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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the equivalent parameter for dashpot (B) in force-current analogy | | CO1 | U | 1 |
| 2. | State the basic components in mechanical Rotational system. | | CO1 | R | 1 |
| 3. | List any two frequency domain specifications. | | CO2 | R | 1 |
| 4. | Sketch the diagram of unit Ramp input signal. | | CO2 | A | 1 |
| 5. | Show the general form of output equation in state model. | | CO3 | U | 1 |
| 6. | Define state. | | CO3 | R | 1 |
| 7. | Recall the formula for centroid in root locus. | | CO4 | U | 1 |
| 8. | Calculate the number of branches of the root locus plot of a system which has 3 open loop poles and 2 open loop zeros. | | CO4 | R | 1 |
| 9. | Name the controller whose transfer function is | | CO5 | R | 1 |
| 10. | Identify the type of non-linearity shown in the figure. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain mason’s gain formula in detail. | | CO1 | An | 3 |
| 12. | Distinguish time response and frequency response in a control system. | | CO2 | U | 3 |
| 13. | Write any three properties of State transition matrix φ(t). . | | CO3 | A | 3 |
| 14. | Apply RH criteria and check the stability for the following system whose characteristic equation is  S4 + 8 S3 + 18 S2 + 16 S + 5 = 0 | | CO4 | A | 3 |
| 15. | Sketch the diagram of Lead –lag compensator and write the transfer function. | | CO5 | An | 3 |
| 16. | Distinguish linear and non-linear systems. | | 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. | Calculate the transfer function for the given mechanical system. | CO1 | A | 6 |
|  | b. | Develop the transfer function using block diagram reduction | CO1 | A | 6 |
| 18. |  | Compute the rise time, peak time, maximum peak overshoot and settling time for the closed loop transfer function shown below | CO2 | A | 12 |
| 19. | a. | Calculate the eigenvalues and eigenvectors of the matrix  A=. | CO3 | A | 8 |
|  | b. | Illustrate the state model from the given state equation  *+* | CO3 | A | 4 |
| 20. |  | The open loop transfer function of a unity feedback control system is given by | CO4 | A | 12 |
| 21. |  | Evaluate static error constants Kp, Kv, Ka for the unity feedback system whose open loop transfer function is  . | CO2 | A | 12 |
| 22. |  | The open loop transfer function of a unity feedback control system is given by  By applying Routh criterion, determine marginal value of K and frequency of sustained oscillations. | CO4 | A | 12 |
| 23. | a. | Describe the following controllers with block diagram and derive its transfer function  i) PI  ii) PID | CO5 | U | 8 |
|  | b. | Evaluate the following for a system whose damping ratio ϛ is 0.5 and natural frequency ωn is 8 rad/sec.  i) Resonant Peak  ii)Resonant frequency | CO2 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Interpret the non-linearity in physical system. | CO6 | U | 8 |
|  | b. | Explain the performance indices in control system. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Develop mathematical model 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 appropriate controller for the given specifications. |
| CO6 | Acquire knowledge on Optimal and Non-linear control. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 12 | 3 |  |  | 17 |
| CO2 | 1 | 3 | 25 | 4 |  |  | 33 |
| CO3 | 1 | 1 | 15 |  |  |  | 17 |
| CO4 | 1 | 1 | 27 |  |  |  | 29 |
| CO5 | 1 | 3 | 8 |  |  |  | 12 |
| CO6 |  | 12 | 4 |  |  |  | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Compare ECG and EEG electrodes. | | CO1 | U | 1 |
| 2. | Interpret an Einthoven triangle. | | CO1 | An | 1 |
| 3. | Comment on heart and pulse rate. | | CO2 | U | 1 |
| 4. | Write the general pH equation. | | CO2 | R | 1 |
| 5. | State faradays law of electromagnetic induction. | | CO3 | R | 1 |
| 6. | Outline the significance of apnea monitors. | | CO3 | U | 1 |
| 7. | Enlist few pacemaker batteries. | | CO4 | R | 1 |
| 8. | Define the term truncated defibrillator. | | CO4 | R | 1 |
| 9. | Explain the time cycled ventillators. | | CO5 | U | 1 |
| 10. | List any four currents used for therapeutic applications. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Outline about the origin of heart sounds. | | CO1 | R | 3 |
| 12. | Portray the design of a blood pO2 electrode used for measurement. | | CO2 | R | 3 |
| 13. | Illustrate the principle of indicator dilution method for CO measurement | | CO3 | U | 3 |
| 14. | Differentiate internal and external pacemakers. | | CO4 | U | 3 |
| 15. | Relate the assist mode in ventilators with control mode. | | CO5 | An | 3 |
| 16. | List various electrotherapy techniques. | | 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. | What is an ECG Lead? Describe various types of leads used for recording ECG signal. | CO1 | U | 6 |
|  | b. | Describe the essential components of an EEG machine with a detailed block diagram. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the working principle of an auscultation method of blood pressure measurement. | CO2 | U | 6 |
|  | b. | Illustrate a thermistor based clinical thermometer with a neat circuit. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Mention the significance of an oximeter and explain any one type of oximeter with a neat diagram. | CO3 | U | 8 |
|  | b. | Describe in detail the acquisition of various parameters from a bed side patient monitor. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Narrate the working principle of DC defibrillator. | CO4 | U | 4 |
|  | b. | Describe various modes of operation of the pacemakers. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 21. | a. | Detail about pneumatic and electronic ventilators. | CO5 | U | 8 |
|  | b. | Illustrate in detail the ventilator testing. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the constructional details of pO2 electrode. | CO2 | R | 4 |
|  | b. | Narrate the working principle of pulse oximetry. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 23. | a. | Explain how EMG is used to assess conduction velocity. | CO3 | U | 8 |
|  | b. | Compare the working principle and applications of ERG and EOG | CO3 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Enumerate the peripheral nerve stimulator circuit. | CO6 | U | 4 |
|  | b. | Describe the working principle of Interferential current therapy. | CO6 | U | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 13 |  | 1 |  |  | 17 |
| CO2 | 8 | 21 |  |  |  |  | 29 |
| CO3 | 1 | 24 |  | 4 |  |  | 29 |
| CO4 | 2 | 15 |  |  |  |  | 17 |
| CO5 |  | 9 |  | 7 |  |  | 16 |
| CO6 | 4 | 12 |  |  |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Sampling converts ­­­­\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_ signal. | | CO1 | U | 1 |
| 2. | Name the bioelectric signal related to the eye 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. | How does an s plane look like after the poles of Chebyshev filter is plotted? | | 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. | An EMG is accompanied by \_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Justify the need for finding the sampling frequency. | | CO1 | An | 3 |
| 12. | Substantiate digital response of a Butterworth filter using impulse invariant method. | | CO2 | U | 3 |
| 13. | Given an analogue time domain signal.  x(t)=sin(2π1000t)  Express in digital form for sampling frequency of 4000 Hz | | CO3 | An | 3 |
| 14. | What is flicker noise? | | 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. | a. | Given an discrete sequence x(n)={1,1,1,1,3,3,3,3}  Find X(k) using Decimation in Time FFT Algorithm. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | For the given analogue low pass filter specifications.  **0.7 ≤ |𝐻(𝑒 𝑗𝜔)| ≤ 1, 0 ≤ |𝜔| ≤ 0.2𝜋**  **|𝐻(𝑒 𝑗𝜔)| ≤ 0.3, 0.2𝜋 ≤ 𝜔 ≤ 0.6𝜋**   1. Draw the analogue filter specifications and find the ripple factors. 2. Find the pre-warping frequencies and write down the digital specifications of the low pass filter with illustration Find the poles of the analogue filter 3. Compute the order of the low pass filter (Chebyshev) | 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. | a. | Plot the magnitude frequency response for N=7 in an ideal low pass FIR filter using Hamming Window 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. | a. | Determine the transfer function H(z) for N=9 in an ideal bandpass filter using Hanning Window with | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | 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. | a. | 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 |

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|  | **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 / P | **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 – APRIL / MAY 2024**

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| **Course Code** | **18BM2013 / 17BM2012 / 15EI2017** | **Duration** | **3hrs** |
| **Course Name** | **MODELING OF PHYSIOLOGICAL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What does “capacitance” account for in mechanical system? | | CO1 | U | 1 |
| 2. | Give example for negative feedback physiological system. | | CO1 | R | 1 |
| 3. | What are two circulations related to heart known as? | | CO2 | R | 1 |
| 4. | What is Stroke Volume? | | CO2 | R | 1 |
| 5. | Rheology is defined as the study of \_\_\_\_\_\_\_\_\_\_ behavior. | | CO3 | U | 1 |
| 6. | The formula for calculating osmotic pressure is \_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | List one efferent response to cold. | | CO4 | R | 1 |
| 8. | Body temperature is controlled by balancing heat production against heat \_\_\_\_\_\_ | | CO4 | U | 1 |
| 9. | Give one example organ invloved in the excretory function. | | CO5 | R | 1 |
| 10. | Facultative reabsorption happens in the \_\_\_\_\_\_\_\_\_\_ tubule. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the various types of physiological systems. | | CO1 | R | 3 |
| 12. | What does Systemic vasoconstriction signify? | | CO2 | U | 3 |
| 13. | List the various factors which affect blood flow. | | CO3 | R | 3 |
| 14. | List the three phases of thermoregulation. | | CO4 | R | 3 |
| 15. | What are non-threshold substances in functionality of a kidney? Give an example. | | CO5 | U | 3 |
| 16. | List three important factors involved in oxygen transport. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | List out 6 differences between an engineering and a physiological control system. | CO1 | An | 6 |
|  | b. | Tabulate the various formulae associated with resistance and compliance of various physiological system with suitable illustrations. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Derive the Cardiac Output Qc for patient with myocardial damage and plot the curve. Give Inferences. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate with neat diagram the basic CPB circuit and explain its parts in detail. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss in detail the various ways in which heat is lost through skin. | CO4 | An | 6 |
|  | b. | Explain in detail the process of thermoregulation in human body. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | List the different types of nephrons and its functionalities. | CO5 | R | 4 |
|  | b. | Give insights into the two types of reabsorption related to the functionalities of the kidney. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. | a. | 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 |
|  |  |  |  |  |  |
| 23. | a. | Compare the hypothermia caused due to general anesthesia and spinal anesthesia. | CO4 | An | 6 |
|  | b. | Explain the chemical regulation of ventilation with proper substantiation. | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about the oxygen transport and systemic oxygenation process. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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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 | 4 | 7 | - | 6 | - | - | 17 |
| CO2 | 2 | 3 | 6 | 24 | - | - | 35 |
| CO3 | 4 | 1 | - | - | 12 | - | 17 |
| CO4 | 4 | 1 | - | 12 | 6 | - | 23 |
| CO5 | 5 | 4 | - | 8 | - | - | 17 |
| CO6 | 3 | - | 12 | - | - | - | 15 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Enlist the physiological parameters commonly monitored using a multiparameter monitor. | | CO1 | U | 1 |
| 2. | State the principle of spectrophotometer. | | CO1 | R | 1 |
| 3. | List the sedative agents used in anesthesia machine. | | CO2 | R | 1 |
| 4. | Enlist the types of dialyzers. | | CO2 | R | 1 |
| 5. | Enlist the types of infrared sources used in physiotherapy. | | CO3 | U | 1 |
| 6. | State the significance of shock waves. | | CO3 | R | 1 |
| 7. | The process of natural release of photons due to transition of electrons is called\_\_\_\_\_ emission. | | CO4 | U | 1 |
| 8. | Mention the significance of ophthalmoscope. | | CO4 | R | 1 |
| 9. | Comment on cryogenic therapy. | | CO5 | U | 1 |
| 10. | \_\_\_\_\_\_\_\_ is a type of endoscope for viewing joints. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the significance of holter monitor. | | CO1 | An | 3 |
| 12. | Mention the need of vaporizer and flowmeter. | | CO2 | U | 3 |
| 13. | Comment on fistula and graft in dialysis. | | CO3 | An | 3 |
| 14. | List the therapeutic use of ultrasonic therapy. | | CO4 | U | 3 |
| 15. | Brief the significance of biofeedback instrumentation. | | CO5 | An | 3 |
| 16. | Justify the need for infusion and syringe pumps in clinical practice. | | 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. | Enumerate few protective circuits commonly used in hospitals to prevent macro shock and explain in brief. | CO1 | U | 9 |
|  | b. | Justify how protective circuits commonly used in hospitals prevents macro shock in hospital environments. | CO1 | An | 3 |
|  |  |  |  |  |  |
| 18. | a. | Sketch a boyle’s machine and explain its working principle in detail. | CO2 | U | 9 |
|  | b. | Comment on the significance of Entonox apparatus. | CO2 | An | 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. | Explain the principle of short-wave diathermy in treating musculoskeletal disorders and discuss its types. | CO4 | U | 6 |
|  | b. | Brief the working principle of ND-YAG Laser. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | With a neat sketch, explain the diagnosing method of audiometer. | CO5 | U | 6 |
|  | b. | Relate 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. | With a neat circuit, explain the working of tonometer. | CO5 | U | 6 |
|  | b. | Discuss implantable infusion pump in detail. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain various types of BMD measurement techniques. | CO6 | U | 8 |
|  | b. | Explain the role of endoscopes of diagnosis of disorders. | CO6 | U | 4 |

