data acquisition system. | | CO4 | U | 1 |
| 9. | Interpret biomedical transmission in your own words. | | CO5 | U | 1 |
| 10. | Discuss surface mount technology. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discriminate between polarization and depolarization. | | CO1 | An | 3 |
| 12. | List the ideal characteristics of an Op-amp. | | CO2 | R | 3 |
| 13. | Differentiate between a band-stop filter and a notch filter. | | CO3 | U | 3 |
| 14. | Sketch the blocks of an analog data acquisition system. | | CO4 | R | 3 |
| 15. | Sketch a biomedical transmission system. | | CO5 | R | 3 |
| 16. | Examine the significance of the soldering process in PCB assembly. | | 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 ‘Electrode skin interface’. | CO1 | An | 8 |
|  | b. | Describe several key characteristics of bio-amplifiers. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the Op-Amp as a ‘Subtractor’. | CO2 | An | 6 |
|  | b. | Construct an Op-amp based Integrator circuit. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain first-order and second-order high-pass filters. | CO3 | An | 8 |
|  | b. | Discuss the advantages of higher-order active filters. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain counter-type and flash-type analog-to-digital converters. | CO4 | An | 9 |
|  | b. | Summarize the disadvantages of weighted resistor ADCs. | CO4 | U | 3 |
|  |  |  |  |  |  |
| 21. | a. | Write a note on amplitude shift keying and phase shift keying. | CO5 | A | 6 |
|  | b. | Write a note on the phase-locked loop. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the Op-amp as a transimpedance amplifier. | CO2 | An | 6 |
|  | b. | Construct a preamplifier using Op-amp. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the instrumentation amplifier. | CO3 | An | 8 |
|  | b. | Write a note on the second-order band-pass filter. | CO3 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the steps involved in the fabrication of printed circuit boards (PCBs), highlighting the significance of each step in ensuring the reliability and functionality of the final product. | CO6 | An | 9 |
|  | b. | Identify the various electrical interface problems encountered in printed circuit boards. | CO6 | U | 3 |

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

|  |  |
| --- | --- |
|  | **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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 4 | 11 | - | - | - | 17 |
| **CO2** | 3 | 1 | 13 | 12 | - | - | 29 |
| **CO3** | 1 | 8 | 4 | 16 | - | - | 29 |
| **CO4** | 4 | 4 | - | 9 | - | - | 17 |
| **CO5** | 3 | 1 | 12 | - | - | - | 16 |
| **CO6** | 1 | 3 | 3 | 9 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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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. | Identify the suitable register to hold the address of memory of the next instruction. | | CO1 | R | 1 |
| 2. | Select the address bus size of 8085 microprocessor. | | CO1 | R | 1 |
| 3. | Indicate the use of an instruction register in 8085 Microprocessor. | | CO2 | U | 1 |
| 4. | Express the operation of MOV A, B. | | CO2 | U | 1 |
| 5. | Write the oscillator frequency of 8051 Microcontroller. | | CO3 | A | 1 |
| 6. | Indicate the use of PCON register of 8051 Microcontroller. | | CO3 | U | 1 |
| 7. | Define Compiler. | | CO4 | R | 1 |
| 8. | Identify the addressing mode in which the address of the data is given as operand. | | CO4 | R | 1 |
| 9. | List the suitable control signal used for reading data from an external memory. | | CO5 | R | 1 |
| 10. | Give an example of embedded systems in biomedical applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the characteristics of an embedded systems. | | CO1 | R | 3 |
| 12. | Write the assembly language programming format of 8085 Microprocessor. | | CO2 | A | 3 |
| 13. | Write the significance of reset circuits in 8051 Microcontroller. | | CO3 | A | 3 |
| 14. | Classify the various addressing modes of 8051 Microcontroller. | | CO4 | U | 3 |
| 15. | Differentiate between timer and counter. | | CO5 | U | 3 |
| 16. | State the working principle of DC motor. | | 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. | Explain in detail about the various functional building blocks of 8085 Microprocessor with neat diagram. | CO1 | U | 10 |
|  | b. | Differentiate between Von Neumann and Harvard architecture. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 18. | a. | Describe the features of various addressing modes of 8085 Microprocessor with an example. | CO2 | R | 8 |
|  | b. | Write the assembly language program for performing any arithmetic operations using 8085 Microprocessor. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | Sketch the architecture of 8051 Microcontroller and highlight its features. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Summarize the features of various instruction sets of 8051 Microcontroller with an example. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the functional blocks of successive approximation type ADC. | CO3 | R | 6 |
|  | b. | Sketch the data format of RS232 communication. | CO5 | A | 2 |
|  | c. | Differentiate between synchronous and asynchronous communication. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the steps involved for serial data transmission using I2C protocol. | CO5 | U | 10 |
|  | b. | Sketch the interfacing diagram of SPI communication protocol. | CO5 | A | 2 |
|  |  |  |  |  |  |
| 23. | a. | Describe the functions of various functional pins of 8085 microprocessor. | CO1 | R | 8 |
|  | b. | Write short notes on microprocessor-based organization system. | CO1 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the interfacing methods of stepper motor with microcontroller. | CO6 | A | 8 |
|  | b | Sketch the interfacing diagram of LEDs with microcontroller. | CO6 | A | 4 |

**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 |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 13 | 16 | - | - | - | - | 29 |
| **CO2** | 8 | 2 | 7 | - | - | - | 17 |
| **CO3** | 6 | 13 | 16 | - | - | - | 35 |
| **CO4** | 2 | 3 | - | - | - | - | 5 |
| **CO5** | 1 | 17 | 4 | - | - | - | 22 |
| **CO6** | 3 | 1 | 12 | -- | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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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)**  **(Answer all the questions)** | | | | | | |
| 1. | Define drift current. | | CO1 | U | | 1 |
| 2. | Name the diode that is constructed by the combination of metal-to-N junction. | | CO1 | U | | 1 |
| 3. | Calculate the thermal voltage when the temperature is 30°C. | | CO4 | U | | 1 |
| 4. | Draw the symbol of Tunnel diode. | | CO2 | R | | 1 |
| 5. | Mention the behaviour of DIAC. | | CO4 | R | | 1 |
| 6. | Draw the schematic of a pi filter. | | CO3 | R | | 1 |
| 7. | What is the efficiency of half wave rectifier? | | CO4 | R | | 1 |
