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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** | **Marks** |
| **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. | Identify the stability of the system whose transfer function is | | 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. | Compare open loop and closed loop system. | | CO1 | An | 3 |
| 12. | Estimate the settling time for 2% and 5% error if damping ratio=0.5 and undamped natural frequency = 3 rad/sec. | | 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 | | CO4 | A | 3 |
| 15. | Evaluate the transfer function of Lead compensator and draw the diagram. | | 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. | Examine the Controllability and Observability for a system represented using the state model shown below. | CO3 | A | 8 |
|  | b. | Write the state equation for the following state model  + | CO3 | A | 4 |
| 20. |  | Construct the root locus for the open loop transfer function of unity feedback control system given below.  G(S) = | CO4 | A | 12 |
| 21. |  | Sketch the polar plot for the system whose open loop transfer function  G(S) =  Determine phase margin and gain margin. | 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 / P | **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** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Compare ECG and EEG electrodes. | | CO1 | U | 1 |
| 2. | Outline about Einthoven triangle. | | CO1 | R | 1 |
| 3. | Memorize the normal blood pH value. | | CO2 | R | 1 |
| 4. | Write the equation giving relationship between potential generated and pH for a glass electrode. | | CO2 | R | 1 |
| 5. | What are the different parameters used for measuring the lung capacity. | | CO3 | U | 1 |
| 6. | Highlight the term cardiac output. | | CO3 | R | 1 |
| 7. | Express the term Defibrillator. | | CO4 | U | 1 |
| 8. | Define the term truncated defibrillator. | | CO4 | R | 1 |
| 9. | Infer the term positive pressure. | | CO5 | U | 1 |
| 10. | What is electrotherapy? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Paraphrase the common types of artefacts encountered in ECG recordings. | | CO1 | An | 3 |
| 12. | Sketch the different method for measuring respiration rate. | | CO2 | U | 3 |
| 13. | Conclude about the ultrasonic spirometers. | | CO3 | An | 3 |
| 14. | Differentiate AC & DC defibrillator. | | CO4 | U | 3 |
| 15. | Relate the assist mode in ventilators with control mode. | | CO5 | An | 3 |
| 16. | Define 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. | What is an ECG Lead? Describe various types of leads used for recording ECG signal. | CO1 | U | 5 |
|  | b. | Explain with the help of a diagram the major building blocks of an EEG machine. | CO1 | U | 7 |
|  |  |  |  |  |  |
| 18. | a. | Draw a diagram showing the constructional details of micro capillary electrode for the measurement of blood pH. What is the effect of blood on the working of the glass electrode and the measures taken to minimize the effect ? | CO2 | A | 6 |
|  | b. | Illustrate in detail the impedance pneumography method. | CO2 | An | 6 |
| 19. | a. | Detail the different types of spirometers. | CO3 | U | 6 |
|  | b. | Illustrate in detail the ‘Ficks’ method. | CO3 | An | 6 |
| 20. | a. | Sketch the different types of defibrillators. | CO4 | A | 6 |
|  | b. | Recognize the modes of operation of pacemakers. | CO4 | U | 6 |
| 21. | a. | Detail about pressure cycled & volume cycled ventillators. | CO5 | R | 7 |
|  | b. | Illustrate in detail the ventilator testing. | CO5 | An | 5 |
| 22. | a. | Describe about the ultrasonic device used for blood flow measurement. | CO3 | U | 7 |
|  | b. | Explain about ear oximetry. | CO3 | R | 5 |
| 23. | a. | Explain the displacement method and thermistor method for respiration rate method. | CO2 | R | 6 |
|  | b. | Describe any method for blood pressure measurement. | CO2 | U | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the Interferential current therapy. | CO6 | R | 6 |
|  | b. | Summarize the Spinal cord stimulator. | CO6 | U | 6 |

**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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 13 | - | 3 | - | - | 17 |
| CO2 | 8 | 9 | 6 | 6 | - | - | 29 |
| CO3 | 6 | 14 | - | 9 | - | - | 29 |
| CO4 | 1 | 10 | 6 | - | - | - | 17 |
| CO5 | 7 | 1 | - | 8 | - | - | 16 |
| CO6 | 6 | 10 | - | - | - | - | 16 |
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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The conversion of analogue to digital signal is known as \_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Name the bioelectric signal related to the muscle activity. | | CO1 | R | 1 |
| 3. | List the two types of analogue filters used for IIR Filter design. | | CO2 | R | 1 |
| 4. | Give reason for 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=7. | | CO4 | U | 1 |
| 8. | In a FIR filters only \_\_\_\_\_\_ are present. | | CO4 | R | 1 |
| 9. | Illustrate the PQRS components of an ECG wave. | | CO5 | U | 1 |
| 10. | An EMG is accompanied by \_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define Sampling Theorem with proper substantiation. | | 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. | Find w(n) for N=5 in Blackmann Window. | | CO4 | U | 3 |
| 15. | List the QRS detection algorithms and mention a few of their respective disadvantages. | | CO5 | An | 3 |
| 16. | Mention the importance of cardio-respiratory interactions. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | For x(n)={2,1,2,1,2,1,2,1}  Find X(k) using Decimation in Time FFT Algorithm. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | For the given digital filter specifications   1. Find the Analogue specifications of the filter and illustrate them. 2. Find the cut off frequency and the order of the digital filter 3. Find the poles of the analogue filter. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the digital transfer function of the following analogue transfer function | CO3 | E | 7 |
|  | b. | Differentiate Butterworth and Chebyshev Filters. | CO3 | An | 5 |
|  |  |  |  |  |  |
| 20. |  | 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 electro-physiological origin of brain waves. | CO5 | An | 6 |
|  | b. | Discuss the basic EEG Analysis blocks with proper formulae. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Determine the transfer function H(z) for N=11 in an ideal bandpass filter using Hanning Window with | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | For the given digital filter specifications   1. Find the analogue specifications for the Chebyshev filter design and illustrate the filter 2. Find the analogue poles of Chebyshev filter with diagrammatic representation using bilinear transformation method. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | For an 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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| **Course Code** | **18BM2014** | **Duration** | **3hrs** |
| **Course Name** | **REAL TIME EMBEDDED SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | Name the embedded system which supports 32-64 bit multiple chips and can perform distributed jobs. | CO1 | R | 1 |
| 2. | Identify the processor with an instruction set designed for specific applications on a VLSI chip | CO1 | R | 1 |
| 3. | List any two software tools used in the embedded system. | CO2 | U | 1 |
| 4. | Which clock causes occurrences of regular interval interrupts on each tick? | CO2 | U | 1 |
| 5. | Write the instruction in 8051 to swap a lower nibble and higher nibble of A register. | CO3 | U | 1 |
| 6. | Name the 8051 register which is used to load the address of next instruction to be fetched. | CO3 | U | 1 |
| 7. | What are source files? | CO4 | R | 1 |
| 8. | Justify the neceesity of compiler in programming language. | CO4 | R | 1 |
| 9. | What is a state diagram? | CO5 | U | 1 |
| 10. | Give two types of semaphores in RTOS. | CO5 | R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Outline the characteristics of embedded system. | CO1 | U | 3 |
| 12. | Define process deadlines. | CO2 | R | 3 |
| 13. | Distinguish between timer and counter. | CO3 | U | 3 |
| 14. | Write an assembly language instructions in 8051 microcontroller to make LED ON/OFF with 500ms delay. | CO4 | A | 3 |
| 15. | Identify the significance of context switching. | CO5 | U | 3 |
| 16. | Define task in real time embedded system. | CO6 | R | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23)** | | | | | |
| 17. |  | Describe the various hardware units of the embedded system. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Summarize the issues related to hardware and software design. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain timer operation in 8051 microcontroller. | CO3 | U | 6 |
| b. | Write an assembly language program to toggle LED for 1 second using the timer. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20 |  | Describe different data structures and how it is put in the memory blocks in an organized way. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Categorize different task states in RTOS. | CO5 | An | 6 |
| b. | Illustrate,for example, the different types of scheduling algorithms. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize various design metrics for an embedded system. | CO2 | U | 6 |
| b. | Illustrate with an example, the different classifications of an embedded system based on complexity and performance. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Summarize the features of general 8 bit microcontroller. | CO3 | U | 6 |
| b. | Write the assembly language program to read the switch status and glow the LED for one second when the switch is ON. | CO3 | A | 6 |
|  |  | **COMPULSORY QUESTION** | | | |
| 24. |  | With a block diagram, explain stepper motor interfacing with microcontroller. Write an embedded C program to rotate the motor in a clockwise direction. | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the basics of embedded systems and their hardware units. |
| CO2 | Identify the various tools and development process of embedded system. |
| CO3 | Demonstrate the various I/O interfacing with the 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 Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | 3 | 20 | 6 | - |  |  | 29 |
| CO3 | - | 17 | 12 | - | - | - | 29 |
| CO4 | 2 | 12 | 3 |  |  |  | 17 |
| CO5 | 1 | 4 | 6 | 6 | - | - | 17 |
| CO6 | 3 | - | - | 12 | - | - | 15 |
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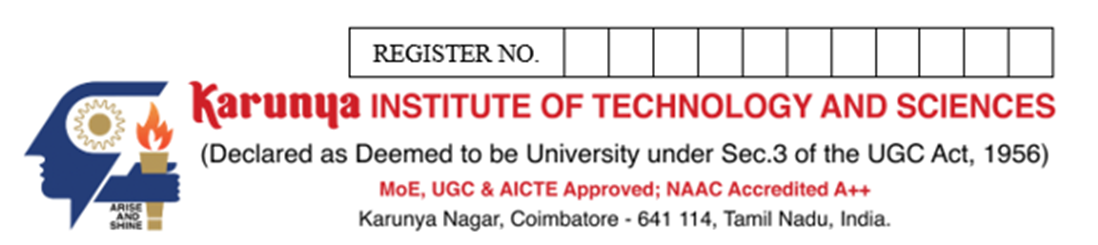
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| **Course Code** | **18BM2015** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL DIAGNOSTICS AND THERAPEUTIC EQUIPMENT-II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What property of sound waves acts like the principle of ultrasound? | | CO1 | R | 1 |
| 2. | Write the principle of Flame emission photometers. | | CO1 | R | 1 |
| 3. | List the sedative agents used in anesthesia machine. | | CO2 | U | 1 |
| 4. | The movement of diaphragm in simple infrared analyzer for gas analysis results \_\_\_\_\_\_\_\_\_\_ | | CO2 | U | 1 |
| 5. | The volume of blood within the dialyzer is known as \_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 6. | What are the two settings of diathermy? | | CO4 | U | 1 |
| 7. | What are the types of audiometer? | | CO4 | U | 1 |
| 8. | Pure-tone audiometers usually generate test tones in octave steps from \_Hz to \_\_\_\_Hz | | CO5 | R | 1 |
| 9. | The endoscope that examines the respiratory tract is called as \_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| 10. | Cryogenics deals with which type of temperature\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the principle of spectrophotometer. | | CO1 | R | 3 |
| 12. | Define tidal volume. | | CO2 | U | 3 |
| 13. | Write the important process in the dialysis. | | CO3 | A | 3 |
| 14. | Define cutting and coagulation in diathermy. | | CO4 | U | 3 |
| 15. | Classify the audiometer. | | CO5 | A | 3 |
| 16. | Define endoscope. | | 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 clinical flame photometer with neat diagram. | CO1 | U | 8 |
|  | b. | List the advantages of multi parameter monitor. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the various respiratory volumes. | CO2 | U | 10 |
|  | b. | Write the two methods to assess the pulmonary function. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 19. | a. | With neat diagram explain about extracorporeal dialysis. | CO3 | U | 9 |
|  | b. | Illustrate the function of kidney. | CO3 | U | 3 |
|  |  |  |  |  |  |
| 20. | a. | Explain the working of Helium Neon laser with neat diagram. | CO4 | U | 8 |
|  | b. | List the advantages of shortwave diathermy. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the transducers used in audiometer. | CO5 | U | 3 |
|  | b. | Outline the measurement of Basal skin response and Galvanic Skin response. | CO5 | U | 9 |
|  |  |  |  |  |  |
| 22. | a. | Explain the working of endoscopy equipment. | CO6 | U | 8 |
|  | b. | Outline the advantages of automated drug delivery system. | CO6 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the working of basic audiometer. | CO5 | U | 10 |
|  | b. | What is meant by TENS? | CO5 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Summarize the types of leakage currents. | CO1 | U | 8 |
|  | b. | Define micro and macro shock. | CO1 | U | 4 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the principle involved in clinical and optical equipment’s |
| 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’s 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 24 |  |  |  |  | 29 |
| CO2 |  | 17 |  |  |  |  | 17 |
| CO3 |  | 14 | 3 |  |  |  | 17 |
| CO4 | 1 | 16 |  |  |  |  | 17 |
| CO5 | 2 | 24 | 3 |  |  |  | 29 |
| CO6 |  | 15 |  |  |  |  | 15 |
|  | | | | | | | **124** |