**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 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 | 10 | - | 6 | - | - | 17 |
| **CO2** | 2 | 12 | - | 3 | - | - | 17 |
| **CO3** | 1 | 10 | - | 6 | - | - | 17 |
| **CO4** | 1 | 28 | - | - | - | - | 29 |
| **CO5** | - | 25 | - | 3 | - | - | 28 |
| **CO6** | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18EI2009 / 14EI2048** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTATION AND CONTROL** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Classify instruments based on their functions. | | CO1 | R | 1 |
| 2. | Define precision. | | CO1 | R | 1 |
| 3. | Which transducer converts heat energy into electrical energy? | | CO2 | U | 1 |
| 4. | Give the applications of measurement systems. | | CO2 | R | 1 |
| 5. | Electromagnetic flow meter is not suitable for which kind of fluids. | | CO3 | U | 1 |
| 6. | Define negative temperature coefficient. | | CO3 | R | 1 |
| 7. | List the basic elements used for modelling mechanical translational system. | | CO4 | U | 1 |
| 8. | Write the rule for eliminating negative feedback loop. | | CO4 | R | 1 |
| 9. | Find the order and Type for system having G(s)=1/S2 (s+1). | | CO5 | U | 1 |
| 10. | Write the equation for phase margin. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is calibration? List the reasons for having instruments calibrated. | | CO1 | R | 3 |
| 12. | Define elastic transducers. | | CO2 | U | 3 |
| 13. | List the applications of **S**train gauges. | | CO3 | U | 3 |
| 14. | Write the Mason's gain formula. | | CO4 | U | 3 |
| 15. | Define Damping ratio. | | CO5 | R | 3 |
| 16. | How to choose controller settings that satisfy both gain margin and phase margin? | | 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. |  | Describe the fundamental measurement process and draw the block diagram of generalized measurement system with example. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Describe the construction and working of XY recorder. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Discuss the constructional features of bourdon-tube pressure gauge. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain briefly the construction and working of a thermocouple. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Describe the working principle of strain gauge with neat sketch and explain the different types of strain gauge. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | With neat diagram, explain the construction and working of hot-wire anemometer. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain open loop and closed loop control system with an example. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Construct Routh array and determine the stability of the system represented by the characteristic equation. Comment on the location of the roots of characteristic equation. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the concept of Mechanical Measurement. |
| CO2 | Summarize the principle of operation of different types of sensors used in the measurement of various physical variables. |
| CO3 | Describe the concept of Viscosity And Force measurement. |
| CO4 | Recognize the type of the control system and to express the transfer function of the system. |
| CO5 | Analyse the time response of various order of the system. |
| CO6 | Analyse the Concept of stability. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | - | 12 | - | - | - | 17 |
| CO2 | 1 | 16 | - | - | - | - | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | 3 | 28 | 12 | - | - | - | 43 |
| CO6 | 1 | - | - | 12 | - | - | 13 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2006** | **Duration** | **3hrs** |
| **Course Name** | **GRAPHICAL SYSTEM DESIGN FOR BIOMEDICAL ENGINEERS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Recall the importance of dataflow in LabVIEW. | | CO1 | R | 1 |
| 2. | Define Polymorphism. | | CO1 | U | 1 |
| 3. | List the objects available in front panel. | | CO2 | R | 1 |
| 4. | State the benefits of using a formula node. | | CO2 | U | 1 |
| 5. | Name any two debugging tools in LabVIEW. | | CO3 | R | 1 |
| 6. | Expand TCP. | | CO4 | R | 1 |
| 7. | Recall VI properties. | | CO4 | U | 1 |
| 8. | Define subVI. | | CO3 | U | 1 |
| 9. | Represent the colour code for Boolean datatype. | | CO5 | R | 1 |
| 10. | Interpret Coercion. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between traditional instrument and virtual instrument. | | CO1 | U | 3 |
| 12. | Discuss the working of property node with an example. | | CO2 | U | 3 |
| 13. | Interpret the different types of variables used in LabVIEW for data sharing and communication between VIs. | | CO4 | U | 3 |
| 14. | State the benefits of simple state machine. | | CO3 | U | 3 |
| 15. | Describe the working of FOR loop with an example. | | CO5 | A | 3 |
| 16. | Discuss the applications of LabVIEW in assistive technology. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the different palettes present in LabVIEW software environment for developing an application. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the datatypes and data structures used in LabVIEW. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Develop a LabVIEW application that utilizes queues to manage data flow between processes. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain how the queued message handler enhances communication and synchronization between different processes in LabVIEW. | CO5 | U | 8 |
|  | b. | Design a simple state machine for a healthcare application. | CO6 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the parameters involved in profile memory and performance management of a LabVIEW application. | CO3 | AN | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the different types of Error handling VIs. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the steps in creating and editing an icon and building a connector pane. | CO2 | U | 8 |
|  | b. | Illustrate the working of case structure with an example. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design a VI to process and analyze the R-R interval of an ECG signal. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of LabVIEW programming |
| CO2 | Interface with real time signals |
| CO3 | Analyze 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 | 1 | 24 |  |  |  |  | 25 |
| CO3 | 1 | 16 |  | 12 |  |  | 29 |
| CO4 | 1 | 4 | 12 |  |  |  | 17 |
| CO5 | 1 | 9 | 7 |  |  |  | 17 |
| CO6 |  |  | 19 |  |  |  | 19 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2007** | **Duration** | **3hrs** |
| **Course Name** | **BIOMEMS TECHNOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Illustrate the working principle of microsensor. | | CO1 | U | 1 |
| 2. | Write down the various typical MEMS and microsystem products. | | CO1 | R | 1 |
| 3. | For monochrome display the pitches in the GLV are\_\_\_\_\_\_\_\_ | | CO2 | R | 1 |
| 4. | Ribbon switching occurs in order of\_\_\_\_\_\_\_\_\_ | | CO2 | R | 1 |
| 5. | List down the various properties of fluid. | | CO3 | U | 1 |
| 6. | Give suitable example which works on the principle of thermocapillary effect. | | CO3 | R | 1 |
| 7. | What is the difference between photolithography and x-ray lithography? | | CO4 | U | 1 |
| 8. | Give an example for 2D materials. | | CO4 | R | 1 |
| 9. | Write the use of microneedle. | | CO5 | U | 1 |
| 10. | What is the size of nanoscale? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | With neat sketch explain the elements of MEMS system. | | CO1 | An | 3 |
| 12. | Explain optical switch used in MOEMS. | | CO2 | U | 3 |
| 13. | Compare electro wetting and optoelectrowetting. | | CO3 | An | 3 |
| 14. | List the properties of materials used in micromachining. | | CO4 | U | 3 |
| 15. | Tabulate some of the software used for designing and testing. | | CO5 | An | 3 |
| 16. | List the types of nanomaterial characterization. | | 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. |  | With neat sketch explain the applications of microactuators. | CO1 | A | 12 |
| 18. | a. | Write short notes on Light modulators. | CO2 | A | 6 |
|  | b. | Write short notes on Beam splitters. | CO2 | A | 6 |
| 19. | a. | Define microfluidic actuation. Explain in detail about dielectroporosis actuation. | CO3 | An | 8 |
|  | b. | Write down the various properties of fluid. | CO3 | A | 4 |
| 20. | a. | Define lithography. Explain the various steps of photolithography in detail with neat diagram. | CO4 | An | 12 |
| 21. | a. | What is the use of atomic force microscope? Discuss its principle of operation in detail with relevant diagram. | CO5 | An | 10 |
|  | b. | What are the important application of nano-devices in biomedical engineering? | CO5 | An | 2 |
| 22. | a. | Describe about the DNA sensors with its application. | CO4 | A | 4 |
|  | b. | Explain the various hybridization types of DNA Sensors with neat diagram in detail. | CO4 | A | 8 |
| 23. |  | With neat sketch explain in detail about the Etching process and its types. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Give a brief note on Carbon Nanotube. | CO6 | U | 4 |
|  | b. | Explain the various biological applications of Carbon nanotubes in detail. | CO6 | An | 8 |

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

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|  | **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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO2 | 2 | 3 | 12 | - | - | - | 17 |
| CO3 | 1 | 1 | 4 | 11 | - | - | 17 |
| CO4 | 1 | 4 | 12 | 12 | - | - | 29 |
| CO5 | - | 1 | - | 15 | - | - | 16 |
| CO6 | - | 4 | 12 | 8 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Hypothesis. | | CO1 | R | 1 |
| 2. | Expand LMS algorithm. | | CO1 | R | 1 |
| 3. | Write the formula for constructing decision tree. | | CO2 | A | 1 |
| 4. | What is the biological term for nodes? | | CO2 | U | 1 |
| 5. | Expand LSTM. | | CO3 | R | 1 |
| 6. | Defuzzification converts ------ into ------- | | CO3 | R | 1 |
| 7. | Write an example for fuzzification. | | CO4 | A | 1 |
| 8. | Human brain contains………...number of neurons. | | CO4 | U | 1 |
| 9. | Genetic algorithms belong to……………. Algorithms. | | CO5 | U | 1 |
| 10. | **True or False**  Mamdani approach is better than Takagi Sugeno’s approach. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | By diagrammatically represent the difference between Machine learning. | | CO1 | An | 3 |
| 12. | Briefly explain the Decision tree model with suitable block diagrams. | | CO2 | An | 3 |
| 13. | List out the types of Taxonomy of Artificial Neural Network. | | CO3 | R | 3 |
| 14. | Define Convolutional networks. | | CO4 | R | 3 |
| 15. | Draw the block diagram of Fuzzy logic control. | | CO5 | An | 3 |
| 16. | Apply the 5 point crossover method and find the value  100100  110011 | | 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. | Describe the types of machine learning in detail. | CO1 | R | 6 |
|  | b. | Apply the concept of Maximally specific hypothesis and find out  the most general hypothesis for given table.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **S.no** | **Origin** | **Manufacturer** | **color** | **Year** | **Charging Type** | **Class** | | h1 | India | Lenovo | Red | 2020 | B | +Ve | | h2 | India | Lava | Blue | 2020 | B | +Ve | | h3 | China | Lava | Black | 2021 | C | -Ve | | h4 | China | Lenovo | Blue | 2021 | C | +Ve | | h5 | Japan | Lenovo | Red | 2022 | B | -Ve | | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18 | a. | Apply the concept of Naive Bayes Classifier for following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Day** | **Outlook** | **Temperature** | **Humidity** | **Wind** | **Play Tennis** | | D1 | Sunny | Hot | High | Weak | No | | D2 | Sunny | Hot | High | Strong | No | | D3 | Overcast | Hot | High | Weak | Yes | | D4 | Rain | Mild | High | Weak | Yes | | D5 | Rain | Cool | Normal | Weak | Yes | | D6 | Rain | Cool | Normal | Strong | No | | D7 | Overcast | Cool | Normal | Strong | Yes | | D8 | Sunny | Mild | High | Weak | No | | D9 | Sunny | Cool | Normal | Weak | Yes | | D10 | Rain | Mild | Normal | Weak | Yes | | D11 | Sunny | Mild | Normal | Strong | Yes | | D12 | Overcast | Mild | High | Strong | Yes | | D13 | Overcast | Hot | Normal | Weak | Yes | | D14 | Rain | Mild | High | Strong | No | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Justify the rule of McCulloch-Pitts neuron and solve any basic gates using the same. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Elaborate in detail about evolution of neural network. | CO4 | U | 6 |
|  | b. | Explain in detail about taxonomy of ANN. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | It is necessary to compare 2 sensors based upon their detection and gain setting the table of gain settings and sensor detection levels with a standard item being monitored providing typical membership values to represent the detection levels for each sensor is given in table.   |  |  |  | | --- | --- | --- | | **Gain setting** | **D1 Sensor** | **D2 Sensor** | | 0 | 0 | 0 | | 10 | 0.2 | 0.35 | | 20 | 0.35 | 0.25 | | 30 | 0.65 | 0.8 | | 40 | 0.85 | 0.95 | | 50 | 1 | 1 |   Find i) D1UD2  ii) D1 n D2  iii) Compliment of D1  iv) Compliment of D2  v) D1/D2  vi) D2/D1 | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write a learning system algorithm based on decision tree method. | CO2 | C | 6 |
|  | b. | Illustrate a case study related to health care applications based on ANN. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Apply the concept of linear separability for basic gates and find the linear separation. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Apply the concept of Genetic algorithm and maximize the function with Xin interval [0,31]. | CO6 | A | 12 |