| 8. | Name the type of power amplifier that can amplify both positive and negative half cycles of the input signal. | | CO3 | U | | 1 |
| 9. | List the diodes that exhibit negative resistance effect. | | CO5 | R | | 1 |
| 10. | What will be the phase shift in an oscillator if the circuit has two RC network? | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | | |
| 11. | If the drift velocity of holes under a field gradient of 400v/m is 20m/sec. Find its mobility. | | CO1 | A | | 3 |
| 12. | Differentiate direct coupled and transformer coupled class A amplifier. | | CO2 | A | | 3 |
| 13. | Draw the output characteristics graph of CB configuration of a BJT and Justify the statement that BJT is a current control device. | | 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 | U | | 3 |
| 15. | 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 | | 3 |
| 16. | Define distortion and list the types of distortion. | | 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 the various methods of electron hole generation and recombination. | CO1 | R | | 6 |
|  | b. | Compare the features of the different types of semiconductor materials used widely. | CO1 | R | | 6 |
| 18. | a. | With neat diagram explain how a Zener diode can act as a voltage regulator irrespective of line and load variations. | CO1 | U | | 8 |
|  | b. | A bipolar NPN transistor has a DC current gain value , β = 99. Calculate the base current Ib required to switch a resistive load of 10mA. Also calculate current gain α | CO1 | AN | | 4 |
| 19. | a. | Describe in detail about various types of coupling used in amplifiers. | CO5 | U | | 6 |
|  | b. | Draw the block diagram of a regulated power supply rationalize the need of voltage regulators in it. | CO6 | U | | 6 |
| 20. | a. | With neat diagram explain the construction and working of a Full wave rectifier and derive the efficiency and ripple factor of it. | CO2 | AN | | 6 |
|  | b. | Justify the need of filters in rectifiers and discuss about the types of filters used. | CO4 | U | | 6 |
| 21. | a. | With neat diagram explain the different types of biasing circuits used in transistors. | CO2 | U | | 8 |
|  | b. | A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 10 Ω. The transformer r.m.s. secondary voltage from center tap to each end of secondary is 50 V and load resistance is 980 Ω. Find : (i) the mean load current (ii) the r.m.s. value of load current. | CO5 | A | | 4 |
| 22. | a. | Compare the VI characteristics of a transistor in CB and CE configuration and derive their input output parameters. | CO5 | U | | 6 |
|  | 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. | CO3 | U | | 6 |
| 23. | a. | Elaborate on Class A and Class B type of power amplifier and compare its performance with Class AB amplifier. | CO3 | U | | 8 |
|  | b. | Comment on the need of differential amplifiers. | CO4 | U | | 4 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Explain the construction and working of a RC phase shift Oscillator and derive the expression fo calculating the frequency of oscillation. | CO6 | U | 12 | |

**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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 8 | - | 4 | - | - | 22 |
| CO2 | 1 | 17 | 3 | 3 | - | - | 24 |
| CO3 | 4 | 10 | 8 | - | - | - | 22 |
| CO4 | 2 | 14 | - | 3 | - | - | 19 |
| CO5 | 1 | 12 | 4 | - | - | - | 17 |
| CO6 | 4 | 16 | - | - | - | - | 20 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2014** | **Duration** | **3hrs** |
| **Course Title** | **SIGNALS AND SYSTEMS FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the unit impulse function, δ (t) with the mathematical expression. | | CO1 | R | 1 |
| 2. | Write the steps to reduce Quantization error. | | CO1 | U | 1 |
| 3. | Express the time-shifted function f(t−t0) of a Fourier Transform. | | CO2 | U | 1 |
| 4. | Determine the Fourier series for a periodic function f(x) with period T, the coefficient a0. | | CO2 | U | 1 |
| 5. | State the principle used for trade-off between time and frequency resolution. | | CO3 | U | 1 |
| 6. | Define the visualization tool used in STFT produces a time-frequency representation. | | CO3 | R | 1 |
| 7. | Name the condition are used to define the existence of Laplace transform | | CO4 | R | 1 |
| 8. | Define the time shifting property of the Laplace transform. | | CO4 | U | 1 |
| 9. | What is the attenuation slope of a first-order filter? | | CO5 | U | 1 |
| 10. | Write the example of a complex system in biology. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate Time scaling and Amplitude scaling with the graphical representation. | | CO1 | An | 3 |
| 12. | Analyze the conditions required for a function's Fourier Transform to exist and evaluate why each condition is necessary for ensuring convergence. | | CO2 | An | 3 |
| 13. | Explain the Hanning window in signal processing, including its mathematical expression and key properties. | | CO3 | A | 3 |
| 14. | Explain the Initial and final value theorem of Laplace Transform. | | CO4 | A | 3 |
| 15. | Estimate the Z transform for the given X(n)= (2,3,4,5,0,4,5,6,3,2,4). | | CO5 | An | 3 |
| 16. | Describe the Concurrent, coupled process in signal processing. | | 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. | a. | Explain the classification of signals with examples for each category. | CO1 | An | 7 |
|  | b. | Determine the signal multiplication of the given signals. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. |  | Evaluate the Fourier series for the given function f(x)=ex. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the operation of adaptive Gabor transform and its benefits. | CO3 | U | 6 |
|  | b. | Describe the Pseudo-Wigner transform and its application and importance in detail. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the properties of Laplace transform. | CO4 | An | 6 |
|  | b. | Determine the inverse Laplace transform f(t) for the given | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the operation of Finite Impulse Response filter in detail. | CO5 | A | 6 |
|  | b. | Determine the z-transform for Z [1/n (n + 2)]. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Estimate the Nyquist interval for the given signal x(t)  x(t)=2000 Π t +3sin(6000Πt)+8(cos12000Πt). | CO1 | An | 6 |
|  | b. | Estimate the DTFT of the discrete-time signal x(n)= 3n u(n)- 2n u(n-1). | CO2 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Determine the inverse z-transform for x(z) using long division method.  X(z)= (1+ 2z-1 ) / 1 -2z-1 +z-2 | CO5 | A | 8 |
|  | b. | Describe the significance of filter attenuation slope and filter order. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the benefits of filtering used for removal of artifacts. | CO6 | An | 6 |
|  | b. | Explain the Methods involve in the event detection with its application and Challenges. | CO6 | An | 6 |

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