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**SUPPLEMENTARY EXAMINATION - JUNE 2023**

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| **Course Code** | **18EI2002** | **Duration** | **3hrs** |
| **Course Name** | **CONTROL SYSTEMS** | **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. | Mention the rule for eliminating feedback loop in block diagram implementation. | | CO1 | U | 1 |
| 2. | Define transfer function. | | CO1 | R | 1 |
| 3. | Name the test signals used in control system. | | CO2 | U | 1 |
| 4. | Sketch the response of a second order underdamped system. | | CO2 | R | 1 |
| 5. | Define cut off rate. | | CO3 | U | 1 |
| 6. | Define bandwidth. | | CO3 | R | 1 |
| 7. | Sketch the step response of a P and PI-controller. | | CO4 | U | 1 |
| 8. | Define state vector. | | CO5 | U | 1 |
| 9. | List the advantages of state variable approach. | | CO5 | U | 1 |
| 10. | Mention the output of the optimal control system. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Mention the force balance equation of ideal mass element. | | CO1 | U | 3 |
| 12. | Give the condition for routh stability. | | CO2 | U | 3 |
| 13. | Define gain margin. | | CO3 | U | 3 |
| 14. | List the advantages of PID Controller. | | CO4 | U | 3 |
| 15. | Give the general form of state variable representation. | | CO5 | U | 3 |
| 16. | List the disadvantages of nonlinear system. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Elaborate open loop and closed loop control system with suitable examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the rules for block diagram reduction technique in control system. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Derive the response of second order system when the input is unit step. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | The characteristic polynomial of a system is s 6+ 2s5+ 8s4+ 12s3+ 20s2+ 16s + 16 = 0.   1. Determine the location of roots on the s-plane. 2. Comment on the stability of the system. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Sketch bode plot for the following transfer function and obtain the gain cross over frequencies. . | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Enumerate the Step by step procedure for design PID Controller in frequency domain. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Consider the matrix A. Compute the state estimation matrix, . . | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Elaborate tracking and regulation in control system. | CO6 | U | 12 |

**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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 28 |  |  |  |  | 29 |
| CO2 | 1 | 4 | 24 |  |  |  | 29 |
| CO3 | 1 | 4 | 12 |  |  |  | 17 |
| CO4 |  | 16 |  |  |  |  | 16 |
| CO5 |  | 5 | 12 |  |  |  | 17 |
| CO6 |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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|  |  |  |  |
| **Course Code** | **18EI2009** | **Duration :** | **3hrs** |
| **Course Name** | **INSTRUMENTATION AND CONTROL** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
|  | **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | List the applications of measurement systems. . | CO1 | U | 1 |
| 2. | Define random error. | CO1 | R | 1 |
| 3. | Which transducer converts heat energy into electrical energy? | CO2 | R | 1 |
| 4. | Define strain. | CO2 | U | 1 |
| 5. | What is negative temperature coefficient? | CO3 | R | 1 |
| 6. | List the characteristics of negative feedback. | CO3 | U | 1 |
| 7. | Write the basic elements used for modelling mechanical translational system. | CO4 | R | 1 |
| 8. | Write the rule for eliminating positive feedback loop. | CO4 | R | 1 |
| 9. | Define transfer function. | CO5 | R | 1 |
| 10. | Find the order and type for system G(s) =1/S3 (s+1) | CO6 | R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Define error and list the types of error. | CO1 | R | 3 |
| 12. | Define Seeback effect. | 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. | Write the condition for stability. | CO6 | R | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23)** | | | | | |
| 17. |  | Describe the fundamental measurement process and draw the block diagram of generalized measurement system with example. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss the constructional features of bourdon-tube pressure gauge. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain briefly the construction and working of a thermocouple. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | With neat diagram, explain the construction and working of dew point meter. | CO2 | U | 12 |
|  |  |  |  |  |  |

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| 21. |  | Explain open loop and closed loop control system with example. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Use Mason’s gain formula for determining the overall transfer function of the system shown in Fig. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Derive the response of first order system and analyze the system when the input is unit step. | CO6 | A | 12 |
|  |  | **Compulsory:** |  |  |  |
| 24. |  | The characteristic polynomial of a system is s 6+ 2s5+ 8s4+ 12s3+ 20s2+ 16s + 16 = 0. Determine the location of roots on the s-plane and hence the stability of the system. | CO5 | AN | 12 |

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|  | **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 | Analyze the time response of various order of the system. |
| CO6 | Analyze the Concept of stability |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 25 | - | - | - | - | 29 |
| CO2 | 1 | 28 | - | - | - | - | 29 |
| CO3 | 1 | 16 | - | - | - | - | 17 |
| CO4 | 2 | 3 | 12 | - | - | - | 17 |
| CO5 | 4 | - | - | 12 | - | - | 16 |
| CO6 | 4 | - | 12 | - | - | - | 16 |
|  | | | | | | | 124 |



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| --- | --- | --- | --- |
| **Course Code** | **19BM2001** | **Duration** | **3hrs** |
| **Course Name** | **SENSORY AND MOTOR REHABILITATION** | **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. | Write the role of assist device to disabled subjects. | | CO1 | R | 1 |
| 2. | Mention the stake holders in community based rehabilitation. | | CO1 | U | 1 |
| 3. | Show the uses of venture capitalist. | | CO2 | R | 1 |
| 4. | Give a user friendly parameter in assist device. | | CO2 | A | 1 |
| 5. | Present the advantages of manual wheel chair. | | CO3 | An | 1 |
| 6. | Confer the tactile information display. | | CO3 | An | 1 |
| 7. | Indicate the materials preferred for orthoses. | | CO4 | U | 1 |
| 8. | Develop the aid for overcoming the dyslexia in old aged. | | CO6 | C | 1 |
| 9. | Analyze the functions of virtual reality aids. | | CO5 | An | 1 |
| 10. | Give the applications of robots in upper limb recovery process. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List few assistive devices that enhance healthy living. | | CO1 | R | 3 |
| 12. | Classify the visual impairments in human. | | CO2 | U | 3 |
| 13. | Present the structure of cochlea. | | CO3 | R | 3 |
| 14. | Analyze the functions of braille language. | | CO4 | An | 3 |
| 15. | Give the application of computer literacy to neuro-rehabilitation subjects. | | CO5 | A | 3 |
| 16. | Infer the significance of biomedical engineering in rehabilitation. | | 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. |  | Evaluate the social relevant models in rehabilitation engineering. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Confer the role and functions of clinical rehabilitation engineering for solving user needs. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 19. |  | Formulate various parameters for considering while designing a product for disabled subjects. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyze the barriers and tools in implementing universal design. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Analyze the attributes of three different mechanisms for funding the transfer of a technology to a commercial assistive device product. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Design the power assisted wheel chair for the locomotor disabled patients. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 23. | a. | Develop the assistive device for visual impaired subjects. | CO6 | C | 8 |
|  | b. | Give the applications of assistive devices to a disabled person. | CO2 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the assistive technology aids for the challenged subjects for supporting their daily living. | CO5 | E | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the models of rehabilitation. |
| CO2 | Interpret the techniques for disabilities related to sensory and motor functions. |
| CO3 | Construct the test bench, tools and methods for troubleshooting. |
| CO4 | Compare various standards and specifications. |
| CO5 | Decide quality and safety standards in design of devices for user needs. |
| CO6 | Formulate advanced methods to solve critical problems related to old aged. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 |  |  | 12 |  | 17 |
| CO2 | 1 | 3 | 5 |  |  |  | 9 |
| CO3 | 3 |  |  | 15 |  | 12 | 30 |
| CO4 |  | 1 |  | 15 |  |  | 16 |
| CO5 | 12 |  | 3 |  | 12 | 12 | 39 |
| CO6 |  |  | 4 |  |  | 9 | 13 |
|  | | | | | | | **124** |



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| **Course Code** | **19BM2004** | **Duration** | **3hrs** |
| **Course Name** | **NUCLEAR MEDICINE** | **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. | Gamma radiation are also called \_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 2. | Positive Beta decay happens in \_\_\_\_\_\_\_\_\_\_\_ deficient nuclei. | | CO2 | U | 1 |
| 3. | Give an example for molecular imaging. | | CO2 | R | 1 |
| 4. | Choline is used as a radiopharmaceutical for diagnosis of \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Gamma camera detects \_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | The collimator is a \_\_\_\_\_\_\_\_ like structure. | | CO3 | R | 1 |
| 7. | Give two algorithms used for Image reconstruction in PET scans. | | CO3 | R | 1 |
| 8. | What are the factors which affect SPECT images? | | CO3 | U | 1 |
| 9. | State one radiopharmaceutical used for therapeutic application. | | CO6 | U | 1 |
| 10. | Give significance for receptor targeted therapy. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain how gamma rays are emitted from Iron with necessary equations. | | CO2 | U | 3 |
| 12. | Comment on “Theranostics” | | CO2 | U | 3 |
| 13. | List out the components present in the gamma camera. | | CO3 | R | 3 |
| 14. | What are Pulse Height Analyzers? | | CO3 | U | 3 |
| 15. | Write short notes on 1311-MIBG Therapy. | | CO6 | R | 3 |
| 16. | List some ICRP recommendations on radiation safety. | | 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. | Tabulate the Mass Number, Decay mode and Half-life of the following radioactive elements  a) Zinc-52  b) Beryllium-4  c) Iridium-77  d) Proactinium-91 | CO2 | R | 4 |
|  | b. | State the principle behind the Electron Capture with example | CO2 | U | 4 |
|  | c. | Define Annihilation and pair production with suitable diagram | CO2 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Portray the generation of Technetium-99m with necessary equations. | CO2 | U | 6 |
|  | b. | Discuss three radiopharmaceuticals used for cancer diagnostics in detail. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss in detail about the signal processing chain involved for radiation detection. | CO3 | An | 6 |
|  | b. | Give an insight about Wilson Cloud Chamber. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Imagine a SPECT system working which has a collimator with minimal radius. Elaborate on the entire process of its working with suitable diagrams and highlight the differences. | CO3 | A | 6 |
|  | b. | List out the eye signs related to Thyrotoxicosis. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Discuss in detail about Intravascular particulate radionuclide therapy. | CO6 | An | 6 |
|  | b. | Discuss in detail about Radio-Synovectomy using Yitrium. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate with necessary diagrams the principle, construction and working of Positron Emission Tomography scans. | CO3 | A | 6 |
|  | b. | Give significant insights on Palliative Treatment for Bone Metastasis. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss about the Pathogenesis of Primary Thyrotoxicosis. | CO1 | U | 6 |
|  | b. | Give insights on different Channel Analyzers with block diagrams. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss about any one radiation accident and quote its management with proper facts. | CO4 | An | 6 |
|  | b | Write short notes on   1. Radiation effect on Pregnancy and Fertility. 2. Handling of Radioactive Patients. | CO4 | U | 6 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Acquire knowledge about radiation activity in the living cells. |
| CO2 | Identify the key principles of nuclear medicine and radioactivity. |
| CO3 | Analyze the working principle of advanced nuclear medicine imaging systems. |
| CO4 | Interpret the effects of ionizing and non-ionizing radiations. |
| CO5 | Analyze the effect of microwave on human organs and systems. |
| CO6 | Suggest suitable therapeutic radiation for diseases without any side effects. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 6 | - | 6 | - | - | 12 |
| CO2 | 7 | 21 | - | 6 | - | - | 34 |
| CO3 | 5 | 11 | 18 | 6 | - | - | 40 |
| CO4 | 3 | 6 | - | 6 | - | - | 15 |
| CO5 | - | - | - | - | - | - | - |
| CO6 | 4 | 1 | 12 | 6 | - | - | 23 |
|  | | | | | | | **124** |