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|  | **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 / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 8 | - | 6 | 3 | - | - | 17 |
| CO2 | - | 1 | 13 | 3 | - | 6 | 23 |
| CO3 | 5 | - | 12 | - | 12 | - | 29 |
| CO4 | 4 | 18 | 1 | - | - | - | 23 |
| CO5 | - | 1 | - | 3 | 12 | - | 16 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two benefits of telemedicine. | | CO1 | R | 1 |
| 2. | Define Telediagnostics. | | CO1 | U | 1 |
| 3. | Mention the copyright law. | | CO2 | R | 1 |
| 4. | Interpret malware. | | CO2 | U | 1 |
| 5. | List the different medium of service in Public Switched Telephone Networks. | | CO3 | R | 1 |
| 6. | Interpret the concept of Frequency Division Multiple Access. | | CO3 | U | 1 |
| 7. | Mention any two data acquisition system. | | CO5 | R | 1 |
| 8. | Give few examples of SSD. | | CO5 | R | 1 |
| 9. | Apply shift Cipher and encrypt the message “medicine” (Assume key=2) | | CO4 | U | 1 |
| 10. | List the protocols used by the application layer in OSI Model. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discuss the delivery modes in Telemedicine. | | CO1 | U | 3 |
| 12. | Describe the types of firewalls that helps in ensuring the privacy and security in a healthcare system. | | CO2 | U | 3 |
| 13. | Summarize the categories of LEO satellite. | | CO3 | U | 3 |
| 14. | Describe the systems used for displaying medical data. | | CO5 | U | 3 |
| 15. | Distinguish symmetric and asymmetric key cryptography. | | CO4 | U | 3 |
| 16. | Describe the applications of telemedicine in health education and self-care. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the essential parameters in Telemedicine and processes involved in transmitting and receiving the medical data with necessary diagrams. | CO1 | U | 9 |
|  | b. | Describe the dataflow in communication technologies. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Explain the ethical and legal aspects of telemedicine in terms of Patient Rights and Consent. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the communication through mobile technology and its transition to different generations. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the different types of Storage devices used for storing healthcare information. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe HL7 standard in facilitating data exchange between healthcare systems. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the concept of cryptography and its types with necessary diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the DICOM standard and its significance in medical imaging data management. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the processes involved in telesurgery. | 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 | 16 | - | - | - | - | 17 |
| **CO2** | 1 | 16 | - | - | - | - | 17 |
| **CO3** | 1 | 16 | 12 | - | - | - | 29 |
| **CO4** | 1 | 28 | - | - | - | - | 29 |
| **CO5** | 2 | 3 | 12 | - | - | - | 17 |
| **CO6** | - | - | 15 | - | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2010** | **Duration** | **3hrs** |
| **Course Name** | **BIOMATERIALS AND ARTIFICIAL ORGANS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Biomaterials. | | CO1 | R | 1 |
| 2. | State few polymers used as biomaterials. | | CO1 | R | 1 |
| 3. | List few methods to modify the surfaces of biomaterials. | | CO2 | R | 1 |
| 4. | Mention the gas used for immobilization of molecules. | | CO2 | R | 1 |
| 5. | List the properties of biomaterials. | | CO3 | U | 1 |
| 6. | Define biocompatibility. | | CO3 | R | 1 |
| 7. | Mention the materials used for articular cartilage replacement. | | CO4 | R | 1 |
| 8. | State the disadvantage of liquid silicone to augment breast tissue. | | CO4 | U | 1 |
| 9. | List the parts of an oxygenator. | | CO5 | R | 1 |
| 10. | Mention the types of dialyzers. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the concept of fatigue. | | CO1 | U | 3 |
| 12. | Differentiate cell absorption and cell adsorption. | | CO2 | U | 3 |
| 13. | Compare thrombogenic and nonthrombogenic devices. | | CO3 | U | 3 |
| 14. | Define the term blood compatibility. | | CO4 | R | 3 |
| 15. | Mention the biomaterials employed for artificial heart. | | CO5 | R | 3 |
| 16. | Differentiate diffusion and osmosis. | | 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 mechanical properties of materials. | CO1 | U | 6 |
|  | b. | Explain the nature of the plasma environment. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the various methods for modifying the surfaces of materials. | CO2 | U | 6 |
|  | b. | Explain the effects of interactions of proteins in biomaterial surface. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Compare the features of assays. | CO2 | U | 6 |
|  | b. | Explain the DLVO model for cell adhesion. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the requirements of tissue compatibility evaluation testing laboratory. | CO3 | U | 6 |
|  | b. | Explain the mechanical and performance requirements of biomaterials. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the factors that are important in the acquisition and handling of blood in BMI experiments. | CO4 | U | 6 |
|  | b. | Discuss about functional load carrying and supporting implants. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Categorize the soft tissue implants based on their functions. | CO4 | U | 6 |
|  | b. | Discuss the characteristics of materials employed in oxygenators. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of air and bone conduction. | CO5 | U | 6 |
|  | b. | Explain the physiology of ear. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the working principle of a hemodialysis machine. | CO6 | U | 6 |
|  | b. | Explain the features of biomaterials used in artificial heart. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 27 |  |  |  |  | 29 |
| CO3 | 4 | 13 |  |  |  |  | 17 |
| CO4 | 4 | 19 |  |  |  |  | 23 |
| CO5 | 4 | 18 |  |  |  |  | 22 |
| CO6 | 1 | 15 |  |  |  |  | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is the primary focus of safety testing in medical devices? | | CO1 | U | 1 |
| 2. | List some common causes of failure in medical devices. | | CO1 | R | 1 |
| 3. | Identify the purpose of external visual inspection in safety and risk management. | | CO2 | R | 1 |
| 4. | How is measurement used in safety and risk management? | | CO2 | R | 1 |
| 5. | How do medical devices impact the environment in terms of ecological safety? | | CO3 | U | 1 |
| 6. | State the environmental conditions that should be considered when operating medical devices to ensure safety. | | CO3 | R | 1 |
| 7. | Define macroshock and microshock in the context of electrical safety. | | CO4 | U | 1 |
| 8. | Why is protection against leakage currents important in medical device safety? | | CO4 | R | 1 |
| 9. | Mention the role of Institutional Review Boards (IRBs) in medical device research involving human subjects. | | CO5 | U | 1 |
| 10. | What does the Active Implantable Medical Devices Directive (AIMDD) regulate? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the concept of failure in the context of medical devices. | | CO1 | An | 3 |
| 12. | Explain the importance of failure assessment in safety and risk management. | | CO2 | U | 3 |
| 13. | Discuss the importance of environmental and ecological safety in the handling of medical devices. | | CO3 | An | 3 |
| 14. | What are the key aspects of mechanical and electrical safety in medical devices? | | CO4 | U | 3 |
| 15. | Discuss the significance of medical device standards and regulations. | | CO5 | An | 3 |
| 16. | Discuss the medical device classification, registration, and adherence to recognized standards. | | 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. | Discuss the basics of reliability and the concept of failure in the context of medical devices. | CO1 | R | 6 |
|  | b. | Explain about the failure of medical devices, including its causes and types. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the importance of failure assessment and documentation in safety and risk management and also discuss the procedures involved in external and internal visual inspections for assessing failures. | CO2 | E | 6 |
|  | b. | Analyze the responsibilities of manufacturers and physicians in managing risks associated with medical devices. How do liability considerations play a role in this process? | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the environmental impact of improper handling and disposal of medical devices within healthcare facilities. | CO3 | U | 6 |
|  | b. | Explain the significance of ecological safety in the operation of medical devices and evaluate the effectiveness of regulatory standards in promoting this aspect. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the principles of mechanical and electrical safety in the context of medical devices. | CO4 | U | 6 |
|  | b. | Discuss the role of magnetic fields and compatibility in ensuring mechanical and electrical safety in medical devices. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the significance of Good Manufacturing Practices (GMPs) in the context of medical device standards and regulations. Provide examples illustrating how adherence to GMPs ensures product quality and safety. | CO5 | An | 6 |
|  | b. | Explain the concept of Investigational Device Exemptions (IDEs) and their role in medical device research and development & also describe the key components of an IDE application and the significance of Institutional Review Boards (IRBs) in the IDE process. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | What are the key components of the Medical Devices Directives (MDD)? Explain the process involved in ensuring compliance with these directives. | CO3 | R | 6 |
|  | b. | Differentiate between the Active Implantable Medical Devices Directive (AIMDD) and the In Vitro Diagnostic Medical Devices Directive (IVDMDD). | CO3 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of environmental safety and its significance in relation to interference with the environment and also elaborate on the importance of ecological safety in maintaining a sustainable environment. | CO4 | C | 6 |
|  | b. | Discuss safety and risk management in the context of medical devices and also explain the concept of risk, the process of deciding on acceptable risk, and the factors important to medical device risk assessment. | CO4 | C | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the basic assumptions in safety technology regarding magnetic fields and compatibility, and discuss the concept of safety classes in this context. | CO6 | An | 6 |
|  | b. | Explain in detail about ensuring safety in Medical Devices. Also elaborate on the holistic approach to Handling, Environmental, and Ecological Concerns. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **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** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 13 | 1 | - | 3 | - | - | 17 |
| **CO2** | 2 | 3 | - | - | 12 | - | 17 |
| **CO3** | 1, | 13 | - | 3 | - | - | 17 |
| **CO4** | 1 | 16 | - | - | - | 12 | 29 |
| **CO5** | 1 | - | - | 15 | - | - | 16 |
| **CO6** | 1 | 3 | - | 24 | - | - | 28 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The up and down motion of the wrist is termed as ……………….. | | CO1 | A | 1 |
| 2. | List the two broad classification of robot arm movement. | | CO2 | A | 1 |
| 3. | Mention the types of work envelope covered by robotic arm movement. | | CO1 | U | 1 |
| 4. | Name the first ever entertainment robot. | | CO2 | R | 1 |
| 5. | Define worldspace in Robots. | | CO3 | R | 1 |
| 6. | In robot vision, \_\_\_\_\_\_ involves the partitioning of an image into an object of interest. | | CO3 | R | 1 |
| 7. | Name the types of fiber optic cable that is classified based on refreactive index profile. | | CO4 | A | 1 |
| 8. | How does LIDAR help in ranging? | | CO5 | U | 1 |
| 9. | Name the path planning algorithm that decides the path with attractive force and repulsive force. | | CO5 | 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. | Comment on the term ROBOT with its meaning. | | CO1 | U | 3 |
| 12. | Comment on the term spatial manipulator. | | CO1 | R | 3 |
| 13. | Differentiate local approach and global approach in path planning. | | CO2 | U | 3 |
| 14. | Give the steps involved in digitization of data. | | CO3 | A | 3 |
| 15. | List the challenges in developing a mobile robot. | | CO4 | U | 3 |
| 16. | Mention the design considerations of a robot manipulator. | | 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. | a. | Comment on the terminologies open loop system and closed loop system and justify the need and advantages of closed loop system over open loop system. | CO1 | R | 2 |
|  | b. | With the help of the neat diagram explain the Anatomy of Robot and the four most common configurations of Robot. | CO1 | U | 10 |
| 18. | a. | With neat diagram discuss the Degrees of freedom of wrist. | CO2 | U | 4 |
|  | b. | Elaborate on the different drive systems used to drive the robot manipulators. | CO2 | A | 8 |
| 19. |  | Derive the forward and reverse kinematics of a robot with 2-Degree of freedom for the vector for link 1 and link 2 | CO1 | U | 12 |
| 20. |  | Discuss in detail the process of image acquisition and processing that would help the robot in sensing. | CO3 | U | 12 |
| 21 |  | Using Dijkstra Algorithm determine the shortest path from the source A to all vertices in the given graph to reach the destination F. | CO3 | A | 12 |
| 22. | a. | Comment on any four static characteristics of a sensor. | CO4 | U | 2 |
|  | b. | Elaborate on tactile sensors and proximity sensors with specific to robotic applications. | CO4 | A | 10 |
| 23. |  | List the four common path planning algorithms and elaborate on A\* algorithm and compare the same with D\* algorithm, | CO5 | R | 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 surgical robots in Cardiac Surgery. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 | Classify the performance to various sensors to its environment |
| CO5 | Recommend the suitable principles for specific conditions |
| 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 | 6 | 3 | 10 |  |  |  | 19 |
| CO2 | 2 | 3 | 18 |  |  |  | 23 |
| CO3 | 1 | 3 | 18 |  |  |  | 22 |
| CO4 | 3 | 2 | 10 |  |  |  | 15 |
| CO5 | 12 | 7 | 10 |  |  |  | 29 |
| CO6 | 1 | 3 | 12 |  |  |  | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | X-rays are harmful to humans depending on \_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | What is the application of fluoroscope? | | CO1 | R | 1 |
| 3. | Radiation can be quantified using\_\_\_\_\_\_\_\_\_\_\_ units. | | CO2 | R | 1 |
| 4. | Choose the Radioisotopes are sent to human body. | | CO2 | A | 1 |
| 5. | Identify the molecule present in human exhibits magnetic property. | | CO3 | A | 1 |
| 6. | Criticize the hazardous effect 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 use in \_\_\_\_\_\_\_\_\_\_ | | CO4 | R | 1 |
| 9. | Defend the applications of Doppler 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 thermography imaging systems. | | CO5 | U | 3 |
| 16. | Optical coherence tomography. | | 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 | 6 |
|  | b. | List out the merits of emission tomography. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 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 |  | 6 |  |  | 11 |
| **CO5** |  | 4 |  | 6 |  | 24 | 34 |
| **CO6** |  | 3 |  |  | 13 | 12 | 28 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Collect 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. | Cite 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. | Discuss 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. | a. | 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

|  |  |
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| **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 / P** | **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** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Expand Cos(nπ) | | CO1 | U | 1 |
| 2. | State the condition for a anti-causal signal. | | CO1 | R | 1 |
| 3. | State the formula for exponential Fourier series expansion. | | CO2 | R | 1 |
| 4. | How is the frequency response of a filter represented as? | | CO2 | R | 1 |
| 5. | What is the use of adaptive Gabor 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 zeros in Laplace Transform. | | CO4 | U | 1 |
| 8. | Give substantiation for time shifting property in Laplace Transforms. | | CO4 | R | 1 |
| 9. | How is Z transform related to Laplace Transform? | | CO5 | U | 1 |
| 10. | State the Z transform of a unit step function | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Give expressions for unit impulse and unit step function with examples. | | CO1 | R | 3 |
| 12. | List the conditions for the existence of Fourier Transform | | CO2 | U | 3 |
| 13. | List the various 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 Non Linear 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. | a. | Explain in detail about classifications of systems | CO1 | R | 12 |
| 18. | a. | Find the Fourier Series for the periodic signal with the function | CO2 | E | 12 |
| 19 | a. | Illustrate and explain how joint time-frequency analysis is applied to EEG signals to diagnose epilepsy. | 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. | a. | Using long division , determine the inverse Z transform of the function for both causal and anti-causal signal | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | 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 2π | CO2 | E | 8 |
| b. | Compute the Laplace Transform of the function  x(t) = cos Ω0t | CO4 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss about the Physical Factors Determining the Dynamic Behavior of Physiological Signal. | CO6 | An | 12 |

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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 | 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 |
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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the various stages included in Signal conditioning process. | | CO1 | R | 1 |
| 2. | List the types of biomedical measurement. | | CO1 | R | 1 |
| 3. | Define differentiator. | | CO2 | R | 1 |
| 4. | Indicate the applications of operational amplifier. | | CO2 | U | 1 |
| 5. | Sketch the frequency response curve of notch filter. | | CO3 | A | 1 |
| 6. | Calculate the cutoff frequency of a RC circuit, if R= 1Kohm and C= 5 F. | | CO3 | An | 1 |
| 7. | Identify the function of analog to digital converter. | | CO4 | R | 1 |
| 8. | Show the relation between time duration T and clock frequency f. | | CO4 | U | 1 |
| 9. | Write the expression for oscillating frequency of an LC oscillator circuit. | | CO5 | A | 1 |
| 10. | List the needs of safety standards in bio potential measurements. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define half-cell potential. | | CO1 | R | 3 |
| 12. | Calculate the output voltage of the summing amplifier, if in the given adder circuit, V1=12 V, V2=13V and V2=15 V. | | CO2 | An | 3 |
| 13. | Differentiate capacitive and inductive bandpass filter. | | CO3 | U | 3 |
| 14. | Compare analog to digital converter and digital to analog converter. | | CO4 | U | 3 |
| 15. | Sketch the block diagram of phase locked loop circuit. | | CO5 | A | 3 |
| 16. | Write down the difference between modulation and demodulation of signals. | | 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 in detail about Bioelectric potential with necessary diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Design an inverting and non-inverting amplifier using the principle of operational amplifier. | CO2 | C | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the working of Optocoupler. | CO3 | U | 6 |
|  | b. | Explain briefly the Second-order active low pass filter circuit and identify the overall gain of the filter when the filters are cascaded together. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the following:   1. Binary Weighted type DAC 2. Successive approximation type ADC | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the working principle of voltage-controlled oscillator with neat diagram. | CO5 | U | 10 |
|  | b. | Compare the capture mode and lock mode in phase locked loop. | CO5 | U | 2 |
|  |  |  |  |  |  |
| 22. | a. | Explain in detail about the working of sodium potassium pump. | CO1 | U | 6 |
|  | b. | Summarize the different interfacing stages involved in recording electrodes. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the working and design consideration of transimpedance amplifier. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Classify the types of modulation techniques used in biosignal processing with neat diagram. | CO6 | An | 8 |
|  | b. | Enumerate the role of safety standards in Bio Potential Measurements. | CO6 | R | 4 |