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the nature of biomedical signals |
| **CO2** | Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis |
| **CO3** | Classify systems based on their properties and determine the response of LTI system using Laplace transform |
| **CO4** | Apply Laplace transform and Z- transform to analyze continuous-time and discrete-time signals and systems |
| **CO5** | Summarize system properties based on impulse response by FIR, IIR filtering techniques. |
| **CO6** | Demonstrate mathematical tools in characterization of physiological system. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 5 | 16 | - | - | 23 |
| **CO2** | - | 2 | - | 21 | - | - | 23 |
| **CO3** | 1 | 13 | 3 | - | - | - | 17 |
| **CO4** | 1 | 1 | 3 | 12 | - | - | 17 |
| **CO5** | - | 5 | 20 | 3 | - | - | 28 |
| **CO6** | - | 3 | 1 | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **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. | Mesh analysis is generally used to determine \_\_\_\_\_\_\_\_\_.  a) Voltage b) Current c) Resistance d) Power. | | CO1 | U | 1 |
| 2. | If 70 J of energy is available for every 30 C of charge, what is the voltage? | | CO1 | R | 1 |
| 3. | Superposition theorem is valid for \_\_\_\_\_\_\_\_\_.  a) Linear systems  b) Non-linear systems  c) Both linear and non-linear systems  d) Neither linear nor non-linear systems | | CO2 | R | 1 |
| 4. | Justify the usage of reciprocity theorem. | | CO2 | R | 1 |
| 5. | Draw the phasor diagram to represent the two sine waves shown in Figure below. | | CO3 | U | 1 |
| 6. | The period of a sine wave is 20 milliseconds. What is the frequency? | | CO3 | R | 1 |
| 7. | The current lags behind the voltage by 90° in a pure \_\_\_\_\_\_\_\_\_\_ | | CO4 | U | 1 |
| 8. | Justify the RMS value of a sine wave. | | CO4 | R | 1 |
| 9. | P= 269 W, Q = 150 VAR (capacitive). The power in the complex form is  a) 150 – j269 VA  b) 150 + j269 VA  c) 269 – j150 VA  d) 269 + j150 VA | | CO5 | U | 1 |
| 10. | The transfer function of a system having the input as X(s) and output as Y(s) is?  a) Y(s)/X(s)  b) Y(s) \* X(s)  c) Y(s) + X(s)  d) Y(s) – X(s) | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the source-transformation technique. | | CO1 | An | 3 |
| 12. | State compensation theorem with suitable example. | | CO2 | U | 3 |
| 13. | A wire is carrying a direct current of 20 A and a sinusoidal alternating current of peak value 20 A. Find the rms value of the resultant current in the wire. | | CO3 | An | 3 |
| 14. | A 50 V resistor is connected in parallel with an inductive reactance of 30 V. A 20 V signal is applied to the circuit. Find the current in the inductive branch. | | CO4 | U | 3 |
| 15. | Justify the use of transfer function in circuit analysis. | | CO5 | An | 3 |
| 16. | Define H 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. | a. | Determine the currents in bridge circuit by using mesh analysis in Figure below | CO1 | A | 6 |
|  | b. | Write nodal equations for the circuit shown in Figure and find the power supplied by the 10V source. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Verify the reciprocity theorem for the circuit shown below. | CO2 | An | 8 |
|  | b. | Explain the concept of duals and the principle of duality. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | A series circuit shown in Figure comprising of a resistance of 10V and an inductance of 0.5H, is connected to a 100V source at t 5 0. Determine the complete expression for the current i(t). | CO3 | E | 6 |
|  | b. | A series RC circuit consists of a resistor of 10 V and a capacitor of 0.1 F as shown in Figure below. A constant voltage of 20 V is applied to the circuit at t = 0. Obtain the current equation. Determine the voltages across the resistor and the capacitor. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | A sinusoidal voltage v = 50 sin ωt is applied to a series RL circuit. The current in the circuit is given by i = 25 sin (ωt - 53°). Determine (a) apparent power, (b) power factor, and (c) average power | CO4 | A | 6 |
|  | b. | Write short note on power triangle with suitable example. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Determine the current i by the Laplace transform method if the circuit is driven by a voltage source as shown in Figure below. The initial value of the voltage across the capacitor and the initial current through the inductor are both zero. | CO5 | A | 8 |
|  | b. | The switch in the circuit shown has been in the position ‘a’ for a long time. At t 5 0, the switch is thrown to the position ‘b’. Find the current I as rational function of s. Find the time-domain expression for the current i. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Determine the current I in the circuit by using loop analysis in figure below: | CO1 | A | 8 |
|  | b. | Obtain the star-connected equivalent for the delta connected circuit shown in figure below. | CO2 | E | 4 |
|  |  |  |  |  |  |
| 23. | a. | To the circuit shown in Figure below, consisting a 1 kV resistor connected in series with a 50 mH coil, a 10 V rms, 10 kHz signal is applied. Find impedance Z, current I, phase angle θ, voltage across resistance VR, and the voltage across inductance VL. | CO3 | An | 6 |
|  | b. | A 500 V resistor, a 16 mH inductor, and a 25 mF capacitor are connected in parallel. Express the admittance of this parallel combination of elements as a rational function of s. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Derive the Z and Y parameters of a two port network and also draw the equivalent circuits in terms of Z and Y parameters. | CO6 | An | 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 AC/DC Circuits |
| **CO5** | Apply circuit theorems in real time |
| **CO6** | Analyze with network theorems on DC circuits |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 20 | 3 | - | - | 25 |
| **CO2** | 2 | 7 | - | 8 | 4 | - | 21 |
| **CO3** | 1 | 1 | - | 9 | 12 | - | 23 |
| **CO4** | 1 | 10 | 6 | - | - | - | 17 |
| **CO5** | - | 1 | 12 | 9 | - | - | 22 |
| **CO6** | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2019** | **Duration** | **3hrs** |
| **Course Title** | **HUMAN ANATOMY AND PHYSIOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the role of potassium ions in action potential. | | CO1 | R | 1 |
| 2. | State ‘All or None’ law. | | CO1 | R | 1 |
| 3. | List the cartilages of human body. | | CO2 | R | 1 |
| 4. | Name the two main divisions of the skeletal system. | | CO2 | R | 1 |
| 5. | Analyze the role of the diaphragm in the breathing process. | | CO3 | An | 1 |
| 6. | Summarize the pathway that air takes as it travels from the nose to the alveoli. | | CO3 | U | 1 |
| 7. | State the purpose of capillaries in tissue exchange. | | CO4 | U | 1 |
| 8. | Classify the blood groups in human body. | | CO4 | U | 1 |
| 9. | Identify the primary organs involved in the urinary system. | | CO5 | R | 1 |