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| **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. | Interpret subVI. | | CO1 | U | 1 |
| 2. | Mention the working of Highlight Execution Button in VI. | | CO1 | R | 1 |
| 3. | Recall the concept of data constructs. | | CO2 | R | 1 |
| 4. | Represent the features of Property node. | | CO2 | R | 1 |
| 5. | Identify the variable that is used to access front panel objects in several VIs. | | CO3 | R | 1 |
| 6. | Specify the functionality of a notifier. | | CO4 | U | 1 |
| 7. | Comment on user interface design. | | CO4 | U | 1 |
| 8. | Interpret polymorphism. | | CO2 | U | 1 |
| 9. | Represent the components in a cluster. | | CO2 | R | 1 |
| 10. | Recall the concept of buffer allocation. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate between graphical programming and text based programming. | | CO1 | U | 3 |
| 12. | Distinguish between arrays and clusters. | | CO2 | U | 3 |
| 13. | Discuss the configuration of VI server. | | CO5 | U | 3 |
| 14. | Explain the benefits of documenting a VI. | | CO4 | U | 3 |
| 15. | Specify the need of VI metrics in a LabVIEW application. | | CO3 | AN | 3 |
| 16. | Discuss the role of LabVIEW in monitoring vital parameters. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Describe the different palettes in LabVIEW with necessary diagrams. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss the types of sequence structure and illustrate its working with a LabVIEW program. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the TCP and UDP communication protocol in detail. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the processes involved in implementing a Notifier for data transmission. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the functionality of user interface event handler and queued message handler. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the concept of profile memory and its performance. | CO2 | U | 6 |
|  | b. | Discuss the tools and techniques involved in debugging. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Demonstrate the concept and working of for loop and While loop with relevant examples. | CO5 | A | 8 |
|  | b. | Summarize the working of simple state machine. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Demonstrate the application of LabVIEW in controlling assistive devices. | CO6 | A | 12 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 3 | 22 |  |  |  |  | 25 |
| CO3 | 1 | 18 |  | 3 |  |  | 22 |
| CO4 | 1 | 29 |  |  |  |  | 30 |
| CO5 |  | 7 | 8 |  |  |  | 15 |
| CO6 |  |  | 15 |  |  |  | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19BM2008** | **Duration** | **3hrs** |
| **Course Name** | **MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE** | **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. | Human brain contains \_\_\_\_\_\_\_\_\_\_ number of neurons. | | CO1 | U | 1 |
| 2. | Write down the rule for Version spaces. | | CO1 | R | 1 |
| 3. | Define Bayes’ Theorem. | | CO2 | U | 1 |
| 4. | Root node is also called as \_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 5. | Expand ART Network. | | CO3 | R | 1 |
| 6. | Expand BAM. | | CO3 | R | 1 |
| 7. | Expand ANN and its features. | | CO4 | R | 1 |
| 8. | Defuzzification converts \_\_\_\_\_\_\_\_\_ into \_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 9. | Difference between classical set and fuzzy set. | | CO6 | U | 1 |
| 10. | **True or False**  Takagi Sugeno’s approach is better than mamdani approach. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Diagrammatically represent the difference between Machine learning and Artificial Intelligence. | | CO1 | C | 3 |
| 12. | Briefly explain the Decision tree model with suitable block diagrams. | | CO2 | U | 3 |
| 13. | List out the types of Taxonomy of Artificial Neural Network. | | CO3 | R | 3 |
| 14. | Explain about Hetero Associative Network. | | CO4 | U | 3 |
| 15. | Draw the block diagram of Fuzzy logic control. | | CO5 | U | 3 |
| 16. | Apply the 5 point crossover method and find the value of  100100  110011 | | 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. | Elaborate in detail about designing a learning system with suitable block diagram. | CO1 | U | 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. | Elaborate about Mountain and Subtractive clustering. | CO2 | U | 6 |
|  | b. | |  |  |  | | --- | --- | --- | | **History** | **Economics** | **Target** | | 4 | 3 | F | | 6 | 7 | P | | 7 | 8 | P | | 5 | 5 | F | | 8 | 8 | P |   By Using Euclidean formula find the 4 Nearest value w.r.t History=6, Economics=8. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Using Hebb rule find weights require to perform the following classification of C pattern which consider the target value of 1, H pattern which consider the target value of 1 and T pattern consider the target value of -1. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate a case study related to Radiological devices based on ANN. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. |  | By applying fuzzy relations method solve the given problem.  Pik = 0.3 0.5 0.8 0.9 0.5 0.7 0.7  0 0.7 1 Qkj = 0.3 0.2 0 0.9  0.4 0.6 0.5 1 0 0.5 0.5 | CO5 | A | 12 |
| 22. | a. | Describe the types of machine learning in detail. | CO1 | R | 8 |
|  | b. | Define classification and Regression. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Justify the rule of McCulloch-Pitts neuron and solve any basic gates using the same. | CO3 | An | 10 |
|  | b. | Explain about Hopfield network. | CO4 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Apply the concept of Genetic algorithm and maximize the function with Xin interval [0, 31]. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | 7 | 6 | - | - | 3 | 25 |
| CO2 | 4 | 11 | 6 | - | - | - | 21 |
| CO3 | 5 | - | 12 | 10 | - | - | 27 |
| CO4 | 1 | 5 | - | - | - | 12 | 18 |
| CO5 | - | 5 | 12 | - | - | - | 17 |
| CO6 | - | 1 | 12 | 3 | - | - | 16 |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State ‘half period of radio active material.’ | | CO1 | R | 1 |
| 2. | Mention the most important radio nuclide used for human body diagnosis. | | CO1 | R | 1 |
| 3. | List the MRI artifacts. | | CO2 | U | 1 |
| 4. | List few materials which exhibit piezo electric effect. | | CO2 | R | 1 |
| 5. | Record an application of M mode display of Ultrasonic Imaging. | | CO3 | U | 1 |
| 6. | List the pros and cons of Ultrasound. | | CO3 | R | 1 |
| 7. | Give the different types of wave motion. | | CO4 | R | 1 |
| 8. | State the medical applications of thermography. | | CO5 | R | 1 |
| 9. | Expand: DICOM. | | CO6 | R | 1 |
| 10. | Expand: ACR. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between gamma rays and X rays. | | CO1 | U | 3 |
| 12. | State the importance of CT Angiography. | | CO2 | R | 3 |
| 13. | List the applications of MRI. | | CO3 | R | 3 |
| 14. | Differentiate between thermal detector and photo detector. | | CO4 | U | 3 |
| 15. | Define Emissivity. | | CO5 | R | 3 |
| 16. | Mention the characteristics of Liquid Crystal Thermography. | | 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. |  | Classify the various generations of Computerized Tomography. | CO2 | U | 12 |
| 18. |  | Explain the concept of back projection algorithm employed in CT. | CO3 | U | 12 |
| 19. |  | Analyze the concept of NMR principle. | CO1 | AN | 12 |
| 20. |  | Highlight the physics of Ultrasound. | CO4 | R | 12 |
| 21. |  | Summarize the construction and working of vidicon camera. | CO6 | AN | 12 |
| 22. |  | Explain the architecture of PACs with its applications. | CO6 | A | 12 |
| 23. |  | Explain the working principle of an X-ray Machine with neat sketch of the block diagram. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Elaborate on the concept of SPECT. | CO5 | A | 8 |
|  | b. | Differentiate between PET and SPECT. | CO5 | A | 4 |