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

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|  | **COURSE OUTCOMES** |
| **CO1** | Identify the origin and characteristics of various biosignals and its acquisition |
| **CO2** | Apply the signal conditioning circuits for biomedical field |
| **CO3** | Analyze and deign bio filters and isolation circuits used in medical signal conditioning |
| **CO4** | Interface the bioelectric signals with analog and digital circuits for data acquisition |
| **CO5** | Create the various circuits for designing medical equipments using different ICs |
| **CO6** | Recommend the various safety standards in biomedical instrumentation |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 5 | 24 | - | - | - | - | 29 |
| **CO2** | 1 | 1 | 12 | 3 | - | 12 | 29 |
| **CO3** | - | 15 | 1 | 1 | - | - | 17 |
| **CO4** | 1 | 16 | - | - | - | - | 17 |
| **CO5** | - | 12 | 4 | - | - | - | 16 |
| **CO6** | 5 | - | 3 | 8 | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

**(Ordinary graph sheet, Polar graph sheet, Semi log graph sheet to be provided)**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2022** | **Duration** | **3hrs** |
| **Course Name** | **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. | Write the rule for eliminating feedback loop. | | CO1 | R | 1 |
| 2. | Define non-touching loop. | | CO1 | R | 1 |
| 3. | Define damping ratio. | | CO2 | R | 1 |
| 4. | Find the type and order of the following system transfer function. | | CO2 | U | 1 |
| 5. | Define Bandwidth. | | CO3 | R | 1 |
| 6. | Give an example for non-minimum phase transfer function. | | CO3 | U | 1 |
| 7. | Define BIBO stability. | | CO4 | R | 1 |
| 8. | Write the formula to determine centroid. | | CO4 | R | 1 |
| 9. | Sketch the schematic illustration of muscle stretch reflex. | | CO5 | U | 1 |
| 10. | Mention the unit for ventilator flow rate. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between open loop and closed loop systems. | | CO1 | U | 3 |
| 12. | A second order system has a damping ratio of 0.6 and natural frequency of oscillation is 10 rad/sec. Determine the damped frequency of oscillation. | | CO2 | A | 3 |
| 13. | State the advantages of frequency response analysis. | | CO3 | U | 3 |
| 14. | How the root locus is determined on real axis? | | CO4 | A | 3 |
| 15. | Sketch the simplified model of cardiac output regulation. | | CO5 | R | 3 |
| 16. | Draw the electrical analog of lung mechanics. | | 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. |  | Reduce the block diagram and find C/R. | CO1 | A | 12 |
| 18. |  | 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. | CO2 | A | 12 |
| 19. |  | Sketch Bode plot for the following transfer function and obtain the gain cross over frequency. **.** | CO3 | An | 12 |
| 20. |  | Measurements conducted on a servomechanism show the system response to be c(t)=1+0.2e-60t -1.2e-10t when subject to a unit step input. Obtain an expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio. | CO2 | U | 12 |
| 21. |  | Construct Routh array and determine the stability of the system represented by the characteristic equation,s6+2s5+8s4+12s3+20s2 +16s+16=0.Comment on the location of the roots of characteristic equation. | CO4 | An | 12 |
| 22. |  | A unity feedback control system has an open loop transfer function, .Sketch the root locus. | CO4 | A | 12 |
| 23 |  | Differentiate between engineering and physiological control systems using suitable examples. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze physiological control system representation for muscle reflex. | CO6 | An | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 |  | - | - | 17 |
| CO2 | 1 | 13 | 15 |  |  |  | 29 |
| CO3 | 1 | 4 |  | 12 | - | - | 17 |
| CO4 | 2 |  | 15 | 12 |  |  | 29 |
| CO5 | 4 | 13 |  |  | - | - | 17 |
| CO6 |  | 3 |  | 12 | - | - | 15 |
|  | | | | | | | 124 |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| **Course Code** | **19BM2023** | **Duration** | **3hrs** |
| **Course Name** | **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 noise model used for digital cameras. | | CO1 | R | 1 |
| 2. | Recall the sensor responsible for the detection of colors. | | CO1 | R | 1 |
| 3. | Define mask. | | CO2 | R | 1 |
| 4. | Locate the representation of 8 neighbors of pixel. | | CO2 | R | 1 |
| 5. | Write the two types of image. | | CO3 | A | 1 |
| 6. | List the tools used for periodic noise reduction. | | CO3 | R | 1 |
| 7. | Identify the methods used for image enhancement. | | CO4 | R | 1 |
| 8. | Differentiate between image enhancement and image restoration. | | CO4 | U | 1 |
| 9. | Give examples of low level computerized process. | | CO5 | U | 1 |
| 10. | Write the advantages of digital image processing. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the need for image compression. | | CO1 | U | 3 |
| 12. | Differentiate between intensity transformation and spatial filtering. | | CO2 | U | 3 |
| 13. | Examine the two basic operations of morphological processing. | | CO3 | R | 3 |
| 14. | List the applications of subband coding. | | CO4 | A | 3 |
| 15. | Discuss the advantages of wavelet transform over Fourier transform. | | CO5 | U | 3 |
| 16. | Recall the two choices involved in representing a region. | | 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. | Describe the different types hardware oriented models. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the human visual system. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the types of sharpening frequency filter. | CO3 | U | 6 |
|  | b. | Illustrate the types of smoothing spatial filter. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the methods of image acquisition. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the Hough transform with example. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Interpret the performance of encoder and decoder of lossless predictive coding. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the algorithm of Huffman coding. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discriminate the chain code based boundary representation. | CO6 | An | 6 |
|  | b. | Describe the image compression standards. | 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** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19BM2025** | **Duration** | **3hrs** |
| **Course Name** | **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 name of the embedded systems which is designed with 8-bit microcontroller. | | CO1 | U | 1 |
| 2. | Name the unit that reset the system after a predefined timeout. | | CO1 | R | 1 |
| 3. | Define embedded system. | | CO2 | R | 1 |
| 4. | List the services provided by simulator. | | CO2 | R | 1 |
| 5. | Identify the largest value that can be loaded in an 8-bit microcontroller register. | | CO3 | U | 1 |
| 6. | Classify the types of an analog to digital converter. | | CO3 | U | 1 |
| 7. | Write an instruction to configure microcontroller PORTE as output port pin. | | CO4 | A | 1 |
| 8. | Indicate the use of data registers in an embedded system. | | CO4 | U | 1 |
| 9. | List the advantages of wireless sensor technologies. | | CO5 | R | 1 |
| 10. | Give an example of embedded systems in biomedical applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Classify the types of embedded systems. | | CO1 | U | 3 |
| 12. | Differentiate host and target machine in an embedded system. | | CO2 | U | 3 |
| 13. | Estimate the target count value for generating 20ms delay by a microcontroller with prescalar value of 64. | | CO3 | E | 3 |
| 14. | Write the significance of high-level programming languages in embedded system design. | | CO4 | A | 3 |
| 15. | List the services of an operating systems. | | CO5 | R | 3 |
| 16. | Sketch the architecture of patient monitoring 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. | a. | Explain in detail about the various functional components of an embedded systems. | CO1 | U | 8 |
|  | b. | Sketch the architecture of an embedded systems. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Describe the features of various design process involved in an embedded system. | CO2 | R | 6 |
|  | b. | Explain in detail about the software development tools used in real time system design. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the following I/O interfacing with schematic diagram.   1. Keypad interfacing with microcontroller 2. Buzzer interfacing with microcontroller | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the features of various elements of C programming language. | CO4 | U | 8 |
|  | b. | Write an embedded C program to activate LEDs using microcontroller. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the different methods of handling interrupt services in RTOS environment. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the working principle of successive approximation type ADC. | CO3 | R | 8 |
|  | b. | Sketch the interfacing diagram of seven segment display with microcontroller. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | List the characteristics of an embedded system. | CO1 | R | 4 |
|  | b. | Summarize the various design metrics that is to be optimized in an embedded system design. | CO2 | U | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design an embedded system to interface ECG sensor and measure heart rate of the patient. Select any known embedded processor of your interest. Support your hardware design with a block diagram and the software development with a flow diagram. | CO6 | C | 12 |

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

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|  | **COURSE OUTCOMES** |
| **CO1** | Discuss the basics of embedded systems and its hardware units |
| **CO2** | Identify the various tools and development process of embedded system |
| **CO3** | Demonstrate the various I/O interfacing 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** | 5 | 12 | 4 | - | - | - | 21 |
| **CO2** | 8 | 17 | - | - | - | - | 25 |
| **CO3** | 8 | 14 | 4 | - | 3 | - | 29 |
| **CO4** | - | 9 | 8 | - | - | - | 17 |
| **CO5** | 4 | 12 | - | - | - | - | 16 |
| **CO6** | - | 1 | 3 | - | - | 12 | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| **Course Code** | **19BM2028** | **Duration** | **3hrs** |
| **Course Name** | **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 white regions in a x-ray film. | | 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 frequency of ultrasound scanner. | | CO2 | R | 1 |
| 5. | Select the CT number of fat tissue 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 imaging for diagnosing blood flow in human heart. | | CO4 | R | 1 |
| 9. | Interpret health hazards for ionizing radiations. | | CO5 | U | 1 |
| 10. | Infer the merits of optical coherence tomography. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Criticize the importance of Bucky grid. | | CO1 | E | 3 |
| 12. | Contrast the applications of x-ray diagnosis with thermography. | | CO2 | An | 3 |
| 13. | Define the principle of image generation in magnetic resonance system. | | CO3 | R | 3 |
| 14. | Infer the construction of medical ultrasonic probe. | | CO4 | U | 3 |
| 15. | Outline the merits of liquid crystal thermography. | | CO5 | U | 3 |
| 16. | Identify the radioisotopes used 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. | a. | Elaborate the working of x-ray generating system. | CO1 | C | 8 |
|  | b. | List the merits of magnetic resonance and x-ray system of radio diagnosis. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Propose the medical imaging methodology for diagnosing fracture in human bone. | CO2 | C | 12 |
|  |  |  |  |  |  |
| 19. | a. | Construct the methodology for viewing abnormalities in human brain. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the functions of positron emission tomography system. | CO4 | An | 8 |
|  | b. | Compile the medical applications of computed tomography. | CO4 | C | 4 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate the applications of Doppler ultrasonography. | CO5 | E | 8 |
|  | b. | Identify the patient preparation criteria for imaging in magnetic resonance system. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the medical applications of single photon emission tomography. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate the merits of optical coherence tomography. | CO5 | E | 6 |
|  | b. | Inspect the radiological hazards that occur in medical field. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the architecture of picture archival system for data management. | CO6 | C | 8 |
|  | b. | Identify the merits of computer in medical imaging system. | CO6 | A | 4 |