| 10. | Locate the main components of the central nervous systems. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the role of adrenal gland in human body. | | CO1 | R | 3 |
| 12. | Name the types of joints in human skeletal system. | | CO2 | R | 3 |
| 13. | Construct a diagram that illustrates the anatomy of the respiratory system. | | CO3 | A | 3 |
| 14. | Compare the structure and function of arteries, veins and capillaries. | | CO4 | U | 3 |
| 15. | Describe the function of the kidneys in waste filtration. | | CO5 | U | 3 |
| 16. | Explain the primary functions associated with each lobe of the brain. | | 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. | a. | Explain the transport mechanism across cell membrane. | CO1 | U | 6 |
|  | b. | Differentiate between the roles of DNA and RNA in cells. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Distinguish between the different types of bones in terms of its functions. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the mechanism of ventilation. | CO3 | U | 6 |
|  | b. | Justify the statement: Respiratory system is essential for homeostasis. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the composition of blood. | CO4 | U | 6 |
|  | b. | Construct a flow chart to illustrate blood circulation through the heart and lungs. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the process of urine formation. | CO5 | U | 6 |
|  | b. | Analyze the regulation of blood pressure by kidneys. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Analyze the significance of different brain wave patterns in EEG readings. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate the interaction of respiratory system with the circulatory system. | CO3 | E | 6 |
|  | b. | Examine the role of red blood cells and hemoglobin in oxygen transport. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Construct a diagram illustrating the structure of a typical neuron and its components. | CO6 | A | 6 |
|  | b. | Interpret the steps involved in the processing of sensory information by the brain. | CO6 | A | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Recall the basic elements of human body. |
| **CO2** | Compare the major bones and their processes as they relate to each region of the body. |
| **CO3** | Interpret the major organs and components of the respiratory system and understand their functions. |
| **CO4** | Recognize the major organs and vessels of the cardiovascular system and understand their functions. |
| **CO5** | Summarize the basic components and functions of urinary and special sensing systems. |
| **CO6** | Demonstrate the structure and functions of nervous system. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 5 | 12 | - | - | - | - | 17 |
| **CO2** | 5 | 12 | - | - | - | - | 17 |
| **CO3** | - | 7 | 3 | 1 | 12 | - | 23 |
| **CO4** | - | 11 | 12 | - | - | - | 23 |
| **CO5** | 1 | 9 | - | 6 | - | - | 16 |
| **CO6** | 1 | 3 | 12 | 12 | - | - | 28 |
|  | | | | | | | **124** |



END SEMESTER EXAMINATION – NOV / DEC 2024

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| **Course Code** | **22BM2021** | **Duration** | **3hrs** |
| **Course Title** | **BIOMEDICAL SENSORS** | **Max. Marks** | **100** |

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| **Q.**  **No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | is the ability of a transducer to produce the same output for repeated applications of the same input. | | CO1 | U | 1 |
| 2. | The gradual deviation in a transducer’s output over time with a constant input is called . | | CO1 | R | 1 |
| 3. | Thermistors are temperature sensors whose resistance decreases with increasing temperature in the case of a coefficient thermistor. | | CO2 | R | 1 |
| 4. | In a capacitive sensor, changes in the capacitance are used to measure or proximity. | | CO2 | R | 1 |
| 5. | For a piezoelectric sensor, signal conditioning often includes a amplifier to convert the high-impedance signal to a low-impedance one. | | CO3 | U | 1 |
| 6. | Signal conditioning for electrochemical sensors typically involves a to stabilize the sensor's output and improve accuracy. | | CO3 | R | 1 |
| 7. | In a fiber-optic sensor, the core of the optical fiber guides light, while the surrounds the core to contain the light within. | | CO4 | U | 1 |
| 8. | In ultrasonic sensing, the time taken for an echo to return is directly proportional to the between the sensor and the object. | | CO4 | R | 1 |
| 9. | Baroreceptors detect changes in blood pressure by sensing the stretch of blood vessel walls, especially in the . | | CO5 | U | 1 |
| 10. | The Calomel electrode is commonly used as a reference electrode due to its stable and reproducible potential. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the importance of reproducibility in a transducer and how it differs from accuracy and precision. | | CO1 | An | 3 |
| 12. | Compare and contrast between the RTDs and Thermistors? | | CO2 | U | 3 |
| 13. | Analyze why piezoelectric sensors are not suitable for static force measurements but excel in dynamic applications. | | CO3 | An | 3 |
| 14. | What are some common applications of fiber-optic sensors? | | CO4 | U | 3 |
| 15. | Analyze the role of chemoreceptors in detecting blood pH and how this impacts respiratory function. | | CO5 | An | 3 |
| 16. | What is the electrolyte-electrode interface, and why is it important in bioelectric signal acquisition? | | 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. |  | Differentiate between static and dynamic characteristics of an input transducer and explain the key dynamic characteristics. | CO1 | U | 12 |

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| 18. | a. | Explain the working principle of a potentiometer and its use in displacement measurement. | CO2 | U | 6 |
|  | b. | Describe the working principle of a light-dependent resistor (LDR) and its applications. | CO2 | U | 6 |
| 19. |  | Explain the working principle of thermoelectric sensors and discuss their types, advantages, and industrial applications. | CO3 | U | 12 |
| 20. |  | Explain the fundamental principles of ultrasonic sensors. Analyze how they are applied in distance measurement and industrial automation. | CO4 | An | 12 |
| 21. |  | Discuss the differences between hot and cold receptors in thermo reception. Analyze their role in maintaining homeostasis and how they are integrated into temperature regulation models. | CO5 | An | 12 |
| 22. |  | Describe the function of baroreceptors in blood pressure regulation. Analyze how the concept of bar reception has influenced the design of blood pressure sensors in biomedical applications. | CO5 | An | 12 |
| 23. | a. | Explain the basic principles of optical sensing and how light interaction is used in optical sensors. | CO4 | U | 6 |