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

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 16 |  | 12 |  |  | 29 |
| CO2 | 5 | 12 |  |  |  |  | 17 |
| CO3 | 2 | 14 |  | 3 |  |  | 19 |
| CO4 | 12 | 3 |  |  |  |  | 15 |
| CO5 |  | 1 | 12 | 3 |  |  | 16 |
| CO6 |  | 4 | 12 | 12 |  |  | 28 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name any two tools for measuring kinetic quantities. | | CO1 | R | 1 |
| 2. | \_\_\_\_\_\_\_\_\_\_\_ is the movement laterally towards the middle of the body. | | CO1 | R | 1 |
| 3. | When a horse attempts to pull a cart forward, the cart exerts an equal and opposite force on the horse, in accordance with \_\_\_\_\_\_\_\_\_\_\_ law. | | CO2 | U | 1 |
| 4. | \_\_\_\_\_\_\_\_\_\_ is the capacity to do work. | | CO2 | R | 1 |
| 5. | In which fluid, the viscous stresses arising from its flow are at every point linearly correlated to the local strain rate? | | CO3 | U | 1 |
| 6. | Bone is a composite of the \_\_\_\_\_\_\_\_\_\_\_\_\_and the \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Muscular \_\_\_\_\_\_\_\_ result from overstretching of muscle tissue. | | CO4 | U | 1 |
| 8. | When muscle temperature is slightly \_\_\_\_\_\_\_\_\_, the force – velocity curve is shifted. | | CO4 | U | 1 |
| 9. | When the body is in an upright position, the major form of loading on the spine is \_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | The torque created at the shoulder by each arm segment is the product of the segment’s weight and the \_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A basketball is dropped from a height of 2 m onto a gymnasium floor. If the coefficient of restitution between ball and floor is 0.9, how high will the ball bounce? | | CO1 | E | 3 |
| 12. | Define impact and coefficient of restitution. | | CO2 | R | 3 |
| 13. | Compare Epiphysis and Diaphysis of human bone. | | CO3 | U | 3 |
| 14. | List out Newtonian and Non-Newtonian fluids. | | CO4 | A | 3 |
| 15. | Draw the microstructure of filament of the muscle. | | CO5 | An | 3 |
| 16. | Abbreviate the following joints: SC joint, AC joint, GH joint and ST joint. | | 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. | Illustrate the relationships between linear and angular motion. | CO1 | An | 6 |
|  | b. | A windmill-style softball pitcher executes a pitch in 0.65s. If her pitching arm is 0.7 m long, what are the magnitudes of the tangential and radial accelerations on the ball just before ball release, when tangential ball speed is 20 m/s? What is the magnitude of the total acceleration on the ball at this point? | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | A 60 kg diver is positioned so that his radius of gyration is 0.5 m as he leaves the board with an angular velocity of 4 rad/s. What is the diver’s angular velocity when he assumes a tuck position, altering his radius of gyration to 0.25 m? | CO2 | E | 8 |
|  | b. | Two children sit on opposite sides of a playground seesaw. 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, which end of the seesaw will drop? | CO2 | E | 4 |
|  |  |  |  |  |  |
| 19. | a. | Elaborate the viscoelastic behavior of Bone Ligament bone complex with Kelvin–Voight model with neat sketches. | CO3 | An | 10 |
|  | b. | Classify the bone composition. | CO3 | U | 2 |
|  |  |  |  |  |  |
| 20. | a. | Draw and describe the morphological and structure remodeling of blood vessel. | CO4 | A | 8 |
|  | b. | Differentiate between laminar and turbulent flow. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Define the following: Bingham plastic fluid, Shear Thinning fluid & Shear Thickening fluids. | CO4 | R | 8 |
|  | b. | State the rheological properties of blood. | CO4 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Determine the force is exerted by the tendon of a pennate muscle when the tension in the fibers is 100 N, for 45⁰, 60⁰, 90⁰ of pennation. Also, draw the free body diagram and force vector. | CO5 | E | 6 |
|  | b. | Evaluate the torque is produced at the elbow by the biceps brachii inserting at an angle of 60 on the radius when the tension in the muscle is 400 N? (Assume that the muscle attachment to the radius is 30 mm from the center of rotation at the elbow joint). | CO5 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Using the simplifying assumptions of Poppen and Walker, a free body diagram of the arm and shoulder can be constructed as shown below. If the weight of the arm is 33 N, the moment arm for the total arm segment is 30 cm, and the moment arm for the deltoid muscle (Fm) is 3 cm, how much force must be supplied by the deltoid to maintain the arm in this position? What is the magnitude of the horizontal component of the joint reaction force (Rh)? | CO6 | E | 6 |
|  | b. | Illustrate the kinematics of spine with principal planes. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine the various movements that can be carried out at the hip joint and the ligaments of the hip joint with neat diagrams. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| 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 | 2 |  |  | 6 | 9 |  | 17 |
| CO2 | 4 | 1 |  |  | 12 |  | 17 |
| CO3 | 1 | 6 | 10 |  |  |  | 17 |
| CO4 | 12 | 6 | 11 |  |  |  | 29 |
| CO5 | 1 |  |  | 3 | 12 |  | 16 |
| CO6 | 4 |  |  | 18 | 6 |  | 28 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define biomechanics. | | CO1 | R | 1 |
| 2. | Give one example of sliding friction. | | CO1 | R | 1 |
| 3. | A skater goes from a standstill to a speed of 6.7 m/s in 12 seconds.  What is the acceleration of the skater? | | CO2 | R | 1 |
| 4. | The process of producing new bone matrix is known as\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 5. | Epiphysis is connected to diaphysis at both ends with a narrow zone called as \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | Define the line of gravity. | | CO4 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_ is a fluid force that always acts vertically upward. | | CO4 | U | 1 |
| 8. | The junction between nerve and muscle is called \_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 9. | When the resistance (force) is negligible, muscle \_\_\_\_\_\_\_\_\_\_\_\_ with maximal velocity. | | CO5 | U | 1 |
| 10. | The proximal femur terminates in a ball like head that \_\_\_\_\_\_\_\_\_\_\_\_\_ within the acetabulum of the pelvis. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A cyclist accelerates at 0.89m/s2 during a 5.0s interval. Determine the change in the speed of the bicyclist and the bicycle? | | CO1 | An | 3 |
| 12. | Discuss three types of methods of measuring body angels with diagrams. | | CO2 | U | 3 |
| 13. | Distinguish between trabecular and cortical bone. | | CO3 | U | 3 |
| 14. | State Newton’s law of viscosity and write the equation. | | CO4 | U | 3 |
| 15. | Sketch the microstructure of filament of the muscle. | | CO5 | An | 3 |
| 16. | Abbreviate the following joints: SC joint, AC joint, GH joint and ST joint. | | 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. | Discuss various coordinate planes and the direction terminologies of a human body in standing position, with a neat diagram. | CO1 | U | 8 |
|  | b. | A windmill-style softball pitcher executes a pitch in 0.65s. If her pitching arm is 0.7 m long, what are the magnitudes of the tangential and radial accelerations on the ball just before ball release, when tangential ball speed is 20 m/s? What is the magnitude of the total acceleration on the ball at this point? | CO1 | E | 4 |
|  |  |  |  |  |  |
| 18. | a. | A 60 kg diver is positioned so that his radius of gyration is 0.5 m as he leaves the board with an angular velocity of 4 rad/s. What is the diver’s angular velocity when he assumes a tuck position, altering his radius of gyration to 0.25 m? | CO2 | E | 8 |
|  | b. | Describe the relationship between impulse and momentum derived from Newton’s second law with equation. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Construct the bone structure. | CO3 | A | 8 |
|  | b. | Classify the bone composition. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Define the following with neat diagrams: Flotation, Skin Friction/surface drag, Form drag, Wave Drag, Lift Force and Magnus Effect. | CO4 | R | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the viscoelastic behavior of Bone Ligament bone complex with Kelvin–Voight model with neat sketches. | CO5 | A | 6 |
|  | b. | Define the following: Bingham plastic fluid, Shear Thinning fluid & Shear Thickening fluids. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the factors affecting muscular force generation with relationships: Force Vs Velocity, Length vs Tension and Stretch Vs Shortening Cycle. | CO5 | E | 8 |
|  | b. | Sketch the skeletal muscle function. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the regions of Spine with a neat diagram and the forces acting on the spine. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe various movements that can be carried out at the hip joint and the structure of the hip joint. | CO6 | U | 12 |

|  |  |
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|  | **COURSE OUTCOMES** |
| 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 | 2 | 8 | - | 3 | 4 | - | 17 |
| CO2 | 1 | 7 | - | - | 8 | - | 16 |
| CO3 | 1 | 8 | 8 | - | - | - | 17 |
| CO4 | 13 | 4 | - | - | - | - | 17 |
| CO5 | 7 | 1 | 6 | 7 | 8 | - | 29 |
| CO6 | 3 | 13 | 12 | - | - | - | 28 |
| Total | 27 | 41 | 26 | 10 | 20 | 0 | **124** |



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| **Course Code** | **19BM2015** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL ETHICS AND STANDARDS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Outline the scope of medical ethics. | | CO1 | R | 1 |
| 2. | Interpret “Double Effect”. | | CO1 | R | 1 |
| 3. | List the types of Utilitarianism. | | CO2 | R | 1 |
| 4. | Recall virtue theory. | | CO2 | R | 1 |
| 5. | Mention the 7th Layer in HL7 Protocol. | | CO3 | R | 1 |
| 6. | Distinguish “Agents” and “Managers” of IEEE11073 standard | | CO3 | U | 1 |
| 7. | Give any two methods to extinguish fire. | | CO4 | R | 1 |
| 8. | List the types of testing adopted in medical devices. | | CO4 | R | 1 |
| 9. | Mention the phases in the life span of the medical device. | | CO5 | R | 1 |
| 10. | Name the standard that is followed by electrically operated medical devices. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Distinguish between Medical Ethics, Bioethics and Research Ethics. | | CO1 | U | 3 |
| 12. | Give an outline on the different types of consent. | | CO2 | U | 3 |
| 13. | Describe the LOINC Standard in handling the laboratory test information. | | CO3 | U | 3 |
| 14. | Summarize the accreditation policies framed by JCI. | | CO4 | U | 3 |
| 15. | Illustrate the types of fire alarm systems. | | CO5 | U | 3 |
| 16. | Discuss the basic standards adopted in electrical medical devices. | | 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 regulations given by Canadian Medical Association regarding the fundamental responsibilities of the physician to the patient, society and profession. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss the importance of Confidentiality and the issues that arise in the field of medicine with illustrations. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the DICOM standard followed for transmitting medical images. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the different types of ethical theories followed in medical field for rendering the best medical services. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the handbook of NABH and explain the compliance of Patient centered standards. | CO4 | U | 8 |
|  | b. | Assess the methods of managing Hazardous materials and wastes. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. |  | Examine the life safety standards in protecting the occupants and maintaining the fire alarms in emergency situations. | CO5 | AN | 12 |
|  |  |  |  |  |  |
| 23. |  | Identify the steps to be followed in inspecting the medical equipment. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine the types of medical devices and classify them based on the classes. | CO6 | AN | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the scope of medical ethics. |
| CO2 | Illustrate the concepts of ethical theories and moral principles for the health professions . |
| CO3 | Explain 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 / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 27 |  |  |  |  | 29 |
| CO3 | 1 | 16 |  |  |  |  | 17 |
| CO4 | 2 | 11 |  |  |  |  | 13 |
| CO5 | 1 | 7 |  | 12 |  |  | 20 |
| CO6 | 1 | 15 |  | 12 |  |  | 28 |
|  | | | | | | | **124** |



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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)**  **(Answer all the questions)** | | | | | |
| 1. | State the condition for an even signal. | | CO1 | U | 1 |
| 2. | State the condition for a causal signal. | | CO1 | R | 1 |
| 3. | State the first Dirichlet condition of Fourier Series Expansion. | | CO2 | R | 1 |
| 4. | How is the frequency response of a filter represented as? | | CO2 | R | 1 |
| 5. | State the transform applied for non-stationary signals. | | CO3 | U | 1 |
| 6. | What is the significance of Joint Time Frequency Analysis? | | CO3 | R | 1 |
| 7. | State the way to find the number of poles 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)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate causal and anti-causal signals. | | 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. | Define Z Transform. What are its applications? | | 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. | Define various types of standard functions with relevant illustrative examples. | CO1 | R | 6 |
|  | b. | Explain any three basic operations on signals. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find the Fourier Series for the periodic signal x(t) shown below.  . | CO2 | E | 10 |
|  | b. | Substantiate with proper formulae for expanding a periodic signal in cosine terms. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 19. | a. | Explain the short term Fourier transform with proper substantiation. | CO3 | U | 6 |
|  | b. | Illustrate and explain how joint time-frequency analysis is applied to EEG signals to diagnose epilepsy. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 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 | CO5 | E | 8 |
|  | b. | State the properties of region of convergence in Z Transform. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Find the Fourier Transform of the following and sketch the magnitude and phase spectrum | CO2 | E | 10 |
|  | b. | List the conditions for the existence of Fourier Transform | CO2 | R | 2 |
|  |  |  |  |  |  |
| 23. | a. | Compute the exponential Fourier series of the following signal | CO2 | E | 8 |
|  | b. | Compute the Laplace Transform of the function  x(t) = sin Ω0t | CO4 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss about any one of the Physical Factors Determining the Dynamic Behavior of Physiological Signal. | CO6 | An | 8 |
|  | b. | State the properties of Physiological Systems. | CO6 | R | 4 |