**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 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 5 |  |  | 3 | 8 | 17 |
| **CO2** | 2 |  |  | 3 |  | 12 | 17 |
| **CO3** | 4 | 1 | 12 |  |  |  | 17 |
| **CO4** | 1 | 4 |  | 8 | 12 | 4 | 29 |
| **CO5** |  | 5 | 4 | 6 | 14 |  | 29 |
| **CO6** |  |  | 7 |  |  | 8 | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19BM2029 / 15EI2025** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL EQUIPMENT MAINTENANCE AND TROUBLESHOOTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Interpret ‘Combined regulation’ in your own words. | | CO1 | U | 1 |
| 2. | Differentiate line Regulation and Load Regulation. | | CO1 | U | 1 |
| 3. | Define the term ‘Acid Trap’. | | CO2 | R | 1 |
| 4. | State the importance of Electro Magnetic compatibility. | | CO2 | R | 1 |
| 5. | List the two types of ECMO. | | CO3 | R | 1 |
| 6. | Recall 2 major types of Hemodialysis Machine Alarms. | | CO3 | R | 1 |
| 7. | Recall the daily checks in X Ray machine. | | CO4 | R | 1 |
| 8. | Differentiate Class I, II and III medical devices. | | CO4 | U | 1 |
| 9. | List the factors that Affect TCO. | | CO5 | R | 1 |
| 10. | Recall the formula to calculate MTTR. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Generalize Steps in setting dynamic Loading. | | CO1 | U | 3 |
| 12. | List any 4 Golden rules of safety. | | CO2 | R | 3 |
| 13. | Cite the role of AmSECT. | | CO3 | U | 3 |
| 14. | Summarize about the most common problem of most infant incubator. | | CO4 | U | 3 |
| 15. | Discuss about the parameters to be considered while buying a medical equipment. | | CO5 | U | 3 |
| 16. | List the 2 benefits and 1 drawback of RCFA. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Evaluate different Transformer Tests. | CO1 | An | 10 |
|  | b. | Define Contactor. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 18. | a. | Explain how to fix the Issues in Printed circuit Board. | CO2 | A | 8 |
|  | b. | Select the important factors in the design of DC power supply. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 19. | a. | Appraise the maintenance of surgical lights. | CO3 | An | 7 |
|  | b. | Write about the Structure of a Haemodialysis Machine. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. | a. | Explain about Medical Equipment Procurement Process Step by Step. | CO4 | An | 6 |
|  | b. | Contrast the benefits of AMC over CMC. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain about the ways to reduce medical equipment maintenance cost. | CO5 | An | 9 |
|  | b. | Discuss briefly about Replacement analysis. | CO5 | U | 3 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the various Requirements of ISO 9000. | CO6 | An | 6 |
|  | b. | Write about Human errors in healthcare systems. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate MEDTRONIC’s Product Lifecycle Management Systems case study. | CO5 | An | 10 |
|  | b. | Discuss briefly about ‘Risk-based approach’ in maintenance. | CO5 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the various aspects of ‘Markov Analysis’. | CO6 | An | 7 |
|  | b. | Write note on Cause Failure analysis. | CO6 | A | 5 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 5 | - | 10 | - | - | 17 |
| CO2 | 5 | - | 8 | 4 | - | - | 17 |
| CO3 | 2 | 3 | 5 | 7 | - | - | 17 |
| CO4 | 1 | 4 | - | 12 | - | - | 17 |
| CO5 | 1 | 8 | - | 19 | - | - | 28 |
| CO6 | 4 | - | 11 | 13 | - | - | 28 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Interpret IDLE. | | CO1 | U | 1 |
| 2. | Give the representation of integer and floating-point literal. | | CO1 | R | 1 |
| 3. | Define Loop Body. | | CO2 | R | 1 |
| 4. | Give the other name for one-way selection statement. | | CO2 | R | 1 |
| 5. | Mention the advantages of accessing the input from a file. | | CO3 | U | 1 |
| 6. | Interpret immutable data structure. | | CO3 | U | 1 |
| 7. | Define dictionary in python. | | CO4 | U | 1 |
| 8. | Give an example for pop operator. | | CO4 | R | 1 |
| 9. | Interpret stucture chart. | | CO5 | U | 1 |
| 10. | Define Abstraction. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the advantages and disadvantages of python programming. | | CO1 | U | 3 |
| 12. | Write a python program using for loop to display “Hello” for 5 times in the same row. | | CO2 | A | 3 |
| 13. | Assume that the variable data refers to the string “pythoncode.txt”. Write the values for the following expressions.  (i)data[3] (ii)len(data) (iii) data[-1] | | CO3 | A | 3 |
| 14. | Describe the concept of adding and replacing keys in a dictionary. | | CO4 | U | 3 |
| 15. | Interpret lifetime of variables in a program. | | CO5 | U | 3 |
| 16. | Discuss the libraries used in python programming for speech recognition. | | 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 different escape sequences with example programs. | CO1 | U | 10 |
|  | b. | Discuss the type conversion functions in python programming. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the different conditional statements in python programming with its syntax and semantics. | CO2 | U | 7 |
|  | b. | Write a python program using while loop to count the values from 1 to 5 and display a message “Counting finished” at the end. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 19. | a. | Describe the concept of data encryption and write the python code to encrypt the data “Hello”. Use the distance value as 3. | CO3 | A | 7 |
|  | b. | Discuss the file operations with example programs. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 20. | a. | Describe the methods for inserting, removing, searching and sorting elements in a list with its syntax and example programs. | CO4 | U | 8 |
|  | b. | Discuss the concept of equality in terms of object identity and structural equivalence. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain how functions acts as abstraction mechanism in eliminating redundancy and hiding complexity. | CO5 | U | 8 |
|  | b. | Discuss problem solving with Top-Down design. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the different arithmetic expressions with its precedence. | CO1 | U | 8 |
|  | b. | Discuss the different list operators with examples. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. |  | Explain the concept of dictionary and the different operations performed on a dictionary with example programs. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Demonstrate a case study using python programming outlining the functionality and steps involved in medical imaging. | CO6 | A | 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** | 1 | 24 | - | - | - | - | 25 |
| **CO2** | 2 | 7 | 8 | - | - | - | 17 |
| **CO3** | - | 7 | 10 | - | - | - | 17 |
| **CO4** | 1 | 20 | 12 | - | - | - | 33 |
| **CO5** | - | 17 | - | - | - | - | 17 |
| **CO6** | - | 3 | 12 | - | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is the effect of ionizing radiation? | | CO1 | R | 1 |
| 2. | Expand REM. | | CO1 | U | 1 |
| 3. | What is the unit for blood sugar level? | | CO1 | R | 1 |
| 4. | What type of medium is present in the inner ear? | | CO2 | R | 1 |
| 5. | State the medical name of the ENT specialists. | | CO2 | U | 1 |
| 6. | How many rows of Outer Hair cells are present in the inner ear? | | CO2 | U | 1 |
| 7. | State the factor on which Compton effect does not depend on. | | CO3 | R | 1 |
| 8. | What does the half value layer of an absorber material showcase? | | CO4 | R | 1 |
| 9. | Define KERMA. | | CO5 | R | 1 |
| 10. | In positron emission tomography (PET), the image is created by detecting \_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define Half Value layer. | | CO1 | R | 3 |
| 12. | State various sources of non-ionizing radiation. | | CO2 | U | 3 |
| 13. | State the principle of a nuclear generator. | | CO3 | R | 3 |
| 14. | Define Bremsstrahlung Radiation. | | CO5 | U | 3 |
| 15. | Define Annihilation. | | CO4 | R | 3 |
| 16. | State some specific applications of gamma radiation in medical world. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23, Qn.No 24 is Compulsory)** | | | | | |
| 17. | a. | Explain in detail about the various sources of non-ionizing radiation and tabulate the effects of the same. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss about the body components involved in the Physics of Hearing with proper illustrations. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain in detail about the various methods of production for radio nuclides. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail about the interaction of X rays and γ rays with matter. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the stochastic and non-stochastic effects of radiation. | CO5 | An | 6 |
| b. | Define inverse square law and Bragg’s curve in relation to radiometry. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the body components involved in the Physics of Vision with proper illustrations. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss briefly about the visual acuity with suitable illustrations. | CO1 | A | 8 |
| b. | Discuss about the properties of sound. | CO2 | U | 4 |
|  |  | **COMPULSORY** | | | |
| 24. | a. | Discuss about the Clinical Applications of Doppler with necessary diagrams. | CO6 | An | 12 |

|  |  |
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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 Taxonomy** | | | | | | | |
| **CO / BL** | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 1 | 32 | - | - | - | 38 |
| CO2 | 1 | 9 | - | 12 | - | - | 22 |
| CO3 | 4 | - | - | 12 | - | - | 16 |
| CO4 | 4 | - | - | 12 | - | - | 16 |
| CO5 | 2 | 3 | 6 | 6 | - | - | 17 |
| CO6 | - | 3 | - | 12 | - | - | 15 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | \_\_\_\_\_\_ is the metabolic process that converts glucose into pyruvic acid. | | CO1 | U | 1 |
| 2. | Isomerism exhibited by compounds possessing asymmetric carbon atom like monosaccharide, is\_\_\_\_\_\_\_\_\_\_\_\_. | | 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. | Explain Fischer & Haworth projection with examples. | | CO6 | U | 3 |
| 12. | What is meant by derived lipids? | | CO1 | R | 3 |
| 13. | What is meant by amide linkage? Write with its molecular structure. | | CO4 | U | 3 |
| 14. | Write the composition of nucleotide. | | CO2 | R | 3 |
| 15. | Which vitamin deficiency is associated with egg white injury? | | CO3 | R | 3 |
| 16. | What is meant by 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. |  | Discuss the composition, structure and properties of DNA. | 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

|  |  |
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|  | **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 – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Discuss the two basic phases of cell cycle. | | CO1 | U | 1 |
| 2. | Analyze the applications of Immunohistochemistry in cancer research. | | CO1 | An | 1 |
| 3. | Define Tumour Markers. | | CO2 | R | 1 |
| 4. | Describe the role of receptor in cell cycle regulation. | | CO2 | R | 1 |
| 5. | Examine the challenges in oncogene detection. | | CO3 | R | 1 |
| 6. | Identify the role of telomerases in cancer development. | | CO3 | U | 1 |
| 7. | List the challenges in targeting invasive cancer cell. | | CO4 | R | 1 |
| 8. | Define the term carcinogen. | | CO5 | R | 1 |
| 9. | Discuss the advantages of cancer nanotechnology. | | CO5 | U | 1 |
| 10. | List the applications of genomic screening. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define the characteristics of Leukemia. | | CO1 | U | 3 |
| 12. | Interpret the general sequence of cell signaling. | | CO2 | U | 3 |
| 13. | Examine the activation of protein kinase A. | | CO3 | R | 3 |
| 14. | Analyze the common diseases associated with basement membrane disruption. | | CO4 | An | 3 |
| 15. | List the key steps of the metastatic cascade. | | CO5 | R | 3 |
| 16. | Analyze the characteristics of heterogeneous tumour cells. | | 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. | Interpret the Mitosis-phase of cell cycle. | CO1 | U | 6 |
|  | b. | Illustrate the early detection of cancer. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the biochemical theories. | CO1 | U | 6 |
|  | b. | Summarize the theory of oncogenic DNA and RNA viruses. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the mechanism and function of fibroblast growth factor. | CO2 | An | 6 |
|  | b. | Discuss the disruption of basement membrane. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Examine the proteinases and tumour cell invasion. | CO3 | R | 6 |
|  | b. | Illustrate the heterogeneity of metastatic phenotype. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate the infectious agents that cause infection. | CO4 | An | 6 |
|  | b. | Discuss the advances in cancer detection. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Interpret the types of cancer and its risk factors. | CO4 | U | 6 |
|  | b. | Discriminate the different forms of cancer therapy. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the types of gene therapy for cancer. | CO5 | U | 6 |
|  | b. | Analyze the importance of predicting aggressiveness of cancer. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Summarize the types of radiation therapy for cancer. | CO6 | U | 6 |
|  | b. | Evaluate the importance of developing effective therapies for cancer and the significance of signal targets in cancer treatment. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 22 | - | 7 | - | - | 29 |
| CO2 | 2 | 9 | - | 6 | - | - | 17 |
| CO3 | 10 | 1 | - | 6 | - | - | 17 |
| CO4 | 1 | 12 | - | 9 | - | - | 22 |
| CO5 | 4 | 7 | - | 12 | - | - | 23 |
| CO6 | 1 | 6 | - | 9 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21BM3004** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED HEALTHCARE SYSTEM 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. | Evaluate the economic implications of wearable devices in terms of healthcare costs and average length of hospital stays. | CO1 | E | 10 |
|  | b. | Discuss the role of standards in the design and implementation of wearable devices and mobile health solutions. Provide examples. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Show few case studies of Wearable devices in health care. | CO2 | U | 10 |
|  | b. | Discuss key components of mobile health care and its contribution to improving healthcare delivery. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the impact of picture archiving and communication systems (PACS) on digital radiology workflow efficiency and patient care outcomes. | CO3 | U | 10 |
|  | b. | Evaluate the integration of digital radiology systems within hospital networks and analyze their influence on the management of medical image archives and storage systems. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Illustrate how digital radiology has improved diagnostic accuracy and patient outcomes. | CO4 | U | 10 |
|  | b. | Explain the concept of digital radiology and its significance in modern healthcare systems. | CO4 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the role of networking in healthcare and its implications for medical reporting and tele-consultation. | CO5 | An | 10 |
|  | b. | Examine the role of speech recognition technology in facilitating medical reporting within digital health systems | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Summarize the application of machine learning in diagnosis and treatment planning in e-health environments. | CO5 | R | 10 |
|  | b. | Analyze the challenges and opportunities in implementing physiological tests and functional diagnosis using digital methods. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the concept of multimodality registration and its significance in daily clinical practice. | CO4 | U | 10 |
|  | b. | Evaluate the utilization of IoT applications in mobile healthcare and assess the advantages they provide to healthcare delivery and patient outcomes. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the challenges associated with ensuring interoperability among different modalities in healthcare. | CO6 | U | 10 |
|  | b. | Examine the role of mobile healthcare in improving access to healthcare services in remote or underserved areas. | CO6 | U | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Analyze the role of digital health in addressing healthcare disparities and improving patient outcomes. | CO6 | An | 10 |
|  | b. | Evaluate various strategies aimed at overcoming barriers to interoperability within digital health systems and facilitate seamless data exchange in digital health. | CO6 | E | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the available technology for wearable healthcare devices |
| CO2 | Interpret the need for digital methods of handling medical records |
| CO3 | Modify the tools and methods for work flow |
| CO4 | Compare various standards for inter-operability of devices |
| CO5 | Decide quality and safety standards for developing healthcare systems |
| CO6 | Formulate advanced strategies for innovation to societal needs. |

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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 | 10 | 10 | - | - | - | - | 20 |
| CO3 | - | 10 | - | - | 10 | - | 20 |
| CO4 | 10 | 20 | - | - | 10 | - | 40 |
| CO5 | 10 | - | - | 30 | - | - | 40 |
| CO6 | - | 20 | - | 10 | 10 | - | 40 |
|  | | | | | | | **180** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| **Course Code** | **21BM3012** | **Duration** | **3hrs** |
| **Course Name** | **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. | a. | Write in detail about different types of Oxygenators. | CO1 | U | 08 |
|  | b. | Explain in detail about the different types of Artificial Heart and its Functioning. | CO1 | U | 08 |
|  |  |  |  |  |  |
| 2. | a. | What are the various pump systems for Synchronous Counter pulsation? Explain in detail. | CO2 | R | 08 |
|  | b. | Explain in detail about the Biomaterials for implantable purposes, its characteristics and testing. | CO2 | R | 08 |
|  |  |  |  |  |  |
| 3. | a. | Write about the Wearable Artificial Kidney. | CO3 | A | 08 |
|  | b. | Discuss the Principle of Haemodialysis and different types of Heamodialysers. | CO3 | A | 08 |
|  |  |  |  |  |  |
| 4. | a. | Explain the types of models in Hand and Arm Replacement. | CO4 | An | 08 |
|  | b. | Discuss about the Functional Electrical Stimulation. | CO4 | An | 08 |
|  |  |  |  |  |  |
| 5. | a. | Write in detail about breathing Apparatus Operating Sequence. | CO5 | U | 08 |
|  | b. | Describe the construction and functional characteristics involved in the Hearing aids. | CO5 | U | 08 |
|  |  |  |  |  |  |
| 6. | a. | i. Classify Visual Impairments.  ii. Analyze the Prevention and cure of visual impairments. | CO2 | An | 08 |
|  | b. | Categorize the IoT based assist devices. | CO2 | An | 08 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail about the types of Prosthesis. | CO6 | E | 08 |
|  | b. | Explain about the properties of Dialyzer membrane. | CO6 | E | 08 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | i. Explain about the hearing aid technology.  ii. Discuss about the operating sequence of hearing aids. | CO6 | C | 10 |
|  | b. | i. Write about the advantages and disadvantages of hemodialysis.  ii. Explain about the properties of Dialyzer membrane. | 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 |

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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 | - | - | 16 | - | - | 32 |
| CO3 | - | - | 16 | - | - | - | 16 |
| CO4 | - | - | - | 16 | - | - | 16 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | - | - | - | - | 16 | 20 | 36 |
|  | | | | | | | **132** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Sub Div.** | **Questions** | **CO / BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | |
| 1. | a. | Summarize the significance of Magnetic Resonance Imaging Modality and compare it with CT modality. | CO1 / R | 05 |
|  | b. | Outline the phases of breast cancer and explain how mammographic imaging is used for diagnosis. | CO1 / A | 05 |
|  | c. | What is a CAD system and explain how its performance is measured for diagnostic information. | CO1 / A | 06 |
|  |  |  |  |  |
| 2. | a. | Explain the spatial domain filters used for Noise reduction in medical images. | CO2 / An | 08 |
|  | b. | Compare the features of Frost, Average and Median filters and explain their significance. | CO2 / U | 08 |
|  |  |  |  |  |
| 3. | a. | Explain how Super Resolution and Richardson –Lucy method help in restoration of degraded medical images | CO3 / U | 08 |
|  | b. | Compare and illustrate the features of Inverse Filter, Wiener Filter and Constrained Least Squares filters in image restoration process | CO3 / A | 08 |
|  |  |  |  |  |
| 4. | a. | Illustrate in depth the Topological Derivative based, and histogram-based image segmentation techniques. | CO4 / A | 08 |
|  | b. | Illustrate the significance of MSE, RMSE, PSNR and Entropy in medical image analysis. | CO4 / An | 08 |
|  |  |  |  |  |
| 5. | a. | Explain in detail about different features used in medical images. | CO5 / U | 06 |
|  | b. | Illustrate the significance of shape related features in the analysis of medical images. | CO5 / R | 10 |
|  |  |  |  |  |
| 6. | a. | Infer on image segmentation methods based on the grayscale values' dissimilarity. | CO4 / An | 08 |
|  | b. | Explain in detail about the systematic evaluation and validation of segmentation algorithms | CO4 / An | 08 |
|  |  |  |  |  |
| 7. | a. | Outline the application of K-Means clustering to medical image analysis. | CO4 / U | 10 |
|  | b. | Compare the kinds of noise present in medical images and the filters that are used to reduce or eliminate it. | CO2 / R | 06 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | |
| 8. | a. | Utilise deep learning applications for cancer detection in skin images and nodule detection in lung imaging. | CO6 / A | 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 |