|  | b. | Describe the basic structure and working principle of fiber-optic sensors. Analyze their advantages in medical diagnostics. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the challenges posed by the electrode-skin interface in bio-potential measurements and how motion artifacts affect signal quality. | CO6 | An | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the need of a closed loop system with feedback and appreciate the use of sensors. |
| **CO2** | Interpret the errors in measurement by analyzing the performance characteristics of the sensors. |
| **CO3** | Develop advanced medical sensors based on the basic transduction principles. |
| **CO4** | Demonstrate the advanced sensor approach based on light and sound |
| **CO5** | Apply the suitable design criteria for developing a medical sensor for a particular application. |
| **CO6** | Summarize the use of electrodes in measuring electrical potential in human body |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 13 |  | 3 |  |  | 17 |
| **CO2** | 2 | 15 |  |  |  |  | 17 |
| **CO3** | 1 | 13 |  | 3 |  |  | 17 |
| **CO4** | 1 | 16 |  | 12 |  |  | 29 |
| **CO5** |  | 1 |  | 27 |  |  | 28 |
| **CO6** |  | 4 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **22BM2025** | **Duration** | **3hrs** |
| **Course Title** | **DIGITAL ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List four postulates used to simplify Boolean expression. | | CO1 | R | 1 |
| 2. | Convert (FA.B4)16 to binary | | CO1 | U | 1 |
| 3. | List the error detection codes. | | CO2 | R | 1 |
| 4. | Sketch a 3 variable K-map. | | CO2 | U | 1 |
| 5. | List two applications of parity checker. | | CO3 | R | 1 |
| 6. | Sketch a half subtractor. | | CO3 | U | 1 |
| 7. | Indicate the importance of enable input in latches. | | CO4 | U | 1 |
| 8. | Write the truth table of JK flip-flop. | | CO4 | U | 1 |
| 9. | Define MOD counter. | | CO5 | R | 1 |
| 10. | Define hardware programming. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Solve (1111-1100)2 through 1’s complement addition | | CO1 | A | 3 |
| 12. | Predict the merits of K-map method over Quine Mc Cluskey method. | | CO2 | A | 3 |
| 13. | Relate encoders with decoders. | | CO3 | U | 3 |
| 14. | Analyze ‘Race around condition’ that occurs in JK flip-flops. | | CO4 | An | 3 |
| 15. | Find the similarities between latches and flip-flops. | | CO5 | U | 3 |
| 16. | Differentiate between ROM and PROM. | | 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. | a. | Design a logic circuit for the given function. F=(A’+B’+C’).(A+B’+C’).(A+B’+C).(A+B+C’).(A+B+C) | CO1 | A | 5 |
|  | b. | Solve (1111-1010)2 using (i) Binary subtraction (ii) 1’s compliment method (iii) 2’s Compliment method. | CO1 | A | 7 |
|  |  |  |  |  |  |
| 18. | a. | Write a note on 3 binary coding system. | CO2 | A | 6 |
|  | b. | Develop a NAND implementation for the given expression.  F = W.X.Y + X.Y.Z + Y.Z.W | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Design a 2 bit comparator. | CO3 | A | 9 |
|  | b. | Construct a full adder circuit using logic gates. | CO3 | A | 3 |
|  |  |  |  |  |  |
| 20. | a. | Differentiate between combinational and sequential circuits. | CO4 | U | 4 |
|  | b. | Determine the reduced state diagram for the given Mealy model | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. | a. | Design a 4 bit UP/DOWN Ripple counter. | CO5 | A | 6 |
|  | b. | Explain SISO and PIPO shift register. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Design a 1:8 multiplexer. | CO3 | A | 7 |
|  | b. | Explain parity generators and their significance in error detection. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 23. | a. | Design a synchronous MOD10 counter. | CO5 | A | 8 |
|  | b. | Construct a Johnson counter using D flip-flop. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Assess various programmable logic devices in terms of structure, merits and demerits. | CO6 | E | 9 |
|  | b. | Write a note on TTL inverter. | CO6 | A | 3 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Compute the Number System Conversions |
| **CO2** | Simplify the Boolean Expression Using Various Simplification Techniques |
| **CO3** | Design Various Combinational Circuits |
| **CO4** | Simulate various Sequential Circuits |
| **CO5** | Implement Combinational Circuits Using PLD |
| **CO6** | Analyze Different Digital Logic Families |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 15 | - | - | - | 17 |
| **CO2** | 1 | 1 | 15 | - | - | - | 17 |
| **CO3** | 1 | 9 | 19 | - | - | - | 29 |
| **CO4** | 1 | 5 | 8 | 3 | - | - | 17 |
| **CO5** | 1 | 9 | 18 | - | - | - | 28 |
| **CO6** | - | 4 | 3 | - | 9 | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Indicate the use of electromyogram (EMG). | | CO1 | U | 1 |
| 2. | Define electronic conduction. | | CO1 | R | 1 |
| 3. | Name the part of human brain which regulates internal body temperature. | | CO2 | R | 1 |
| 4. | Write the expression for calculating body mass index. | | CO2 | A | 1 |
| 5. | Identify the function of spirometer. | | CO3 | R | 1 |
| 6. | Define ejection fraction. | | CO3 | R | 1 |
| 7. | Name the components of pacemaker. | | CO4 | R | 1 |
| 8. | List the types of permanent pacemakers. | | CO4 | R | 1 |
| 9. | Define minute ventilation. | | CO5 | R | 1 |
| 10. | List the types of waveforms required for electro diagnosis. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the schematic representation of normal ECG waveform. | | CO1 | A | 3 |
| 12. | List the different heat loss mechanism in human body. | | CO2 | R | 3 |
| 13. | Compare inspiratory reserve volume and expiratory reserve volume. | | CO3 | U | 3 |
| 14. | Write the significance of porous tip electrode. | | CO4 | A | 3 |
| 15. | Identify the advantages and disadvantages of peak airway pressures. | | CO5 | R | 3 |
| 16. | Differentiate faradic current and surging current. | | 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. | a. | Write the significance of Einthoven triangle. | CO1 | A | 5 |
|  | b. | Explain the working of ECG machine with neat block diagram. | CO1 | U | 7 |
|  |  |  |  |  |  |
| 18. | a. | Explain extravascular sensor in blood pressure measurement. | CO2 | U | 6 |
|  | b. | Describe the features of Palpatory method for blood pressure measurement. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Examine the working of ear oximeter with necessary diagrams. | CO3 | A | 6 |
|  | b. | Enumerate the functional elements of bedside patient monitoring system with neat diagram. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail about the features of external pacemaker. | CO4 | U | 5 |
|  | b. | Sketch the system architecture of implantable defibrillator and highlight its features. | CO4 | A | 7 |
|  |  |  |  |  |  |
| 21. | a. | Write short note on pressure-cycled ventilation. | CO5 | A | 6 |
|  | b. | Discuss about the significance of humidifier. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Describe the role of 10-20 electrodes placement system for EEG signal acquisition with necessary diagrams. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Analyze the techniques used for blood pH measurement with neat diagram. | CO2 | An | 9 |