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

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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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **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 | 7 | - | - | 8 | - | - | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19BM2018 / 18BM2001** | **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)** | | | | | |
| 1. | Human cell is a tiny biological battery. Justify the statement. | | CO1 | An | 1 |
| 2. | State the significance of plasma membrane. | | CO1 | U | 1 |
| 3. | Define cardiac output. | | CO2 | R | 1 |
| 4. | Differentiate pericardium and myocardium. | | CO2 | U | 1 |
| 5. | Mention the significance of epiglottis. | | CO3 | U | 1 |
| 6. | Comment on nasal sinuses. | | CO3 | U | 1 |
| 7. | Define cardiac output. | | CO4 | R | 1 |
| 8. | Differentiate pericardium and myocardium. | | CO4 | U | 1 |
| 9. | State the significance of semicircular canals in ear. | | CO5 | U | 1 |
| 10. | Enlist any two neurotransmitters. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Enlist the type of tissues and give example for each. | | CO1 | R | 3 |
| 12. | Comment on bone marrow. | | CO2 | U | 3 |
| 13. | Differentiate aerobic and anaerobic respiration. | | CO3 | An | 3 |
| 14. | Sketch ECG waveform and enlist the segments. | | CO4 | R | 3 |
| 15. | Enlist the ossicles of a human ear. | | CO5 | R | 3 |
| 16. | State the significance of medulla oblongata. | | 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. |  | Portray a clear layout of cell structure, its organelles and explain the functions of each organelle. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Enlist the principal bones of axial and appendicular skeleton. | CO2 | U | 6 |
|  | b. | Explain the structure of a bone with a neat sketch. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Enumerate the process of gas exchange through capillaries with relevant diagrams. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Enumerate a cardiac cycle and the subsequent events in the cycle for a subject having 75 beats per minute with neat sketch. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Portray the structure of human eye, outline its basic anatomical features and explain the process of image formation in eyes. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Classify various blood group system and comment on rare blood groups. | CO4 | U | 8 |
|  | b. | Compare and contrast various types of blood cells. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. |  | Sketch the structure of a nephron and describe the various blood vessels involved in urine formation in henle’s loop. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Sketch a neuron and explain the process of conduction of action potential by neuron and events that occur following release of a neurotransmitter at a synapse. | CO6 | U | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recall the basic elements of human body. |
| CO2 | Compare the major bones and their processes as they relate to each region of the body. |
| CO3 | Interpret the major organs and components of the respiratory system. |
| CO4 | Recognize the major organs and vessels of the cardiovascular system. |
| CO5 | Describe 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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 3 | 13 | - | 1 |  |  | 17 |
| CO2 | 1 | 16 | - | - |  |  | 17 |
| CO3 | - | 14 | - | 3 |  |  | 17 |
| CO4 | 4 | 13 | - | 12 |  |  | 29 |
| CO5 | 3 | 25 | - | - |  |  | 28 |
| CO6 | 1 | 15 | - | - |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19BM2019** | **Duration** | **3hrs** |
| **Course Name** | **BIOMEDICAL SENSORS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define static sensitivity. | | CO1 | R | 1 |
| 2. | Express the relation between relative error and absolute error. | | CO2 | R | 1 |
| 3. | High Precision equipment do not imply high accuracy. True/False | | CO1 | U | 1 |
| 4. | Name the electrode used for measuring ECG. | | CO3 | R | 1 |
| 5. | The time difference between the systems response to 10% of its final value to 90% of its final value is called ……………… | | CO4 | U | 1 |
| 6. | Mention the range of Clinical thermometer. | | CO3 | R | 1 |
| 7. | Name the person behind the first biosensor. | | CO6 | R | 1 |
| 8. | …………………… provide transduction between ionic  and electronic conduction. | | CO2 | U | 1 |
| 9. | Mention the material that is preferred in making the plated disk of disposable foam pad board type elcetrode. | | CO3 | U | 1 |
| 10. | List the two major components of biosensor. | | CO2 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Why is blood pressure measured in Brachial Artery? | | CO2 | AN | 3 |
| 12. | Define mechanoreceptors. | | CO3 | U | 3 |
| 13. | Write about capacitive sensor with neat sketch. | | CO1 | U | 3 |
| 14. | The speed of light in an unknown medium is measured to be  2.76 x 108m/s.  Calculate the refractive index of the medium. | | CO4 | A | 3 |
| 15. | Compare the sensitivity and range of operation of RTD and thermistor. | | CO3 | AN | 3 |
| 16. | Comprehend on the use of enzymes in biocatalyst based sensors. | | CO5 | 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. |  | Discuss in detail on generalized Static characteristics of sensor. | CO1 | U | 12 |
| 18. | a. | Elaborate on how the receptors work and discuss about how a stimuli is converted to nerve impulse. | CO2 | AN | 6 |
|  | b. | Discuss about Pacinian corpuscles. | CO2 | U | 6 |
| 19. |  | Mention the different method of blood pressure measurement and discuss in detail about blood pressure measurement using  Sphygmomanometer. | CO3 | U | 12 |
| 20. |  | Illustrate the biomedical application of inductive sensor and explain in detail about the types of inductive sensors. | CO4 | A | 12 |
| 21. |  | Explain in detail about the fiber optics and optical measurement with a general block diagram. | CO5 | R | 12 |
| 22. |  | Analyze about the different temperature measurement types and discuss in detail about the measurement of temperature using thermistor & RTD. | CO3 | AN | 12 |
| 23. |  | Summarize the different types of biosensors and explain the working of blood glucometer. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the use of different measurement methods in blood flow and compare the electromagnetic type blood flow meter and ultrasonic based blood flow meter. | CO6 | AN | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the calibration procedure for the basic instruments involved in physiological parameter measurement. |
| CO2 | Interpret the errors in measurement by analyzing the performance characteristics of the sensors. |
| CO3 | Demonstrate the appropriate sensor approach which is most likely to meet a specific biosensor application. |
| CO4 | Apply the suitable design criteria for developing a medical sensor for a particular application. |
| CO5 | Develop advanced medical sensors based on the basic transduction principles. |
| CO6 | Predict the qualitative performance of advanced medical sensors. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 12 | 3 |  |  |  |  |  |
| CO2 | 6 | 7 |  | 9 |  |  |  |
| CO3 | 2 | 14 |  | 12 |  |  |  |
| CO4 |  | 1 | 27 |  |  |  |  |
| CO5 | 14 |  | 3 |  |  |  |  |
| CO6 |  |  |  | 12 |  |  |  |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List any two applications of biomedical instrumentation. | | CO1 | U | 1 |
| 2. | Define action potential. | | CO1 | R | 1 |
| 3. | Sketch the diagram for negative feedback amplifier. | | CO2 | A | 1 |
| 4. | Write down the types of preamplifier circuits. | | CO2 | A | 1 |
| 5. | Observe the frequency response curve of stopband filter. | | CO3 | U | 1 |
| 6. | Represent the mathematical expression of overall gain of a cascading filter. | | CO3 | U | 1 |
| 7. | Indicate the use of comparator. | | CO4 | U | 1 |
| 8. | Show the relation between time duration T and clock frequency f. | | CO4 | U | 1 |
| 9. | State the purpose of capture mode in phase locked loop. | | CO5 | R | 1 |
| 10. | Define modulation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare diffusion and active transport. | | CO1 | U | 3 |
| 12. | Write down the characteristics of ideal operational amplifier. | | CO2 | A | 3 |
| 13. | Differentiate capacitive and inductive bandpass filter. | | CO3 | U | 3 |
| 14. | Define zero crossing detector. | | CO4 | R | 3 |
| 15. | List the advantages of phase detector. | | CO5 | R | 3 |
| 16. | Sketch the general analog front end system design for any biomedical application. | | 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 different stages of nerve action potential. | CO1 | U | 10 |
|  | b. | State the role of recording electrodes and highlight its features. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 18. | a. | Describe the working of Non-inverting summing amplifier with neat diagram. | CO2 | A | 6 |
|  | b. | Explain the circuit configuration of an inverting op-amp with neat sketch. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Design a non-inverting active low pass filter circuit that has a gain of ten at low frequencies, a high frequency cut-off or corner frequency of 159Hz and an input impedance of 10KΩ. | CO3 | C | 8 |
|  | b. | Explain in detail about the working of Optocoupler. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. |  | Discuss the following:   1. Successive approximation type ADC 2. Flash type ADC | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the working and functions of Voltage controlled oscillator. | CO5 | An | 10 |
|  | b. | Define phase locked loop. | CO5 | R | 2 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the working principle of trans impedance amplifier. | CO2 | U | 9 |
|  | b. | List down the applications of operational amplifier. | CO2 | R | 3 |
|  |  |  |  |  |  |
| 23. |  | Describe the circuit schematic and working principle of 555 timers with neat diagram. | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the role of safety standards in Bio Potential Measurements. | CO6 | U | 6 |
|  | b. | Compare various modulation techniques used in biosignal processing with neat diagram. | CO6 | U | 6 |

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

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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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 14 | - | - | - | - | 17 |
| CO2 | 3 | 9 | 17 | - | - | - | 29 |
| CO3 | - | 9 | - | - | - | 8 | 17 |
| CO4 | 3 | 26 | - | - | - | - | 29 |
| CO5 | 6 | - | - | 10 | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | For the cascaded block what is the overall transfer function from block diagram? | | CO1 | R | 1 |
| 2. | What is meant by Non-touching loops? | | CO1 | R | 1 |
| 3. | Name the test signals used in control system. | | CO2 | U | 1 |
| 4. | What is the damping ratio? | | CO2 | U | 1 |
| 5. | State the use of Nichol’s chart. | | CO3 | U | 1 |
| 6. | For a stable closed loop system, the gain at phase crossover frequency should always be\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 7. | State the condition for stable system. | | CO4 | U | 1 |
| 8. | What is root locus? | | CO4 | R | 1 |
| 9. | On needle electromyography, a normal, fully relaxed muscle typically shows\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | Name the process of gaseous exchange in the body. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the characteristics of negative feedback. | | CO1 | U | 3 |
| 12. | Name the various standard test signals and its mathematical equation. | | CO2 | U | 3 |
| 13. | List the advantage of frequency response analysis. | | CO3 | U | 3 |
| 14. | What is the relation between stability and coefficient of characteristic polynomial? | | CO4 | R | 3 |
| 15. | List the difference between engineering and physiological control systems. | | CO5 | U | 3 |
| 16. | Define chemical regulation of ventilation. | | 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. | Convert the given block diagram to signal flow graph and determine the transfer function using Mason’s gain formula. | CO1 | U | 9 |
|  | b. | Write the advantages of open loop and closed loop system. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Measurements conducted on a servo mechanism show that the system response to be C(𝑡) = 1 + 0.2𝑒 −60𝑡− 1.2𝑒 −10𝑡 when subjected to a unit step input.Compute the undamped natural frequency and damping ratio. | CO2 | A | 6 |
|  | b. | Consider a unity feedback system with a closed loop transfer C(s)/R(s) = (Ks+b)/(s2 + as + b). Determine the open loop transfer function G(s). Show that steady state error with unit ramp input is given by (a-k)/b. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Sketch Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec. G(s)=Ks2 /[(1+0.2s)(1+0.02s)]. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Consider the sixth order system with the characteristic equation  S 6+2S5+8S4+12S3+20S2+16S+16 = 0. Use Routh-Hurwitz criterion to examine the stability of the system and comment on location of the roots of the characteristics equation. | CO4 | An | 10 |
|  | b. | How will you find root locus on real axis? | CO4 | An | 2 |
|  |  |  |  |  |  |
| 21 | a | Analyze the generalized system properties. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the open loop system. | CO1 | A | 4 |
|  | b. | State the block diagram reduction rules with example. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Mathematical Model of chemical regulation of ventilation | CO6 | A | 6 |
|  | b. | Explain the linear model of respiratory system | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Identify the root locus of a unity feedback system having transfer function G(S) = K/[S(S2+4S+13)].Find the range of K for which the system is stable. | CO4 | A | 10 |
|  | b. | What are asymptotes? How will you find the angle of asymptotes? | CO4 | A | 2 |