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 |  | 11 |  | - | - | 16 |
| CO2 | 06 | 08 | - | 08 | - | - | 22 |
| CO3 | - | 08 | 08 | - | - | - | 16 |
| CO4 | - | 10 | 08 | 24 | - | - | 42 |
| CO5 | 10 | 06 | - | - | - | - | 16 |
| CO6 | - | - | 10 | - | - | 10 | 20 |
|  | | | | | | | **132** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the German philosopher, who declared "Deontology as an ethical approach centered on rules and professional duties". | | CO1 | R | 1 |
| 2. | Recognize the principle used in medical ethics. | | CO1 | R | 1 |
| 3. | List down the four domains expected from a physician to maintain the standard as per the General Medical Council. | | CO2 | R | 1 |
| 4. | Indicate the use of non-maleficence. | | CO2 | U | 1 |
| 5. | Identify an industry standard which is used facilitating the processing and exchange of medical images in digital form. | | CO3 | R | 1 |
| 6. | Define Information Resources Management Association (IRMA). | | CO3 | R | 1 |
| 7. | Indicate the use of JCAHO Accreditation. | | CO4 | U | 1 |
| 8. | Memorize the mission statement of Joint Commission International (JCI) Accreditation. | | CO4 | R | 1 |
| 9. | Classify the different types of fire exitinguishers. | | CO5 | U | 1 |
| 10. | Give examples of class III medical devices. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the components of medical ethics. | | CO1 | U | 3 |
| 12. | Differentiate between the types of utilitarianism. | | CO2 | U | 3 |
| 13. | Sketch the procedure involved in developing ethical standards. | | CO3 | A | 3 |
| 14. | Compare medical model and patient centered care model. | | CO4 | U | 3 |
| 15. | Recognize the various colour coding system in managing hazardous material and wastes. | | CO5 | R | 3 |
| 16. | Identify the stages in the lifecycle of medical device. | | 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 functional responsibilities of a doctor towards their patients. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the term Predictive genetic test. | CO2 | U | 6 |
|  | b. | Examine the ethical issues involved in carrier screening and prenatal genetic testing. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the significance and the challenges in HIPAA medical standard. | CO3 | U | 10 |
|  | b. | Define LOINC. | CO3 | R | 2 |
|  |  |  |  |  |  |
| 20. | a. | Sketch the structure of Quality Council of India for accreditation. | CO4 | A | 4 |
|  | b. | Illustrate the significance of accreditation and highlight the NABH accreditation process. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 21. | a. | Analyse the safety measures for protecting the occupants in hospital environment from fire, smoke, and heat with one case study. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain in detail about the fundamental commitments of the medical profession as standardised by CMA code of medical ethics. | CO1 | U | 10 |
|  | b. | Define prudence. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the role of various ethical theories used in medical ethics. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the significance of IEC 60601 standards in medical electrical equipment. | CO6 | U | 9 |
|  | b. | Differentiate between class 1 and class 2 medical devices. | CO6 | U | 3 |

**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 Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 4 | 25 | - | - | - | - | 29 |
| **CO2** | 1 | 22 | 6 | - | - | - | 29 |
| **CO3** | 4 | 10 | 3 | - | - | - | 17 |
| **CO4** | 1 | 12 | 4 | - | - | - | 17 |
| **CO5** | 3 | 1 | - | 12 | - | - | 16 |
| **CO6** | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2007** | **Duration** | **3hrs** |
| **Course Name** | **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. | List the type of feedback employed in control System. | | CO1 | R | 1 |
| 2. | Draw the block diagram rule for eliminating positive feedback loop. | | CO1 | U | 1 |
| 3. | Define poles and zeros of a system. | | CO2 | R | 1 |
| 4. | Mention the types of steady state error constants. | | CO2 | R | 1 |
| 5. | Define: Phase Margin | | CO3 | R | 1 |
| 6. | Give the frequency domain specifications. | | CO3 | R | 1 |
| 7. | Define BIBO stability. | | CO4 | R | 1 |
| 8. | Define root locus. | | CO4 | R | 1 |
| 9. | Draw the block diagram of the 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. | Classify the different types of II order system according to damping ratio. | | CO2 | U | 3 |
| 13. | State the advantages of frequency response analysis. | | CO3 | U | 3 |
| 14. | State Principle of Argument. | | 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. |  | Determine the transfer function from the given signal flow graph. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | For servo mechanisms with open loop transfer function given below what type of input signal give rise to a constant steady state error and calculate their values. | CO2 | U | 6 |
|  | b. | Inspect the response of first order system when subjected to unit step input. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | The open loop transfer function of a unity feedback system is given by G(s) = 1/s2(1+s)(1+2s). Sketch the polar plot and determine the gain margin and phase margin. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Construct Routh array and determine the stability of the system represented by the characteristic equation,s6+2s5+8s4+12s3+20s2 +16s+16=0. Comment on the location of the roots of characteristic equation. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the model of chemical regulation of ventilation. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Determine the range of K for stability of unity feedback system whose open loop transfer function is G(s) = K/ s(s+1)(s+2). | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A unity feedback control system has an open loop transfer function  G(s) = K/s(s +2)(s+4). Sketch the root locus. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Differentiate engineering and physiological control systems with suitable examples. | CO5 | U | 6 |
|  | b. | Explain the model of regulation of cardiac output. | 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 | 16 |  |  |  |  | 17 |
| **CO2** | 2 | 15 |  |  |  |  | 17 |
| **CO3** | 2 | 3 | 12 |  |  |  | 17 |
| **CO4** | 5 |  | 24 | 12 |  |  | 41 |
| **CO5** | 3 | 19 |  |  |  |  | 22 |
| **CO6** |  | 10 |  |  |  |  | 10 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the persons treated the patients in churches. | | CO1 | R | 1 |
| 2. | Write any four professional societies in Biomedical Engineering. | | CO1 | A | 1 |
| 3. | Define the term transducer. | | CO2 | R | 1 |
| 4. | Name the system most highly developed and complex system in the body. | | CO2 | R | 1 |
| 5. | List down the properties of x – rays. | | CO3 | U | 1 |
| 6. | Define Radioactivity. | | CO3 | U | 1 |
| 7. | Sketch the Einthoven triangle. | | CO4 | A | 1 |
| 8. | Write the types of dialyzers present for the treatment of kidneys. | | CO4 | A | 1 |
| 9. | Expand ISO and IEC. | | CO5 | U | 1 |
| 10. | Write the functions of medical council. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write short notes on medical profession. | | CO1 | A | 3 |
| 12. | Explain the various display system found in the basic biomedical instrumentation system. | | CO2 | U | 3 |
| 13. | Explain r-scintillation camera and list down its parts. | | CO3 | U | 3 |
| 14. | Describe repolarization and depolarization. | | CO4 | R | 3 |
| 15. | Express the need of regulations & standards in health care sectors. | | CO5 | U | 3 |
| 16. | Define the term ‘Ethics’. | | 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 details the roles played by the Biomedical Engineers. | CO1 | U | 8 |
|  | b. | Write short notes on the ‘First Hospital’. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the block diagram of basic Biomedical Instrumentation system and explain in detail. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe in detail the x-rays machine with neat diagram. | CO3 | R | 6 |
|  | b. | Explain the working of Positron Emission Tomography. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail the Electroencephalogram. | CO4 | U | 6 |
|  | b. | Write the cardiac pacemakers and its application in detail. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | List down the good laboratory practices in medical research labs. | CO5 | R | 10 |
|  | b. | Recall and write the functions of regulatory agencies and standards organizations. | CO5 | R | 2 |
|  |  |  |  |  |  |
| 22. | a. | Explain in detail the various sources of Biomedical signals found in the human body. | CO2 | U | 8 |
|  | b. | List down the different system in the human body. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the working of diagnostic ultrasound in detail. | CO3 | U | 6 |
|  | b. | Explain in detail the ventilators. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Summarize the ethical issues in the treatment process. | CO6 | U | 5 |
|  | b. | Discuss the code of ethics for Biomedical Engineers. | CO6 | U | 7 |

**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 professions. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 8 | 8 | - | - | - | 17 |
| **CO2** | 6 | 11 | 12 | - | - | - | 29 |
| **CO3** | 6 | 17 | - | - | - | - | 23 |
| **CO4** | 3 | 12 | 8 | - | - | - | 23 |
| **CO5** | 12 | 4 | - | - | - | - | 16 |
| **CO6** | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define ‘Resting potential’ | | CO1 | R | 1 |
| 2. | Discuss Sodium pumping briefly. | | CO1 | U | 1 |
| 3. | Sketch an op-amp. | | CO2 | A | 1 |
| 4. | List few op-amp manufacturers. | | CO2 | U | 1 |
| 5. | Summarize the role of a filter in signal conditioning circuits. | | CO3 | U | 1 |
| 6. | Give practical examples of filter. | | CO3 | U | 1 |
| 7. | Define aliasing. | | CO4 | R | 1 |
| 8. | List the advantages of data acquisition system. | | CO4 | R | 1 |
| 9. | Discuss the significance of biomedical transmission. | | CO5 | U | 1 |
| 10. | Summarize the significance of SMT in PCB design. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discriminate between electric current and bio-current. | | CO1 | An | 3 |
| 12. | List practical characteristics of Op-amp. | | CO2 | U | 3 |
| 13. | Summarize opto-couplers. | | CO3 | U | 3 |
| 14. | Sketch the blocks of a digital data acquisition system. | | CO4 | A | 3 |
| 15. | Discriminate analog and digital phase detectors. | | CO5 | An | 3 |
| 16. | Analyze the role of PCBs in electronic device design process. | | 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 in detail the detection of Bio electric events. | CO1 | An | 7 |
|  | b. | Write notes on various types of bio-electrodes used in bio-potential measurement. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. | a. | Explain the op-amp as an ‘Adder’. | CO2 | An | 6 |
|  | b. | Examine the differentiator circuit using Op-amp. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain any two types of Isolation amplifier. | CO3 | An | 8 |
|  | b. | Write note on the second order band stop filter. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain astable and monostable multivibrator using 555 IC timer. | CO4 | An | 9 |
|  | b. | Write a note on the applications of comparator. | CO4 | A | 3 |
|  |  |  |  |  |  |
| 21. | a. | Write a note on voltage-controlled oscillators. | CO5 | A | 6 |
|  | b. | Explain frequency shift keying and amplitude shift keying. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Write a note on the Inverting amplifier. | CO2 | A | 6 |
|  | b. | Write a note on the Non inverting amplifier. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain about first-order LPF and second-order LPF. | CO3 | An | 8 |
|  | b. | Write note on active filters and Passive filters. | CO3 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the challenges and advancements in PCB fabrication technology over the past decade. Assess the impact of emerging trends in fabrication process. | CO6 | An | 8 |
|  | b. | Explain briefly about circuit design using NI Multisim software. | CO6 | An | 4 |

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

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 5 | 10 | - | - | 17 |
| **CO2** | - | 4 | 19 | 6 | - | - | 29 |
| **CO3** | - | 5 | 8 | 16 | - | - | 29 |
| **CO4** | 2 | - | 6 | 9 | - | - | 17 |
| **CO5** | - | 1 | 6 | 9 | - | - | 16 |
| **CO6** | - | 1 | - | 15 | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2012** | **Duration** | **3hrs** |
| **Course Name** | **MICROPROCESSOR AND MICROCONTROLLER** | **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 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. | a. | Sketch the architecture of 8051 Microcontroller and highlight its features. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | 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 LED’s with microcontroller. | CO6 | A | 4 |

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

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



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define drift current. | | CO1 | U | 1 |
| 2. | Name the diode that is constructed with n type semiconductor material alone. | | CO1 | R | 1 |
| 3. | Calculate the thermal voltage when the temperature is 30°C. | | CO1 | R | 1 |
| 4. | Draw the symbol of Photo Diode. | | CO1 | R | 1 |
| 5. | Define bandwidth of an amplifier. | | CO3 | U | 1 |
| 6. | Draw the schematic of a pi filter. | | CO2 | R | 1 |
| 7. | What is the efficiency of full wave rectifier? | | CO2 | U | 1 |
| 8. | Define CMRR. | | CO2 | R | 1 |
| 9. | List the two difference between power amplifier and voltage amplifier. | | CO1 | U | 1 |
| 10. | What will be the phase shift in an oscillator if the circuit has two RC network? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Silicon is the preferred semiconductor material over Germanium. Justify the statement. | | CO1 | U | 3 |
| 12. | Differentiate direct coupled and transformer coupled class A amplifier. | | CO5 | U | 3 |
| 13. | Define ripple factor and calculate the ripple factor for a HWR. | | CO2 | 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? | | CO3 | A | 3 |
| 15. | List the Barkhausen's criteria for sustained oscillations. | | CO6 | U | 3 |
| 16. | Define distortion and list the types of distortion. | | CO4 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Elaborate on the different methods of electron hole generation and recombination. | CO1 | R | 8 |
|  | b. | Compare Intrinsic and Extrinsic semiconductors. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 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. | Draw the input and output characteristics graph of CE configuration of a BJT and Justify the statement that BJT is a current control device. | CO1 | AN | 4 |
|  |  |  |  |  |  |
| 19. | a. | Describe in detail about various types of coupling used in amplifiers. | CO2 | U | 6 |
|  | b. | Comprehend the need for faithful amplification and elaborate on the different types of transistor biasing. | CO2 | 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 | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss in detail about a RC coupled multistage amplifier. | CO3 | U | 8 |
|  | b. | Elaborate on the broad classification of transistor amplifiers. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | With a neat diagram explain a power supply and justify the need of voltage regulators in it. | CO2 | 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. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Elaborate on the construction and working of differential amplifier in difference mode and common mode. | CO2 | U | 8 |
|  | b. | Compare the performance of different class of power amplifiers. | CO4 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail the construction and working of a RC phase shift Oscillator and derive the expression for calculating the frequency of oscillation. | CO6 | An | 8 |
|  | b. | A Hartley oscillator has L1 = 19μH, L2 = 1μH, and c=100PF. Neglect mutual coupling. Determine frequency and oscillation. | CO6 | A | 4 |