|  | b. | Summarize the various methods used for heart rate measurement. | CO2 | U | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about the various features of spinal cord stimulator. | CO6 | U | 9 |
|  | b. | Sketch the schematic diagram of a diagnostic therapeutic stimulating unit. | CO6 | A | 3 |

**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 equipments |
| **CO4** | Illustrate the techniques for cardiac equipment |
| **CO5** | Assess the merits of the respiratory equipment based on its applications |
| **CO6** | Analyse the behavior of electrotherapy equipment |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 13 | 8 | 8 | - | - | - | 29 |
| **CO2** | 4 | 15 | 1 | 9 | - | - | 29 |
| **CO3** | 8 | 3 | 6 | - | - | - | 17 |
| **CO4** | 2 | 5 | 10 | - | - | - | 17 |
| **CO5** | 4 | 6 | 6 | - | - | - | 16 |
| **CO6** | 1 | 12 | 3 | - | - | - | 6 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2027** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL DIAGNOSTICS AND THERAPEUTIC EQUIPMENT II** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Differentiate between macroshock and microshock. | | CO1 | U | 1 |
| 2. | Illustrate the significance of lancet in glucometer. | | CO1 | U | 1 |
| 3. | List the common anesthetic agents used in anesthesia machine. | | CO2 | R | 1 |
| 4. | State the significance of soda lime used in anesthesia machine. | | CO2 | R | 1 |
| 5. | Justify the need for dialysis process. | | CO3 | A | 1 |
| 6. | State the working principle of shortwave diathermy. | | CO3 | R | 1 |
| 7. | Quote the frequency and wavelength of therapeutic microwaves. | | CO4 | R | 1 |
| 8. | Explain the principle of lithotripsy. | | CO4 | U | 1 |
| 9. | Define hearing aid. | | CO5 | R | 1 |
| 10. | Identify the type of pumps used to deliver medium to large volumes of therapeutic fluids. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare holter monitor with event monitor. | | CO1 | An | 3 |
| 12. | State the clinic use of entonox apparatus. | | CO2 | U | 3 |
| 13. | Differentiate between fistula and graft. | | CO3 | An | 3 |
| 14. | List the different methods of application of ultrasonic waves for therapy. | | CO4 | R | 3 |
| 15. | Illustrate the significance of biofeedback instrumentation. | | CO5 | U | 3 |
| 16. | Describe cryogenic therapy. | | 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. | a. | Describe the purpose of the Holter monitor in tracking heart rhythms over a 24 to 48-hour period. | CO1 | U | 6 |
|  | b. | Analyze the interaction process of different components of a mixture with the stationary and mobile phases to achieve separation in chromatography. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Examine the operation of the pneumatic system with a clear layout of the anesthesia machine. | CO2 | A | 6 |
|  | b. | Illustrate the use of Entonox apparatus in safely, ensuring proper administration of medical gases. | C02 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the effectiveness of main components of hemodialysis machine | CO3 | An | 6 |
|  | b. | Compare hemodialysis with peritoneal dialysis. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the characteristics and working principle of laser with relevant sketches. | CO4 | U | 8 |
|  | b. | Illustrate the major milestones of laser applications in biomedicine. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Examine the working mechanism of the tonometer, emphasizing pressure readings. | CO5 | A | 8 |
|  | b. | Compare the advantages and disadvantages of various types of ophthalmoscopes. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 22. | a. | Sketch a lithotripter. | CO4 | U | 4 |
|  | b. | Identify the main types of lithotripsy. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 23. | a. | Explain the clinical working principle of microwaves in diathermy equipment for treating musculoskeletal disorders. | CO3 | A | 8 |
|  | b. | Evaluate the performance of implantable infusion pumps used in clinical setting. | CO6 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Assess the significance of endoscopy in modern medicine. | CO6 | E | 6 |
|  | b. | Compare SXA with DXA. | CO6 | An | 6 |

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

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|  | **COURSE OUTCOMES** |
| **CO1** | Describe the principle involved in clinical and optical equipment |
| **CO2** | Identify the various therapeutic devices for pulmonary diseases. |
| **CO3** | Apply the appropriate therapeutic device related to kidney ailment. |
| **CO4** | Demonstrate the functions and applications of electrotherapy and lasers |
| **CO5** | Assess the merits and demerits of the diagnostic equipment for basic senses. |
| **CO6** | Design new therapeutic devices for application based on given specifications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** |  | 8 |  | 9 |  |  | 17 |
| **CO2** | 2 | 9 | 6 |  |  |  | 17 |
| **CO3** | 1 |  | 9 | 15 |  |  | 25 |
| **CO4** | 4 | 25 |  |  |  |  | 29 |
| **CO5** | 1 | 3 | 8 | 4 |  |  | 16 |
| **CO6** | 1 | 3 |  | 6 | 10 |  | 20 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2029** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRICAL AND ELECTRONICS FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the advantages of AC system. | | CO1 | R | 1 |
| 2. | Define crest factor. | | CO1 | R | 1 |
| 3. | Identify the type of material that can allow the current in one or more directions. | | CO2 | U | 1 |
| 4. | Differentiate between series and parallel circuit. | | CO2 | An | 1 |
| 5. | State Kirchhoff’s current law. | | CO3 | R | 1 |
| 6. | Define real power. | | CO3 | R | 1 |
| 7. | Distinguish between inductive and capacitive reactance. | | CO4 | E | 1 |
| 8. | Interpret the working principle of transformer. | | CO4 | A | 1 |
| 9. | Differentiate between core type and shell type transformer. | | CO5 | An | 1 |
| 10. | List the merits of IGBT. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the generation of AC voltage. | | CO1 | An | 3 |
| 12. | Analyze the different types of dependent sources. | | CO2 | An | 3 |
| 13. | Describe the construction of Synchronous motor. | | CO3 | U | 3 |
| 14. | Distinguish between short-shunt and long-shunt compound generator. | | CO4 | An | 3 |
| 15. | Explain the construction of n-channel JFET. | | CO5 | An | 3 |
| 16. | Interpret the output characteristics of p-channel JFET. | | 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. |  | Describe the types of DC circuit and their characteristics. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the construction and working principle of DC motors. | CO2 | An | 10 |
|  | b. | Distinguish between conductor and insulator. | CO2 | An | 2 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the operating modes of Silicon Controlled Rectifier. | CO3 | U | 10 |