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

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



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | \_\_\_\_\_\_is the projection of 3D scene in 2D plane. | | CO1 | R | 1 |
| 2. | The two primary component of human visual system is \_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Illustrate the process of image enhancement. | | CO2 | U | 1 |
| 4. | Comment briefly on the two categories of spatial domain. | | CO2 | R | 1 |
| 5. | List out the types of notch filter. | | CO3 | R | 1 |
| 6. | What are the drawbacks of inverse filter? | | CO3 | An | 1 |
| 7. | Define Segmentation. | | CO4 | U | 1 |
| 8. | Comment briefly on the types on gray level discontinuities. | | CO5 | An | 1 |
| 9. | Filters that only pass components below certain frequency is called as \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Define chain codes. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List out the advantages of digital image. | | CO1 | R | 3 |
| 12. | Explain the non-linear smoothing spatial filter. | | CO2 | U | 3 |
| 13. | Write short notes on pseudo reverse filtering. | | CO3 | U | 3 |
| 14. | Illustrate the two basic operations of morphological processing. | | CO4 | R | 3 |
| 15. | Sketch out some of the popular wavelets. | | CO5 | An | 3 |
| 16. | Explain the need for image compression. | | 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. | Create a neat block diagram that summarizes the basic steps in processing the digital image. | CO1 | A | 10 |
|  | b. | Sketch out the diagram of human photoreceptor distribution. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 18. | a. | With neat block diagram, explain the human visual system. | CO1 | U | 9 |
|  | b. | Write short notes on sensor strips-based image acquisition. | CO1 | R | 3 |
|  |  |  |  |  |  |
| 19. | a. | Elaborate on the basic intensity transformation function. | CO2 | An | 10 |
|  | b. | Identify the applications of sharpening spatial filter. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 20. | a. | With example, explain the process of histogram equalization | CO3 | A | 10 |
|  | b. | Describe the ideal low pass filter. | CO3 | U | 2 |
|  |  |  |  |  |  |
| 21. | a. | Comment briefly on noise models. | CO4 | An | 10 |
|  | b. | Sketch out the model of image restoration process. | CO4 | U | 2 |
|  |  |  |  |  |  |
| 22. | a. | With example, explain the process of Hough transform. | CO4 | A | 10 |
|  | b. | Write short note on edge linking. | CO5 | R | 2 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the sub band coding algorithm. | CO5 | R | 10 |
|  | b. | Discuss about the image compression model. | CO5 | An | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the polygonal approximations. | CO6 | U | 10 |
|  | b. | Describe the advantages of segmenting a boundary using convex hull. | CO6 | U | 2 |

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

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 11 | 10 | 0 | 0 | 0 | 29 |
| CO2 | 1 | 4 | 2 | 10 | 0 | 0 | 17 |
| CO3 | 1 | 3 | 10 | 1 | 0 | 0 | 17 |
| CO4 | 3 | 2 | 10 | 10 | 0 | 0 | 26 |
| CO5 | 12 | 1 | 0 | 3 | 0 | 0 | 19 |
| CO6 | 0 | 13 | 0 | 3 | 0 | 0 | 16 |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the name of the architecture which has separate memories for code and data. | | CO1 | R | 1 |
| 2. | Give examples of an embedded system which are designed with 8-bit microcontroller. | | CO2 | U | 1 |
| 3. | Name the design process for performing “decomposition of modules”. | | CO2 | R | 1 |
| 4. | State Interpreter. | | CO2 | R | 1 |
| 5. | Calculate the largest value that can be loaded in a 16-bit microcontroller register. | | CO3 | A | 1 |
| 6. | Indicate the use of prescalar in timer operation. | | CO3 | U | 1 |
| 7. | Estimate the delay count value for 1 second in Atmega timer. | | CO4 | E | 1 |
| 8. | Write the instruction for configuring PORT A pins as output pins. | | CO4 | A | 1 |
| 9. | List the modes of an operating system. | | CO5 | R | 1 |
| 10. | Define Interrupt latency. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify the types of embedded systems. | | CO1 | U | 3 |
| 12. | Differentiate host and target machine in an embedded system. | | CO2 | U | 3 |
| 13. | Construct the circuit diagram for binary weighted type digital to analog converter. | | CO3 | A | 3 |
| 14. | Write an embedded C program for bitwise port access. | | CO4 | A | 3 |
| 15. | Indicate the different services provided by Kernel. | | CO5 | U | 3 |
| 16. | Identify the use of wireless sensor network for biomedical applications. | | 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 process for converting an assembly code into machine code. | CO1 | R | 6 |
|  | b. | Explain in detail the architecture of an embedded system with neat diagram. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the stages for embedded system software development process. | CO2 | U | 6 |
|  | b. | Explain in detail about the software development tools used in real time system. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Discuss the following:   1. Switch Interfacing 2. Keypad Interfacing | CO4 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Write an embedded C program for generating 20ms delay using Atmega 128 microcontroller. | CO3 | A | 6 |
|  | b. | Write an embedded C program for interfacing LED with a microcontroller. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the different methods of handling interrupt services in RTOS environment. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the function of different C program elements with an example. | CO3 | U | 8 |
|  | b. | State the advantages and disadvantages of high-level programming languages. | CO3 | R | 4 |
|  |  |  |  |  |  |
| 23. |  | Design a real time embedded system for displaying the numerical numbers using micro controller and activate the seven-segment display through an embedded C code. | CO4 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write an embedded C program to control the stepper motor in forward and reverse direction. | CO6 | A | 6 |
|  | b. | Describe the various drive modes of stepper motor control. | CO6 | U | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the basics of embedded systems and its hardware units. |
| CO2 | Identify the various tools and development process of embedded system. |
| CO3 | Create the programming for embedded system design. |
| CO4 | Demonstrate the various I/O interfacing with microcontroller. |
| 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 7 | 9 |  |  |  |  | 16 |
| CO2 | 2 | 16 |  |  |  |  | 18 |
| CO3 | 4 | 9 | 16 |  |  |  | 29 |
| CO4 |  | 12 | 4 |  | 1 | 12 | 29 |
| CO5 | 2 | 15 |  |  |  |  | 17 |
| CO6 | 3 | 6 | 6 |  |  |  | 15 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the embedded unit for providing interrupt service to the system. | | CO1 | R | 1 |
| 2. | Give examples of small-scale embedded system. | | CO1 | U | 1 |
| 3. | Name the unit that reset the system after a predefined timeout. | | CO2 | R | 1 |
| 4. | State Cross Compiler. | | CO2 | R | 1 |
| 5. | Define resolution. | | CO4 | R | 1 |
| 6. | Write an oscillator clock frequency of Atmega 128 microcontroller. | | CO3 | A | 1 |
| 7. | Calculate the largest value that can be loaded in an 8-bit microcontroller register. | | CO4 | A | 1 |
| 8. | Identify the instruction to write 8-bit data to any of the microcontroller port. | | CO4 | R | 1 |
| 9. | Indicate the use of state diagram. | | CO5 | U | 1 |
| 10. | Define Scheduler. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Represent the architecture of an embedded system. | | CO1 | U | 3 |
| 12. | List the advantages of Integrated Development Environment. | | CO2 | R | 3 |
| 13. | Sketch the block diagram of successive approximation type ADC. | | CO3 | A | 3 |
| 14. | Write an embedded C program to interface switch with microcontroller. | | CO4 | A | 3 |
| 15. | Indicate the purpose of In-circuit emulator. | | CO5 | U | 3 |
| 16. | State the advantages and disadvantages of stepper motor. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain in detail the various functional components of an embedded systems. | CO1 | U | 10 |
|  | b. | Classify the types of an embedded systems. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 18. | a. | Describe the features of various design process involved in an embedded system. | CO2 | R | 8 |
|  | b. | Identify the various design metrics that is to be optimized in an embedded system design. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | Sketch the hardware connection between microcontroller and LED display and write an embedded C code for activating it. | CO4 | A | 8 |
|  | b. | Develop an interfacing diagram to connect seven segment display to microcontroller. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Enumerate the function of different C program elements with an example. | CO3 | R | 8 |
|  | b. | Indicate the steps involved for CTC mode of timer operation. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain in detail about various task states used in real time operating system. | CO5 | U | 8 |
|  | b. | Illustrate the different services provided by simulators. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Describe the features of various software development tools used in real time system design. | CO3 | U | 8 |
|  | b. | List the techniques for optimizing power dissipation and consumption. | CO3 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Summarize the different methods of handling interrupt services in RTOS environment. | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design an IoT based real time system for monitoring patient data. 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

|  |  |
| --- | --- |
|  | **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 I/O interfacing with microcontroller |
| 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 17 |  | 1 |  |  |  | 18 |
| CO3 | 12 | 12 | 4 |  |  |  | 28 |
| CO4 | 2 | 12 | 15 |  |  |  | 29 |
| CO5 | 1 | 16 |  |  |  |  | 17 |
| CO6 | 3 |  |  |  |  | 12 | 15 |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Notify the property of x-rays. | | CO2 | U | 1 |
| 2. | Give a note on mammography. | | CO2 | R | 1 |
| 3. | Contrast the first and second generation computed tomography machines. | | CO1 | An | 1 |
| 4. | Notify the imaging system used to view the position of implants in human body. | | CO6 | A | 1 |
| 5. | Present the significance of lead material in radiology. | | CO1 | An | 1 |
| 6. | Contrast between x-ray and positron emission imaging systems. | | CO2 | An | 1 |
| 7. | Mention the advantages of echo cardiography. | | CO3 | R | 1 |
| 8. | Give the applications of liquid crystal thermography in medical use. | | CO4 | A | 1 |
| 9. | Evaluate the Picture archiving and communication system**.** | | CO5 | E | 1 |
| 10. | Notify the applications of computer in medical imaging system. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Give the applications of bucky grid. | | CO6 | A | 3 |
| 12. | Present the impact of echocardiogram. | | CO4 | An | 3 |
| 13. | Compare ultrasonography with medical x-rays. | | CO3 | An | 3 |
| 14. | Mark the significance of ultrasound probe. | | CO2 | U | 3 |
| 15. | Write the principle of nuclear magnetic resonance techniques. | | CO1 | R | 3 |
| 16. | Give few radiation hazards. | | 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. | Articulate the generation of X-rays. | CO1 | An | 6 |
|  | b. | Infer the applications of X-rays in medical diagnosis. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Classify the medical imaging systems and its applications. | CO2 | An | 6 |
|  | b. | Confer the merits of detectors in computed tomography. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the image processing steps in iterative reconstruction method. | CO3 | An | 6 |
|  | b. | Present the medical applications of computed tomography. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Examine the salient features of magnet used in magnetic resonance tomography. | CO4 | An | 6 |
|  | b. | Evaluate the biological effects of nuclear magnetic resonance imaging method. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Detail the principle of ultrasonography. | CO3 | U | 6 |
|  | b. | Mention the applications of ultrasound scanners in clinical investigations. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Illustrate the applications of Gamma camera in medical diagnosis. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Inspect the Scanning and imaging process of Infrared thermographic equipment. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine the recommendations of food and drug administration authority to healthcare professionals for reducing radiation exposure. | CO5 | E | 12 |

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

|  |  |
| --- | --- |
|  | **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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | - | - | 8 | - | - | 11 |
| CO2 | 1 | 4 | - | 13 | - | - | 18 |
| CO3 | 1 | 6 | - | 9 | - | - | 16 |
| CO4 | - | - | 1 | 9 | 6 | - | 16 |
| CO5 | - | - | - | - | 25 | - | 25 |
| CO6 | - | 3 | 35 | - | - | - | 38 |
|  | | | | | | | **124** |