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

|  |  |
| --- | --- |
|  | **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 Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 15 | 13 |  | 10 |  |  | 38 |
| **CO2** | 2 | 30 |  | 12 |  |  | 44 |
| **CO3** |  | 13 | 3 |  |  |  | 16 |
| **CO4** | 3 |  | 4 |  |  |  | 7 |
| **CO5** |  | 3 |  |  |  |  | 3 |
| **CO6** |  | 4 | 4 | 8 |  |  | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22BM2014** | **Duration** | **3hrs** |
| **Course Name** | **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. | Sketch the continuous time signal x(t)= 2sinπt. | | CO1 | U | 1 |
| 2. | Justify the importance of a proper sampling frequency. | | CO1 | R | 1 |
| 3. | Give expressions for unit impulse function. | | CO2 | R | 1 |
| 4. | How do you term a signal periodic? | | CO2 | R | 1 |
| 5. | Expand STFT. | | CO3 | U | 1 |
| 6. | The window used in Gabor Transform is based \_\_\_\_\_\_\_\_\_ function. | | CO3 | R | 1 |
| 7. | Laplace transform is applied for \_\_\_\_\_\_\_\_\_\_ signals. | | CO4 | U | 1 |
| 8. | Substantiate for linearity property of Laplace Transform. | | CO4 | R | 1 |
| 9. | Complete the following formulae.  Z{nx(n)} = ? | | CO5 | U | 1 |
| 10. | A 3-D view of the transformed signal is known as \_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate causal and anti-causal signals. | | CO1 | U | 3 |
| 12. | Define Sampling Theorem with example. | | CO2 | U | 3 |
| 13. | List three application of Joint Time Frequency Analysis. | | CO3 | R | 3 |
| 14. | Define Laplace Transform with example. | | CO4 | U | 3 |
| 15. | Define Z Transform. What are its applications? | | CO5 | U | 3 |
| 16. | List the properties of Non Linear Systems. | | 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. | Discuss about the various operations on signals with proper illustrations. | CO1 | An | 6 |
|  | b. | Briefly explain the different classifications of signals with examples. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find the Fourier Transform of the following.  i) x(t)= 𝑡𝑒−3𝑡𝑢(𝑡)  ii) x(t)= 𝑒−2𝑡𝑢(𝑡−1) | CO2 | A | 8 |
|  | b. | Find the Fourier Series for the periodic signal with the function. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Explain the short term Fourier transform with proper substantiation. | CO3 | An | 6 |
|  | b. | Illustrate and explain how joint time-frequency analysis is applied to heart sounds to detect valve pathologies inside the heart. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Find the Inverse Laplace Transform of the following. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | If the given signal is causal find the Inverse z Transform of the following using long division method. | CO5 | E | 6 |
|  | b. | Find the Inverse z Transform of the following using partial fraction method. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Compute the cosine Fourier series of the function.  where the fundamental period is 2π | CO2 | A | 6 |
|  | b. | Find inverse Laplace Transform of the function. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss about the Gabor Transform with proper substantiation. | CO3 | An | 6 |
|  | b. | Find the exponential Fourier series for the periodic signal given below. | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss about the physical factors 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** | 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 | 4 | - | 12 | - | - | 17 |
| **CO2** | 2 | 3 | 24 | - | - | - | 29 |
| **CO3** | 1 | 4 | - | 18 | - | - | 23 |
| **CO4** | 1 | 4 | - | - | 18 | - | 23 |
| **CO5** | - | 4 | - | -- | 12 | - | 16 |
| **CO6** | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The current in a single circuit loop across different circuit components \_\_\_\_\_\_\_\_.  a)Remains Constant b) Increases c) Decreases d) Doubles | | CO1 | U | 1 |
| 2. | What is the voltage across the 10 Ω resistor in circuit given below? | | CO1 | R | 1 |
| 3. | Justify the usage of compensation theorem. | | CO5 | U | 1 |
| 4. | In Reciprocity theorem, ratio of response to excitation is ratio of\_\_\_\_\_\_\_\_\_\_.  a) voltage to voltage b) current to current c) voltage to current d) No ratio is considered | | CO5 | R | 1 |
| 5. | Find the Capacitive Reactance in the given circuit. | | CO2 | R | 1 |
| 6. | The phase angle between the resistor voltage and the source voltage in an RC circuit with a sinusoidal input is \_\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 7. | In which component, the current leads the voltage by 90°? | | CO4 | U | 1 |
| 8. | What is the time period of the sine wave shown in the figure below? | | CO2 | U | 1 |
| 9. | Write proper formula for an inductor in s domain. | | CO4 | U | 1 |
| 10. | The Y parameters are also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the mesh current equations in the circuit shown in Figure. | | CO1 | A | 3 |
| 12. | State Thevinin’s Theorem with suitable example. | | CO5 | U | 3 |
| 13. | Determine the resonant frequency for the circuit shown in the figure below. | | CO3 | An | 3 |
| 14. | Draw the phasor diagram of series RLC circuit. | | CO4 | U | 3 |
| 15. | Discuss the transfer function and its application in circuit analysis. | | CO5 | U | 3 |
| 16. | Define Z parameters and image 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. | Use nodal analysis to find the power dissipated in the 6 Ω resistor for the circuit shown in the figure below. | CO1 | A | 6 |
|  | b. | In the circuit shown in Figure below, find the power delivered by the 4 V source using mesh analysis. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find the voltage across the 2 V resistor in circuit shown below by using  the superposition theorem. | CO2 | A | 6 |
|  | b. | Determine the Thevenin’s equivalent circuit across ‘AB’ for the given circuit shown in Figure below. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | In the network shown in Figure below, the switch is moved from the position 1 to the position 2 at t =0. The switch is in position 1 for a long time. Determine the current expressions for i(t) at position 1 and 2. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Write short notes on the following for a sine wave with proper substantiation   1. Instantaneous Value 2. Peak Value 3. Peak to Peak Value 4. Average Value 5. Root Mean Squared Value/Effective Value 6. Peak Factor 7. Form Factor | CO4 | U | 8 |
|  | b. | A voltage of v(t) = 100 sin ωt is applied to a circuit. The current flowing through the circuit is i(t) = 15 sin (ωt – 30°). Determine the average power delivered to the circuit. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Obtain the expression for i1 and i2 in the circuit shown in Figure below when dc voltage source is applied suddenly. Assume that the initial energy stored in the circuit is zero. | CO5 | An | 8 |
|  | b. | The switch in the circuit shown has been in the position “a” for a long time. At t = 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 | E | 4 |
|  |  |  |  |  |  |
| 22. | a. | Define the following with example equations.   1. Poles 2. Zeros 3. Laplace transform 4. Inverse Laplace transform | CO2 | U | 8 |
|  | b. | Determine the source voltage and the phase angle, if voltage across the resistance is 70 V and voltage across the inductive reactance is 20 V as shown in Figure below. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Use nodal analysis to find the voltage across the 4 V resistor for the circuit shown below. | CO1 | An | 8 |
|  | b. | Obtain the delta-connected equivalent for the star-connected circuit shown in Figure below. | CO2 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Derive the transmission (ABCD) and hybrid (H) parameters of a two port network and also draw the equivalent circuits in terms of transmission and hybrid parameters. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **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 | 9 | 14 |  |  | 25 |
| **CO2** | 1 | 9 | 10 |  |  |  | 20 |
| **CO3** | 1 |  | 4 | 3 | 12 |  | 20 |
| **CO4** |  | 13 | 4 |  |  |  | 17 |
| **CO5** | 1 | 7 | 6 | 8 | 4 |  | 26 |
| **CO6** | 1 | 3 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Differentiate smooth and rough endoplasmic reticulum | | CO1 | U | 1 |
| 2. | Enlist the type of tissues. | | CO1 | R | 1 |
| 3. | Write a note on cellular respiration. | | CO3 | U | 1 |
| 4. | Give an example for sesamoid bone. | | CO2 | R | 1 |
| 5. | Mention the significance of SA node. | | CO4 | U | 1 |
| 6. | Compare granular and agranular leucocytes. | | CO4 | U | 1 |
| 7. | Comment on nasal sinuses. | | CO3 | R | 1 |
| 8. | Comment on pinna. | | CO5 | R | 1 |
| 9. | Enlist the ossicles of human ear. | | CO5 | R | 1 |
| 10. | Define gray matter and white matter. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare and contrast active and passive transport of substances across cell membranes. | | CO1 | U | 3 |
| 12. | Portray the structure of a femur bone. | | CO2 | R | 3 |
| 13. | Mention the significance of epiglottis. | | CO3 | U | 3 |
| 14. | Illustrate the electrical activity of human heart and mention the segments. | | CO4 | U | 3 |
| 15. | Compare and contrast rods and cones. | | CO5 | U | 3 |
| 16. | Compare myelinated and non-myelinated neurons. | | 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. | Compare and contrast the structure and functions of endocrine and exocrine glands. | CO1 | U | 8 |
|  | b. | Describe the cell transport mechanism in detail. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the structure of a bone with a neat sketch. | CO2 | U | 8 |
|  | b. | Enlist the types of joints and quote examples for each. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | Detail the process of aerobic and anaerobic respiration. | CO3 | U | 6 |
|  | b. | Enumerate the process of gas exchange through capillaries with relevant diagrams. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Enlist and brief about various blood groups and comment on rare blood groups. | CO4 | U | 8 |
|  | b. | Brief the electrical activity of heart. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Portray the structure of human ear and outline its basic anatomical features. | CO5 | U | 8 |
|  | b. | Describe the mechanism of hearing. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the physiology of a human kidney with a neat diagram. | CO5 | U | 8 |
|  | b. | Sketch a nephron and label its parts. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Portray a human cell and explain the functions of each organelle. | CO1 | U | 8 |
|  | b. | Explain the process of image formation in human eye. | CO1 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Portray a human brain and explain how it is connected to physical events. | CO6 | U | 8 |
|  | b. | Brief a note on tracts of the spinal cord. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 28 |  |  |  |  | 29 |
| CO2 | 8 | 8 |  |  |  |  | 16 |
| CO3 | 1 | 16 |  |  |  |  | 17 |
| CO4 |  | 17 |  |  |  |  | 17 |
| CO5 | 2 | 27 |  |  |  |  | 29 |
| CO6 | 1 | 15 |  |  |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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|  |  |  |  |
| **Course Code** | **22BM2021** | **Duration** | **3hrs** |
| **Course Name** | **BIOMEDICAL SENSORS** | **Max. marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
|  | **PART-A(10X1=10 MARKS)** | | | | |
| 1. | What is the relative error percentage of an observation taken by an ultrasonic sensor which predicts the distance of an object to be 2.12cm but the actual value is 2cm? | | CO 2 | A | 1 |
| 2. | Write the importance of rise time in a sensor while analyzing its dynamic characteristics. | | CO 1 | A | 1 |
| 3. | How does hysteresis help in determining the static characteristics of a system. | | CO 4 | U | 1 |
| 4. | Name the electrode used for measuring ECG. | | CO 5 | R | 1 |
| 5. | Mention the types of biosensors classified under biorecognition element. | | CO 6 | R | 1 |
| 6. | RTD shows ……………. temperature coefficient | | CO 1 | R | 1 |
| 7. | Which of the following is FALSE about sensory pathway  a.It usually takes 3 orders of neuron to reach brain  bThe sensory tract usually crosses to opposite side cerebrum  c.Stimuli to the receptor always comes from the exterior  d.Thalamus is the relay centre for all sensory information | | CO 4 | A | 1 |
| 8. | Define biochemical sensor. | | CO 3 | U | 1 |
| 9. | Name the sensor used in digital thermometer. | | CO 5 | R | 1 |
| 10. | Specify the resistance range of a sweaty skin. | | CO 4 | R | 1 |
|  | **PART B (6 X 3= 18 MARKS)** | | | | |
| 11. | Comprehend the principle of conduction in thermocouples. | | CO 1 | U | 3 |
| 12. | Define mechanoreceptors. | | CO 2 | R | 3 |
| 13. | Write about capacitive sensor with neat sketch. | | CO 5 | U | 3 |
| 14. | A thermometeris calibrated for the range of 1000C to 1500C. The accuracy is specified within 0.25 percent. What is the maximum static error? | | CO 6 | A | 3 |
| 15. | Sketch the block diagram of Medical Instrumentation system | | CO 4 | U | 3 |
| 16. | Differentiate action potential and resting potential | | CO 3 | U | 3 |
|  | **PART C (6 X 12= 60 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | | |
| 17. | a. | Discuss in detail the Static characteristics of a sensor | CO 2 | R | 8 |
|  | b. | Comprehend the significance of the terminologies like Rise time, Dead time, Peak time and Settling time in determining the dynamic behaviour of a sensor. | CO1 | U | 4 |
| 18. | a. | Explain in detail about the thermoreceptor types with its thermal sensation pathways. | CO 1 | U | 8 |
|  | b. | Differentiate Rods and Cones in photo receptors | CO4 | U | 4 |
|  |  |  |  |  |  |
| 19. |  | Elaborate on the transduction type and biorecognition type bio sensor. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail about a self generating thermoelectric sensor. | CO 3 | U | 8 |
|  | b. | Differentiate the properties of Incandensence light and LASER light. | CO 3 | U | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain in detail about the principle of fiber optics measurement system with a general block diagram and also discuss about any one source and detector used in fiber optic sensing. | CO 4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe on electrochemical type bio sensor used in detecting blood glucose. | CO 3 | A | 8 |
|  | b. | Brief on biomedical applications of Ultrasound sensor | CO 4 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the measurement of temperature using thermistor & RTD principle. | CO 5 | U | 8 |
|  | b. | Differentiate Inductive and Cpacitive type proximity sensors | CO 4 | R | 4 |
|  | **COMPULSORY** | | | | |
| 24. | a. | List the types of Electrodes and elaborate on the types of surface electrodes. | CO 6 | A | 8 |
|  | b. | Comment on the terminology ‘Electrode – Electrolyte’ interface and ‘Electrolyte – Skin Interface’ | CO 6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 26 | 1 |  |  |  | 28 |
| CO2 | 11 | 12 | 2 |  |  |  | 25 |
| CO3 | - | 16 | 8 |  |  |  | 24 |
| CO4 | 2 | 18 | 1 |  |  |  | 21 |
| CO5 | 2 | 11 | - |  |  |  | 13 |
| CO6 | 1 | - | 12 |  |  |  | 13 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define ‘universal Gates’. | | CO1 | R | 1 |
| 2. | List out any 4 number systems. | | CO1 | R | 1 |
| 3. | Represent (-7) in 2s complement form. | | CO2 | U | 1 |
| 4. | Differentiate ASCII code and EBCDIC code. | | CO2 | U | 1 |
| 5. | Tabulate the truth table of full adder. | | CO3 | R | 1 |
| 6. | Sketch the circuit diagram of half subtractor. | | CO3 | R | 1 |
| 7. | Define racearound condition. | | CO4 | R | 1 |
| 8. | Indicate the difference between latch and flipflop. | | CO4 | U | 1 |
| 9. | Define counter. | | CO5 | U | 1 |
| 10. | Sketch the basic structure of a programmable logic device. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Convert the given decimal number 165.45 to octal. | | CO1 | U | 3 |
| 12. | Solve the boolean function F(A, B, C, D) = Σm(0, 1, 3, 5, 7, 8, 9, 11, 13, 15) using Kmap. | | CO2 | U | 3 |
| 13. | Differentiate parity generator and checker. | | CO3 | U | 3 |
| 14. | Distinguish between combinational and sequential circuit. | | CO4 | U | 3 |
| 15. | Indicate the differences between edge triggering and level triggering in flipflop. | | CO5 | U | 3 |
| 16. | Show how PLA is different from PAL. | | 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 binary addition, binary subtraction, binary multiplication and binary division with relevant examples. | CO1 | A | 7 |
|  | b. | State and prove commutative law, associative law and distributive law. | CO1 | U | 5 |
|  |  |  |  |  |  |
| 18. | a. | Explain the procedure to convert to NAND and NOR implementations. | CO2 | An | 5 |
|  | b. | Examine the 7 rules followed in solving a Boolean expression using K-Map. | CO2 | A | 7 |
|  |  |  |  |  |  |
| 19. | a. | Construct a BCD to grey code converter and implement the same using logic gates. | CO3 | A | 7 |
|  | b. | Write a note on encoders and decoders with necessary examples. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. | a. | Develop a sequence generator to generate an even sequence of 000, 010,100,110 using delay flip flop. | CO4 | A | 6 |
|  | b. | Describe the evolution of Latches from 1 bit memory cell. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Develop a MOD10 asynchronous counter and explain its working principle. | CO5 | A | 7 |
|  | b. | Construct a Johnson counter and describe its functioning using truth table. | CO5 | A | 5 |
|  |  |  |  |  |  |
| 22. | a. | Construct a data flipflip and toggle flipflop from JK flipflop and explain their operation. | CO4 | A | 8 |
|  | b. | Discuss about different types of triggering. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Design a 3:8 decoder using logic gates. | CO3 | A | 6 |
|  | b. | Develop a full adder using two multiplexers. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Construct an inverter using CMOS logic and explain the operation. | CO6 | A | 7 |
|  | b. | Construct a PROM logic model for the given two functions.   1. F1 (A, B, C) = ( 0,1,2,5,7) 2. F2 (A, B, C) = (1,4,6) | CO6 | A | 5 |