|  | b. | Describe the I-V characteristics of JFET. | CO3 | U | 2 |
|  |  |  |  |  |  |
| 20. |  | Analyze the mechanism of Zener breakdown and Avalanche breakdown. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the types of binary code with example. | CO5 | An | 8 |
|  | b. | Analyze the working of digital thermometer. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 22. |  | Explain the block diagram of Microprocessor and its necessary tools. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe the purpose of Embedded system for the following tasks.   1. Data Collection 2. Data Communication 3. Data Processing 4. Monitoring | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the working principles of an energy meter. | CO6 | An | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Compute electric circuit parameters for simple problems |
| **CO2** | Understand the working principle and application of electrical machines |
| **CO3** | Analyze the characteristics of analogue electronic devices |
| **CO4** | Outline the basic concepts of digital electronics |
| **CO5** | Interpret the operating principles of measuring instruments |
| **CO6** | Recollect the application of electronics in medical world |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 12 | - | 3 | - | - | 17 |
| **CO2** | - | 1 | - | 16 | - | - | 17 |
| **CO3** | 2 | 15 | - | - | - | - | 17 |
| **CO4** | - | - | 1 | 15 | 1 | - | 17 |
| **CO5** | - | - | - | 28 | - | - | 28 |
| **CO6** | 1 | 12 | 3 | 12 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23BM2004** | **Duration** | **3hrs** |
| **Course Name** | **ICU AND OPERATION THEATRE EQUIPMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | **State the role of a surgical light.** | | CO1 | U | 1 |
| 2. | **What does an anesthetic machine do?** | | CO1 | R | 1 |
| 3. | Define the role of the CSSD in a hospital. | | CO2 | R | 1 |
| 4. | Write the primary function of a suction apparatus in a medical setting. | | CO2 | R | 1 |
| 5. | **Name a common monitor used in the ICU.** | | CO3 | U | 1 |
| 6. | What does an intracranial pressure monitor measure? | | CO3 | R | 1 |
| 7. | **Defibrillator is \_\_\_\_\_\_\_\_type of equipment.** | | CO4 | U | 1 |
| 8. | Define Cryosurgical Unit. | | CO4 | R | 1 |
| 9. | Write the function of the suction system in a medical facility. | | CO5 | U | 1 |
| 10. | How do pulse transformers contribute to patient electrical safety? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | **Analyse the advantages of using a robotic surgery system.** | | CO1 | An | 3 |
| 12. | What parameters are typically measured by an ABG machine, and why are they important? | | CO2 | U | 3 |
| 13. | List the key controls and measurements in a haemodialysis machine. | | CO3 | An | 3 |
| 14. | What is an IABP? How does it support cardiac function? | | CO4 | U | 3 |
| 15. | Analyse the importance of centralized gas supply systems (oxygen, nitrogen, and air) and suction systems in a hospital setting. | | CO5 | An | 3 |
| 16. | Explain the role of optocouplers and pulse transformers in enhancing patient electrical safety. | | 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. | a. | Explain about the Robotic Surgery System in detail with its application. | CO1 | U | 6 |
|  | b. | Explain in Detail about Surgical Instruments. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the design, components, and clinical applications of suction apparatus in healthcare settings. | CO2 | U | 6 |
|  | b. | Describe the key components of an effective biomedical waste management program and its significance in healthcare. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain in detail the Working Principle of a Haemodialysis Machine with advantages & Disadvantages. | CO3 | U | 6 |
|  | b. | Explain in detail the Classification of Medical Devices Based on Risk. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe the components and functions of a heart-lung machine and its significance in cardiac surgery. | CO4 | R | 6 |
|  | b. | Explain the various types of oxygenators used in cardiopulmonary bypass and their respective advantages. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the essential features of an operation theatre table and the importance of proper lighting in surgical procedures. | CO5 | R | 6 |
|  | b. | Explain the role of centralized air conditioning in hospitals and its impact on infection control and patient comfort. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the role and functions of the Central Sterile Services Department (CSSD) in healthcare facilities. | CO2 | U | 6 |
|  | b. | Discuss various methods of decontamination used in healthcare settings and their significance in infection control. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Differentiate between ICU, ICCU, ICMU, and CCU in terms of patient care and services provided. | CO3 | An | 6 |
|  | b. | Illustrate the function of incubators in healthcare settings and their significance. | CO3 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Identify and explain the various types of electrical hazards present in healthcare environments. | CO6 | R | 6 |
|  | b. | Define leakage current and explain its significance in the context of patient electrical safety. | CO6 | R | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Choose suitable surgical materials, decontamination method and management. |
| **CO2** | Design new monitoring devices for ICU |
| **CO3** | Assess the importance of critical care equipment based on their applications |
| **CO4** | Analyse the merits of the operation theatre equipment based on its applications. |
| **CO5** | Compare the various techniques and trends used in clinical diagnosis, therapy and surgery |
| **CO6** | Apply the knowledge acquired on patient safety in hospital premises. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 13 |  | 3 |  |  | 17 |
| **CO2** | 2 | 27 |  |  |  |  | 29 |
| **CO3** | 1 | 13 | 12 | 3 |  |  | 29 |
| **CO4** | 13 | 4 |  |  |  |  | 17 |
| **CO5** | 12 | 1 |  | 3 |  |  | 16 |
| **CO6** | 12 | 4 |  |  |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **23BM3001** | **Duration** | **3hrs** |
| **Course Title** | **MEDICAL INSTRUMENTATION DESIGN** | **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. | Explain central nervous system in detail. | CO1 | An | 12 |
|  | b. | Differentiate lymphatic system and cardiovascular system. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 2. | a. | Evaluate the role of electrodes used in biopotential measurement system | CO2 | E | 12 |
|  | b. | Write short notes on different types of EEG waveforms. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 3. | a. | Explain the block diagram, set up, applications, advantages, challenges and scope of research aspects in wireless EEG measurement system. | CO3 | An | 14 |