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| **Course Code** | **19BM2029/15EI2025** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL EQUIPMENT MAINTENANCE AND TROUBLESHOOTING** | **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. | Restate ‘PARD’ in your own words. | | CO1 | U | 1 |
| 2. | Indicate the importance of ‘Leakage Current tests’. | | CO1 | U | 1 |
| 3. | Review PCB Failure. | | CO2 | U | 1 |
| 4. | Cite the importance of Fuse. | | CO2 | U | 1 |
| 5. | Indicate the importance of maintenance. | | CO3 | U | 1 |
| 6. | Interpret “Testing” in your own terms. | | CO3 | U | 1 |
| 7. | List out the parameters that should be daily checked in X Ray machine. | | CO4 | R | 1 |
| 8. | Differentiate circuit breakers and fuses. | | CO4 | U | 1 |
| 9. | Summarize the importance of equipment life-cycle cost analysis (LCCA). | | CO5 | U | 1 |
| 10. | State the importance of reliability in medical devices. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Indicate how to test if an equipment is grounded. | | CO1 | U | 3 |
| 12. | List the 5 types of classifications of cables. | | CO2 | R | 3 |
| 13. | List out at-least five surgical tools. | | CO3 | R | 3 |
| 14. | Describe about AMC. | | CO4 | U | 3 |
| 15. | Illustrate the importance of Medical Equipment Lifecycle Management. | | CO5 | U | 3 |
| 16. | Judge the role of MTBF in maintenance. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a note on System Earthing. | CO1 | An | 6 |
|  | b. | Explain about Insulation Test and its types. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Appraise on different errors in Sensor Measurement. | CO2 | An | 7 |
|  | b. | Examine the common issues with PCBs. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 19. | a. | Explain testing and maintenance of Heart lung machine. | CO3 | An | 8 |
|  | b. | Write brief note on Testing Ventilators. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the Troubleshooting of ECG recorders. | CO4 | An | 6 |
|  | b. | Discriminate different manufacturing standards. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Write the strategies to ease Medical Equipment Lifecycle Management. | CO5 | An | 7 |
|  | b. | Analyze different types of equipment maintenance. | CO5 | An | 5 |
|  |  |  |  |  |  |
| 22. | a. | Prioritize the Golden rules of safety. | CO2 | An | 8 |
|  | b. | Contrast the three types of calibration. | CO2 | An | 4 |
| 23 | a. | Evaluate the Case study conducted by Saleh et al to solve the problem of medical equipment purchasing priority. Discuss about priority index for purchasing requests of medical equipment and Quality Function Deployment (QFD) which were integrated together to produce a framework that prioritizes requests of acquisition | CO5 | An | 10 |
|  | b. | Define Multi Criteria Decision Making (MCDM) and Decision Support System (DSS). | CO5 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain about Failure Mode and Effects Analysis. | CO6 | An | 5 |
|  | b. | Analyze Fault Tree Analysis with necessary sketches. | CO6 | An | 7 |

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

|  |  |
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|  | **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 / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 5 |  | 12 |  |  | 17 |
| CO2 | 3 | 2 | 5 | 19 |  |  | 29 |
| CO3 | 3 | 2 | 4 | 8 |  |  | 17 |
| CO4 | 1 | 4 | - | 12 | - | - | 17 |
| CO5 | - | 6 | - | 22 | - | - | 16 |
| CO6 | - | 4 | - | 12 | - | - | 28 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | \_\_\_\_\_\_\_\_\_\_ is the region of the brain that receives, integrates, and processes visual information relayed from the retinas. | | CO1 | R | 1 |
| 2. | The continuous change in the intraatomic distance along the axis of bonds between the two atom is termed as \_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | What are artifacts? | | CO2 | R | 1 |
| 4. | \_\_\_\_\_\_\_\_\_\_\_ occurs when the ultrasound wave is deflected towards the transducer. | | CO2 | R | 1 |
| 5. | Define Half-life. | | CO3 | U | 1 |
| 6. | \_\_\_\_\_\_\_ is a reaction in which the nucleus of an atom splits into two or more smaller nuclei. | | CO3 | R | 1 |
| 7. | What is annihilation? | | CO4 | U | 1 |
| 8. | Define braggs peak. | | CO4 | R | 1 |
| 9. | State the necessity of LD50. | | CO5 | R | 1 |
| 10. | Give an advantage of radionuclide. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is diabetes? Explain it with its types | | CO1 | R | 3 |
| 12. | Discuss the production of Ultrasonic waves using Magnetostriction method. | | CO2 | U | 3 |
| 13. | Write down the procedure to produce 99mTc. | | CO3 | A | 3 |
| 14. | List any three ways of interacting neutron particles with matter. | | CO4 | U | 3 |
| 15. | Write short note on Inverse Square Law. | | CO5 | U | 3 |
| 16. | What are the applications of doppler shift? | | 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. |  | Summarize the features of different types of non-ionizing radiation. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss how artifacts are generated in Ultrasound scanning system. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the different ways of decaying radioactive elements. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain in detail the interaction of alpha and beta particles with matter. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the non-stochastic effects of radiation in human health. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Brief the working principle of Thermographic unit. | CO1 | U | 6 |
|  | b. | The maximum sound intensity that an ear can tolerate at 1000Hz is approximately 1 W/m2. What is the maximum displacement in air corresponding to this intensity? | CO1 | A | 3 |
|  | c. | Consider lens A with focal length FA = 0.33m is combined with lens B with focal length FB = 0.25m. What is the focal length of the combination? | CO1 | A | 3 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the features of different types of Ultrasonic waves. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Narrate the application of Gamma radiation in medicine with an example. | CO6 | U | 12 |

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

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 18 | 6 | - | - | - | 29 |
| CO2 | 2 | 27 | - | - | - | - | 29 |
| CO3 | 1 | 13 | 3 | - | - | - | 17 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20BM2002** | **Duration** | **3hrs** |
| **Course Name** | **BIOCHEMISTRY 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. | The most abundant organic molecules in nature and are also referred to as\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Glucose-6-phosphate is isomerised into\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Which lipid participates in tissue development, cell recognition? | | CO6 | R | 1 |
| 4. | \_\_\_\_\_\_\_ is used as the primer rather than acetyl-CoA. | | CO6 | U | 1 |
| 5. | Write the general molecular structure of amino acids. | | CO2 | R | 1 |
| 6. | An amino acid yielding acetyl CoA during catabolism is \_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 7. | RNA contains repeating units of \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | Uridine present in RNA is \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | **Which nutrient deficiency causes megaloblastic anaemia?** | | CO3 | R | 1 |
| 10. | **Which mineral deficiency may result into impaired growth and development, skin lesions and loss of appetite?** | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify Monosaccharaides based on the presence of functional group. | | CO1 | R | 3 |
| 12. | What is Ozonolysis process? | | CO6 | U | 3 |
| 13. | What is meant by Ramar plot? | | CO4 | U | 3 |
| 14. | Write the Chargaff’s rule on DNA. | | CO2 | R | 3 |
| 15. | Explain a water-soluble vitamin that is required for the synthesis of collagen. | | CO3 | U | 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. | a. | Describe the significance and classification of Monosaccharides with its molecular structure. | CO1 | R | 5 |
|  | b. | Explain the steps involved in TCA Cycle. | CO1 | U | 7 |
|  |  |  |  |  |  |
| 18. |  | Write the mechanism of cholesterol synthesis pathway. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | How does the formation of peptide bond take place? Give relevant examples with its molecular structure. | CO2 | U | 8 |
|  | b. | Describe the Properties and classification of Amino acids. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 20. |  | Reproduce the structure of mRNA, rRNA and tRNA with suitable diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Describe the function of the B-complex vitamins with its structure and deficiency symptoms. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 22. |  | Illustrate the process of Biosynthesis of aromatic amino acids. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | What is mean by Gluconeogenesis? Explain the enzymes involved in this process. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write down the importance Of the minerals and its deficiency. | CO3 | U | 6 |
|  | b. | Describe the function of Macro 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 / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | 8 | - | - | - | - | 17 |
| CO2 | 8 | 21 | - | - | - | - | 29 |
| CO3 | 19 | 9 | - | - | - | - | 28 |
| CO4 | 0 | 17 | - | - | - | - | 17 |
| CO5 | 0 | 4 | - | - | - | - | 4 |
| CO6 | 1 | 28 | - | - | - | - | 29 |
|  | | | | | | | **124** |



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| **Course Code** | **20BM2010** | **Duration** | **3hrs** |
| **Course Name** | **ANALYTICAL INSTRUMENTATION** | **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. | Mention the method that is used to estimate the quantity of an analyte in a solution. | | CO1 | R | 1 |
| 2. | Name the type of opto-electric detector mainly used for infrared spectroscopy. | | CO1 | R | 1 |
| 3. | Recall the concept of Chromatography. | | CO2 | U | 1 |
| 4. | Interpret the working of calorimeter. | | CO2 | U | 1 |
| 5. | Mention the types of gas analyzers. | | CO3 | R | 1 |
| 6. | List the gases that are measured using infrared radiation absorption. | | CO3 | R | 1 |
| 7. | Name the electrodes used in pH measurement. | | CO4 | R | 1 |
| 8. | Mention the types of Voltammetry. | | CO4 | R | 1 |
| 9. | State the principle of Electron Spin Resonance Spectroscopy. | | CO5 | R | 1 |
| 10. | List the applications of NMR spectroscopy. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss the working of calorimeter. | | CO1 | U | 3 |
| 12. | Give few applications of high pressure liquid chromatograph. | | CO2 | R | 3 |
| 13. | Explain the air pollution that occurs due to carbon monoxide. | | CO3 | U | 3 |
| 14. | Describe the working of sodium analyzer. | | CO4 | U | 3 |
| 15. | Enumerate few applications of Electron Spin Resonance Spectroscopy. | | CO5 | U | 3 |
| 16. | Differentiate between optical and electron microscope. | | 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 construction and working of Fourier Transform Infrared spectrometer (FTIR) with necessary diagrams. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss the working of liquid chromatography with a neat diagram. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the working of infrared analyzer and thermal conductivity analyzer. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Describe the principle, construction and working of the types of biosensors. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the principle, types and working of Nuclear Magnetic Resonance Spectroscopy. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the construction, working and applications of flame emission photometers. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Discuss the instrumentation involved in detecting smoke and dust. | CO3 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the components and working of Transmission Electron Microscope (TEM). | CO6 | U | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Identify various techniques and methods of analysis which occur in the various regions of the spectrum. |
| CO2 | Summarize the unique methods of separation of closely similar materials, the most powerful being gas chromatography |
| CO3 | Outline the important analytical methods of industrial gases and pollution monitoring instruments. |
| CO4 | Discuss the principle involved in pH and dissolved component analyzers. |
| CO5 | Illustrate the methods of electromagnetic resonance. |
| CO6 | Investigate the structures using microscopic methods of analysis. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 27 |  |  |  |  | 29 |
| CO2 | 3 | 17 |  |  |  |  | 17 |
| CO3 | 2 | 29 |  |  |  |  | 29 |
| CO4 | 2 | 17 |  |  |  |  | 17 |
| CO5 | 2 | 17 |  |  |  |  | 17 |
| CO6 |  | 15 |  |  |  |  | 15 |
|  | | | | | | | **124** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Illustrate the conditions for avoiding aliasing with relevant examples. | CO1 | A | 10 |
|  | b. | Explain the biomedical signal analysis using a block diagram with its objectives. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Sketch the signal reconstruction and recovery and explain it. | CO1 | U | 10 |
|  | b. | Evaluate the convolution for two sequence,x(n)= {1,1,2,1}; h(n)={2,3,1,1}. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail about DSP system with a neat sketch. | CO2 | U | 10 |
|  | b. | Explain optimal filtering and derive the expression for finding the optimal weight vector and estimated error. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Design a Butterworth digital IIR highpass filter using bilinear transformation by taking T =0.1 second, to satisfy the following specifications. Draw direct form I structure of the filter. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain High Speed QRS detection Algorithm. | CO5 | U | 12 |
|  | b. | Describe the different types of noise with suitable examples. | CO3 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain in detail about VAG and VMG. | CO2 | A | 10 |
|  | b. | Illustrate about synchronous avenging. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the applications Artificial Intelligence in Bio signal Analysis. | CO1 | U | 10 |
|  | b. | Illustrate the estimation of ST segment inclination. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Categorize on the adaptive segmentation of EEG and PCG signals. | CO6 | An | 12 |
|  | b. | Explain about Machine learning applications in noise cancellation. | CO4 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Summarize the analysis of Ectopic beats using Pan-Tompkins Algorithm. | CO6 | U | 10 |
|  | b. | Construct the Template Matching technique in ECG QRS Detection. | CO5 | C | 10 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 20 | 20 |  |  |  | 40 |
| CO2 |  | 20 | 10 |  |  |  | 30 |
| CO3 |  | 8 | 20 | 10 |  |  | 38 |
| CO4 |  |  | 18 |  |  |  | 18 |
| CO5 |  | 12 |  | 10 |  | 10 | 32 |
| CO6 |  | 10 |  | 12 |  |  | 22 |
|  | | | | | | | **180** |