**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 Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 8 | 7 |  | - | - | 17 |
| CO2 | - | 5 | 7 | 5 | - | - | 17 |
| CO3 | 2 | 3 | 24 | - | - | - | 29 |
| CO4 | - | 15 | 14 | - | - | - | 29 |
| CO5 | - | 4 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the purpose of electrocardiogram (ECG). | | CO1 | R | 1 |
| 2. | Define ionic conduction. | | CO1 | R | 1 |
| 3. | List down the types of medical thermometers. | | CO2 | R | 1 |
| 4. | Write down the expression for Nernst equation. | | CO2 | A | 1 |
| 5. | Name the law applied in ear oximeter. | | CO3 | R | 1 |
| 6. | Define stroke volume. | | CO3 | R | 1 |
| 7. | List down the types of temporary pacemakers. | | CO4 | R | 1 |
| 8. | Compare internal and external defibrillator. | | CO4 | U | 1 |
| 9. | Indicate the function of ventilator. | | CO5 | U | 1 |
| 10. | Identify the significance of electrodiagnostics. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Classify the types of surface electrodes. | | CO1 | U | 3 |
| 12. | Calculate body mass index, if the weight of a person is 80 kg, and height is 1.67 m. | | CO2 | An | 3 |
| 13. | Sketch the block diagram of an apnea monitor. | | CO3 | A | 3 |
| 14. | Differentiate between intracardiac electrode and endocardia electrode. | | CO4 | U | 3 |
| 15. | Define synchronized intermittent mandatory ventilation. | | CO5 | R | 3 |
| 16. | Compare galvanic current and faradic 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. | Describe the role of standard 12-lead configurations for ECG signal acquisition with necessary diagrams. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working of Rheograhic method for blood pressure measurement with neat diagram. | CO2 | U | 6 |
|  | b. | Discuss in detail about the role of extravascular sensor in blood pressure measurement. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Enumerate the functional elements of computerized patient monitoring system with neat diagram. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 20. | a. | Write short notes on steroid-eluting electrode. | CO4 | A | 4 |
|  | b. | Sketch the schematic of defibrillator and highlight its features. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. | a. | Discuss about Nebulizer. | CO5 | U | 5 |
|  | b. | Explain the functioning of ventilator with neat block diagram. | CO5 | U | 7 |
|  |  |  |  |  |  |
| 22. | b. | Explain the working of phonocardiogram with neat block diagram and highlight its features. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe the working principle of pulse oximeter with neat diagram. | CO3 | U | 10 |
|  | b. | Write the expression for calculating oxygen saturation. | CO3 | A | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the working principle of stimulator used for treating pain with neat diagram. | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **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** | 14 | 15 | - | - | - | - | 29 |
| **CO2** | 1 | 12 | 1 | 3 | - | - | 17 |
| **CO3** | 14 | 10 | 5 | - | - | - | 29 |
| **CO4** | 1 | 4 | 12 | - | - | - | 17 |
| **CO5** | 3 | 13 | - | - | - | - | 16 |
| **CO6** | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Distinguish between direct current and alternating current. | | CO1 | U | 1 |
| 2. | State the faraday’s law of electromagnetic induction. | | CO1 | R | 1 |
| 3. | Define the term peak factor. | | CO2 | R | 1 |
| 4. | List the types of kirchoff’s law. | | CO2 | R | 1 |
| 5. | Sketch the electronic symbol of resistor. | | CO3 | A | 1 |
| 6. | Categorize the different types of DC circuit. | | CO3 | An | 1 |
| 7. | Define the term resistance. | | CO4 | R | 1 |
| 8. | Write the expression for ohm’s law. | | CO5 | A | 1 |
| 9. | List the applications of DC motors. | | CO5 | R | 1 |
| 10. | Discuss the applications of three phase alternators. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the effective value or RMS value of AC circuit. | | CO1 | R | 3 |
| 12. | List the uses of capacitor. | | CO2 | R | 3 |
| 13. | Illustrate the behavior of AC for series RLC circuit. | | CO3 | An | 3 |
| 14. | List the applications of DC series-parallel circuit. | | CO4 | R | 3 |
| 15. | An 110V supplies a load with a resistance of 3 ohm, 5 ohm and 7 ohm respectively. Find the current in the circuit. | | CO5 | An | 3 |
| 16. | Explain the types of DC generators. | | 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. | Discuss the standard terminology of AC circuit. | CO1 | U | 6 |
|  | b. | An inductor coil having a resistance of 10 ohm, and inductance of 50 mH is connected to 220V, 5 Hz supply. Calculate the current, real power, reactive power and apparent power. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the working of inductor. | CO1 | U | 6 |
|  | b. | Explain the kirchoff voltage law with example. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the node analysis procedure. | CO2 | An | 6 |
|  | b. | Tabulate the main difference between the series connection of resistor and parallel connection of resistor. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 20. | a. | Interpret the behavior of AC when passing through a pure inductance. | CO3 | A | 6 |
|  | b. | Explain the key components of DC series circuit. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Differentiate between series and parallel DC circuit. | CO4 | U | 6 |
|  | b. | Illustrate the construction of DC generator. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Evaluate the torque equation of DC motor. | CO4 | E | 6 |
|  | b. | Explain the two modes of PN junction diode. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the operation of depletion type MOSFET. | CO5 | U | 6 |
|  | b. | Illustrate the representations of logic functions. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Enumerate the key features of sphygmomanometer. | CO6 | R | 6 |
|  | b. | Describe the components of blood gas analyser. | CO6 | R | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 19 | 6 | - | - | - | 29 |
| CO2 | 11 | - | - | 6 | - | - | 17 |
| CO3 | - | 6 | 7 | 4 | - | - | 17 |
| CO4 | 4 | 12 | - | - | 6 | - | 22 |
| CO5 | 1 | 12 | 1 | 9 | - | - | 23 |
| CO6 | 12 | 4 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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| **Course Code** | **23BM3001** | **Duration** | **3hrs** |
| **Course Name** | **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. |  | Explain the physiology of human eye. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Compare the different types of electrodes. | CO2 | U | 10 |
|  | b. | Summarize the concept of action potential. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the indirect measurement of blood pressure. | CO4 | U | 10 |
|  | b. | Summarize the functions of hardware modules involved in the design of heart lung machine. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the concept of artificial mechanical ventilation. | CO5 | U | 10 |
|  | b. | Analyze the physiology of respiratory system. | CO5 | U | 10 |
|  |  |  |  |  |  |
| 5. |  | Design the interfacing circuit for EEG measurement. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the measurement of potentials from ECG. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 7. |  | Classify the different methods of blood flow measurement. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Describe the method to monitor the bi spectral index in EEG. | CO3 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the physiological effects of electricity on the human body. | CO6 | U | 10 |
|  | b. | Differentiate macro and micro shock. | CO6 | U | 10 |

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

|  |  |
| --- | --- |
|  | **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 neurological illness |
| CO4 | Categorize the medical devices based on cardiovascular applications |
| CO5 | Assess the various parameters, constraints in methodology for effective diagnosis of respiratory systems |
| CO6 | Design of biomedical equipment 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 | 20 |  |  |  |  |  | 20 |
| CO2 | 20 |  |  |  |  |  | 20 |
| CO3 | 40 | 20 |  |  |  |  | 60 |
| CO4 | 40 |  |  |  |  |  | 40 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 |  |  |  |  |  | 20 |
|  | | | | | | | **180** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Classify embedded systems based on ‘functional requirements’. | CO1 | An | 8 |
|  | b. | Write a detailed note on embedded hardware units. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | Explain the steps in designing an embedded Software. | CO2 | A | 10 |
|  | b. | Write notes on linking and locating software. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | Analyze programming in a high-level language. | CO3 | An | 11 |
|  | b. | Discuss the basic structure of embedded C programming. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 4. | a. | Summarize Interrupt concepts followed in embedded systems. | CO4 | E | 9 |
|  | b. | Write a program to interface 7 segment LED to an embedded system. | CO4 | C | 7 |
|  |  |  |  |  |  |
| 5. | a. | Assess various clinical problems involved in designing wearable devices and mention engineering approaches to overcome them. | CO5 | E | 10 |
|  | b. | Explain various components in a wearable device. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 6. | a. | Write a note on skills required for an embedded design engineer. | CO1 | A | 10 |
|  | b. | Write a note on design metrics in embedded systems. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 7. | a. | Explain DAQ and design an Arduino-based DAQ. | CO4 | A | 12 |
|  | b. | Discuss briefly timers and counters. | CO4 | U | 4 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain the design of a wearable body temperature measurement device. | CO6 | A | 10 |
|  | b. | Write a note on wireless body area network. | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Discuss the basics of embedded systems and its hardware units |
| CO2 | Identify the various tools and development process of embedded system |
| CO3 | Create the programming for embedded system design |
| CO4 | Demonstrate the various peripherals interfacing with microcontroller |
| CO5 | Summarize the characteristics of wearable device |
| CO6 | Develop 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 | - |  | 8 | 24 | - | - | 32 |
| CO2 | - |  | 16 | - | - | - | 16 |
| CO3 | - | 5 | - | 11 | - | - | 16 |
| CO4 | - | 4 | 12 | - | 9 | 7 | 32 |
| CO5 | - | - | 6 | - | 10 | - | 16 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **132** |



**END SEMESTER EXAMINATION – APRIL / MAY 2024**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Illustrate the concept of BPN with a relevant solved example. | CO1 | An | 16 |
|  |  |  |  |  |  |
| 2. | a. | Explain Convolutional Neural Network with a solved example. | CO2 | A | 10 |
|  | b. | Demonstrate the principle behind Deep Belief Network with suitable diagram. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 3. | a. | Illustrate Electronic Health Record system and genomics in detail. | CO3 | E | 8 |
|  | b. | Enumerate the concept of medical imaging in detail. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Discuss the advantages of digital therapeutics in healthcare field. | CO4 | An | 8 |
|  | b. | Describe the significance of biomarkers in medical imaging field. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the steps involved in small dataset in medical field technique. | CO5 | E | 8 |
|  | b. | Define data augmentation and its benefit. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 6. | a. | Illustrate a case study on Radiological equipment using deep learning technique with appropriate diagram. | CO4 | C | 16 |
|  |  |  |  |  |  |
| 7. | a. | Specify the method to detect and prevent overfitting challenges. | CO5 | E | 8 |
|  | b. | Explain General Adversarial Network and its type. | CO2 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Generate a deep learning concept, technique and an algorithm in ultrasound and MRI diagnostic devices. | CO6 | C | 20 |

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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. | | | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 16 | - | - | 16 |
| CO2 | - | - | 10 | 8 | 6 | - | 24 |
| CO3 | - | - | - | - | 16 | - | 16 |
| CO4 | - | 8 | - | 8 | - | 16 | 32 |
| CO5 | - | - | - | - | 24 | - | 24 |
| CO6 | - | - | - | - | - | 20 | 20 |
|  | | | | | | | **132** |