|  | b. | Summarize the scope of artificial intelligence in BIS monitoring. | CO3 | E | 2 |
|  |  |  |  |  |  |
| 4. | a. | Assess the design of any two blood flow measurement system. | CO4 | E | 8 |
|  | b. | Explain the design specifications of digital blood pressure monitoring system. | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explain mechanics of breathing. | CO5 | An | 10 |
|  | b. | Write notes on of instrumentation system for respiratory system. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 6. | a. | Assess the purpose, design consideration, design steps, applications and challenges involved in medical device interface system | CO4 | E | 10 |
|  | b. | Explain the design of heart lung machine in detail. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 7. | a. | Explain respiratory system in detail. | CO1 | An | 9 |
|  | b. | Discriminate voluntary and involuntary actions that happens in body. | CO1 | E | 7 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Summarize the legal and insurance requirements to be met in hospital management. | CO6 | E | 10 |
|  | b. | Correlate leakage current and line isolation systems. | CO6 | An | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the basic functions of various human physiological systems. |
| CO2 | Analyze the features of electrodes and the interfacing of circuits. |
| CO3 | Categorize the design procedures involved in neurological signal analysis. |
| CO4 | Analyze working of various measurement instruments related to cardiac activity. |
| CO5 | Design a suitable Instrumentation system for respiration analysis. |
| CO6 | Assess the medical device safety and testing of devices. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 25 | 7 | - | 32 |
| CO2 | - | - | 4 | - | 12 | - | 16 |
| CO3 | - | - | - | 14 | 2 | - | 16 |
| CO4 | - | - | - | 14 | 18 | - | 32 |
| CO5 | - | - | 6 | 10 | - | - | 16 |
| CO6 | - | - | - | 10 | 10 | - | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23BM3008** | **Duration** | **3hrs** |
| **Course Title** | **BIOMEDICAL ENGINEERING ENTREPRENEURSHIP** | **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. | Enumerate the process of entrepreneurship. | CO1 | R | 10 |
|  | b. | Illustrate the scope of entrepreneurship in biomedical engineering. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 2. |  | Examine the innovation in medical devices that impact towards  patient outcomes. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 3. | a. | Identify the scope for biomedical venture. | CO3 | U | 8 |
|  | b. | Discover the essential components for establishing a venture. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | Compute the process of market survey for entrepreneurship. | CO5 | A | 8 |
|  | b. | Assess the sources and challenges in funding for startups. | CO4 | E | 8 |
|  |  |  |  |  |  |
| 5. |  | Criticize the value proposition concepts for the Startup. | CO5 | An | 16 |
|  |  |  |  |  |  |
| 6. |  | Compile the recent technology developments in medical field. | CO5 | C | 16 |
|  |  |  |  |  |  |
| 7. | a. | Evaluate the government initiatives for entrepreneurial development. | CO4 | E | 10 |
|  | b. | Interpret the safety considerations of medical waste management. | CO6 | A | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Evaluate the processes involved in assessing the intellectual property of a medical device. | CO6 | E | 10 |
|  | b. | Formulate quality standards adapted for medical devices in India. | CO6 | C | 10 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Describe the role of biomedical engineers in entrepreneurship |
| CO2 | Interpret the background for biomedical engineers in entrepreneurship |
| CO3 | Acquire the skills and techniques required towards innovation |
| CO4 | Categorize the resources and funding agencies |
| CO5 | Judge the right product based on market needs |
| CO6 | Compile and quantify the opportunities and challenges |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 6 |  |  |  |  | 16 |
| CO2 |  |  | 16 |  |  |  | 16 |
| CO3 |  | 8 | 8 |  |  |  | 16 |
| CO4 |  |  |  |  | 18 |  | 18 |
| CO5 |  |  | 8 | 16 |  | 16 | 40 |
| CO6 |  |  | 6 |  | 10 | 10 | 26 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23BM3009** | **Duration** | **3hrs** |
| **Course Title** | **DEEP LEARNING FOR HEALTHCARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Analyze Back Propagation Network with a suitable example to illustrate its algorithm. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the principles of Deep Belief Networks and discuss their functionality. | CO2 | A | 10 |
|  | b. | Evaluate Convolutional Neural Network and highlight their advantages in image processing. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Illustrate the integration of Electronic Health Record systems with genomics and discuss its implications for patient care. | CO3 | An | 10 |
|  | b. | Enumerate the concepts of medical imaging and analyze their impact on diagnostic practices. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Summarize the advantages of digital therapeutics in healthcare field. | CO4 | A | 10 |
|  | b. | Discuss the role of biomarkers in medical imaging field to enhance diagnostics. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the steps to process small datasets in medical techniques and assess the associated challenges. | CO5 | E | 10 |
|  | b. | Explain data augmentation and outline its advantages for enhancing model performance. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Enumerate the methods to detect and prevent overfitting in deep learning models. | CO5 | An | 10 |
|  | b. | Explain Generative Adversarial Networks and compare their different types and applications. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Analyze the challenges on the application of deep learning in radiological equipment using a suitable sketch. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Create a model and deep learning algorithm for drug delivery applications. | CO6 | C | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Develop a deep learning concept, technique, and algorithm for use in ultrasound and MRI diagnostic devices. | CO6 | C | 20 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend the concept of deep learning |
| CO2 | Review the concepts of advanced neural networks. |
| CO3 | Analyse the deep learning techniques in computational medicine. |
| CO4 | Examine the importance of digital deep learning biomarkers. |
| CO5 | Compute the challenges in applying medical deep learning techniques. |
| CO6 | Summarize the features of deep learning in diagnostic and therapeutic devices. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | 20 | - | 10 | - | 30 |
| CO3 | - | - | - | 20 | - | - | 20 |
| CO4 | - | - | 20 | 20 | - | - | 40 |
| CO5 | - | - | 10 | 10 | 10 | - | 30 |
| CO6 | - | - | - | - | - | 40 | 40 |
|  | | | | | | | **180** |