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| **Course Code** | **21BM3003** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED MEDICAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write a detailed note on Histogram operation techniques. | CO1 | An | 8 |
|  | b. | Explain about various Intensity Transformation functions. | CO1 | An | 12 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Appraise different thresholding techniques. | CO2 | An | 12 |
|  | b. | Explain sophisticated segmentation methods. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 3. | a. | Explain about Image guided therapy. | CO3 | An | 9 |
|  | b. | Write about interpolation and volume regularization. | CO3 | A | 11 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discriminate about various filters used in medical image processing. | CO1 | An | 10 |
|  | b. | Illustrate with examples the differences between Rastor and vector image formats. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain Surface based rendering in detail. | CO4 | An | 7 |
|  | b. | Explain ‘Raycasting’ in detail. | CO4 | An | 13 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain about different registration algorithms. | CO5 | An | 10 |
|  | b. | Write note on ‘Optimization Strategies’. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the role of Deep learning in image processing. | CO3 | U | 7 |
|  | b. | Explain in detail different interpolation techniques used in Spatial Transform. | CO3 | An | 13 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Contrast the importance of DICOM format in medical image processing. | CO2 | An | 12 |
|  | b. | Explain about Translation rotation and Reformatting. | CO3 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss about ‘IoT for clinical applications’. | CO6 | U | 10 |
|  | b. | Write a note on ‘Filtered back projection’ methods. | CO6 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the fundamentals to represent the images as per the given requirement. |
| CO2 | Discuss the segmentation method for a given clinical application. |
| CO3 | Explain the spatial transformation and its use for medical application. |
| CO4 | Distinguish between various rendering techniques on medical images. |
| CO5 | Assess the effect of image registration with respect to clinical application. |
| CO6 | Discuss the techniques for reconstruction of CT images. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  |  | 40 |  |  | **40** |
| CO2 |  |  |  | 32 |  |  | **32** |
| CO3 |  | 07 | 11 | 30 |  |  | **48** |
| CO4 |  |  |  | 20 |  |  | **20** |
| CO5 |  |  |  | 20 |  |  | **20** |
| CO6 |  | 10 | 10 |  |  |  | **20** |
|  | | | | | | | **180** |



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| **Course Code** | **21BM3003** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED MEDICAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyze different file formats used in image processing. | CO1 | An | 8 |
|  | b. | Evaluate Grayscale and color representation of image. | CO1 | An | 6 |
|  | c. | Differentiate Pixels and Voxels. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 2. | a. | Discover about the segmentation problem with medical images. | CO2 | An | 4 |
|  | b. | Appraise different thresholding techniques. | CO2 | An | 10 |
|  | c | Describe Region growing. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 3. | a. | Write briefly about ‘Discretization’. | CO3 | A | 6 |
|  | b. | Explain about Image guided therapy. | CO3 | An | 6 |
|  | c. | Summarize the role of Deep learning in image processing. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | Explain Surface based rendering in detail. | CO4 | An | 12 |
|  | b. | Discriminate orthogonal and perspective projection. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 5. | a. | Write short note on Fusing information. | CO5 | A | 6 |
|  | b. | Explain about different registration algorithms. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 6. | a. | Explain in detail about histogram operations. | CO1 | An | 8 |
|  | b. | Contrast the importance of DICOM format in medical image processing. | CO1 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Write a Matlab program to implement OTSU thresholding and Truncate thresholding for a Grayscale image. | CO2 | A | 9 |
|  | b. | Write a Matlab program to convert an RGB image to Gray scale image and find its histogram. | CO2 | A | 7 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Explain about Fourier transform and filtering in CT reconstruction. | CO6 | An | 10 |
|  | b. | Summarize the clinical applications of IoT. | CO6 | An | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the fundamentals to represent the images as per the given requirement. |
| CO2 | Discuss the segmentation method for a given clinical application. |
| CO3 | Explain the spatial transformation and its use for medical application. |
| CO4 | Distinguish between various rendering techniques on medical images. |
| CO5 | Assess the effect of image registration with respect to clinical application. |
| CO6 | Discuss the techniques for reconstruction of CT images. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 2 | - | 30 | - | - | 32 |
| CO2 | - | 2 | 16 | 14 | - | - | 32 |
| CO3 | - | 4 | 6 | 6 | - | - | 16 |
| CO4 | - | - | - | 16 | - | - | 16 |
| CO5 | - | - | 6 | 10 | - | - | 16 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **132** |



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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** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyse the healthcare equipment technology for outpatient services. | CO1 | An | 12 |
|  | b. | Point out methods of reducing length of stay in hospital. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 2. | a. | Evaluate the demographic developments of healthcare services. | CO2 | E | 10 |
|  | b. | Mention the merits of mobile healthcare. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | Analyze the work flow of healthcare cost for an average population. | CO3 | An | 10 |
|  | b. | Discuss the methods of transportation mechanism in urban population. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 4. | a. | Illustrate the methods of picture archives in radiology. | CO4 | R | 12 |
|  | b. | List few applications of radiological equipment used in rural healthcare. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 5. |  | Evaluate the architecture of health care networking services for quality of healthcare. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 6. | a. | Analyze the methods of multimodality registration of clinical data. | CO4 | An | 10 |
|  | b. | Classify the sources and modality of clinical data. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 7. |  | Evaluate the model of chronic care using wearable applications. | CO6 | E | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Develop the diagnostic model for monitoring lung disease using advanced internet of things technology. | CO6 | C | 14 |
|  | b. | Confer the laws and regulations in Digital health. | CO5 | U | 6 |

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

|  |  |
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|  | **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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 6 | 16 |  |  | 22 |
| CO2 |  |  | 6 |  | 10 |  | 16 |
| CO3 |  |  |  | 10 |  |  | 10 |
| CO4 | 12 |  | 4 | 10 |  |  | 26 |
| CO5 |  | 6 |  | 6 | 16 |  | 28 |
| CO6 |  |  |  |  | 16 | 14 | 30 |
|  | | | | | | | **132** |



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| **Course Code** | **21BM3005** | **Duration** | **3hrs** |
| **Course Name** | **EMBEDDED SYSTEM AND PROGRAMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain in detail about the basic architecture of Embedded system. | CO1 | U | 10 |
|  | b. | What are the skills required for the embedded design engineer to design the small scale embedded system? | CO1 | R | 6 |
|  |  |  |  |  |  |
| 2. | a. | What are the embedded system design steps in the design process? | CO2 | A | 12 |
|  | b. | Differentiate Host and target machine. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail about embedded system programming languages. | CO3 | U | 12 |
|  | b. | Write a short note on elements of C programming. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | Explain the Harvard based architecture of embedded system. | CO4 | U | 8 |
|  | b. | Describe the mechanism of interfacing seven segment display with microcontroller. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Describe the state machine and state tables in embedded system design. | CO5 | U | 10 |
|  | b. | What is meant by RTOS? Provide relevant examples. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 6. | a. | Describe the steps involved in the conversion of embedded C programming into machine codes. | CO2 | U | 10 |
|  | b. | What are the differences between assembly language and high level language? | CO3 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | Describe the mechanism of interfacing keypad with microcontroller. | CO4 | A | 10 |
|  | b. | Illustrate the significance and operation of Analog to digital converter. | CO4 | U | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Design an embedded system based Patient monitoring system with relevant examples. | CO6 | A | 10 |
|  | b. | Write an assembly language program to interface stepper motor with 8051 microcontroller. | CO6 | A | 10 |

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

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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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 6 | 10 | - | - | - | - | 16 |
| CO2 | - | 14 | 12 | - | - | - | 26 |
| CO3 | - | 22 | - | - | - | - | 22 |
| CO4 | - | 14 | 18 | - | - | - | 32 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **132** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Discuss the sensory rehabilitation of the visual system. | CO1 | U | 8 |
|  | b. | Describe any three dimensions of health. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Analyze the assessment of health related Quality of life. | CO1 | An | 8 |
|  | b. | Differentiate between QALYs and DALYs. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Explain about linear and angular displacement transducer. | CO2 | U | 8 |
|  | b. | Elucidate the measurement of linear velocity and angular velocity. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 4. | a. | Comment briefly on the linear resistance potentiometer. | CO3 | R | 8 |
|  | b. | Illustrate the design of upper limb. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Enumerate the design parameter of lower limb. | CO4 | A | 8 |
|  | b. | Explicate the deep learning based upper limb design. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain how controllers and actuators are used in rehabilitation engineering. | CO5 | U | 8 |
|  | b. | Write short notes on robots in rehabilitation. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the design of smart wheel chair. | CO5 | A | 8 |
|  | b. | Comment briefly on wearable robotic system. | CO5 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Explain the modeling of exoskeleton. | CO6 | An | 10 |
|  | b. | Enumerate the control of exoskeleton. | CO6 | A | 10 |

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

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

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



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| **Course Code** | **21BM3016** | **Duration** | **3hrs** |
| **Course Name** | **MACHINE LEARNING FOR HEALTHCARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe the working principle of support vector machine algorithm with an example. | CO1 | U | 15 |
|  | b. | List the various steps involved in decision tree algorithm. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Illustrate the functions of K means clustering techniques and their role in biomedical application with an example. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Enumerate the features and working of different ensemble methods used in machine learning algorithms. | CO3 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe the operation of ANN with an example. | CO3 | U | 15 |
|  | b. | Summarize the features of deep learning techniques. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between online and distributed learning methods. | CO4 | U | 10 |
|  | b. | State the principle of Bayes theorem and highlight its features. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyze the steps involved for real time disease classification by Principal Component Analysis method. | CO2 | An | 15 |
|  | b. | Write the significance of matrix factorization. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the working of random forest algorithm for disease classification with an example. | CO6 | A | 15 |
|  | b. | Identify the difference between supervised and reinforcement learning methods. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain in detail about logistic regression algorithm with necessary diagram. | CO2 | U | 10 |
|  | b. | Write short notes on different types of linear regression methods. | CO2 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Design an IoMT based real time system for monitoring patient data with neat diagram. | CO5 | C | 16 |
|  | b. | Sketch the architecture for deep learning model. | CO6 | A | 4 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Classify contrast pros and cons of various machine learning techniques. |
| CO2 | Illustrate various methods for developing the application. |
| CO3 | Infer various machine learning approaches and paradigms. |
| CO4 | Choose the methods towards challenges. |
| CO5 | Create solution to human problems in healthcare domain. |
| CO6 | Describe features that can be used for a particular machine learning approach. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 15 | 5 | 20 |  |  | 50 |
| CO2 |  | 10 | 10 | 15 |  |  | 35 |
| CO3 | 20 | 20 |  |  |  |  | 40 |
| CO4 | 10 | 10 |  |  |  |  | 20 |
| CO5 |  |  |  |  |  | 16 | 16 |
| CO6 |  |  | 19 |  |  |  | 19 |
|  | | | | | | | **180** |



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| **Course Code** | **21BM3017** | **Duration** | **3hrs** |
| **Course Name** | **ROBOTICS IN SURGERY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Write about Path planning algorithms involved in robotics. | CO1 | An | 8 |
|  | b. | Explain about generations of robots and its features in detail. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | How does a tactile sensor work? | CO2 | R | 4 |
|  | b. | Elaborate in detail the architecture of Machine vision system. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 3. | a. | Explain the design of controllers based on embedded system. | CO3 | U | 8 |
|  | b. | Elucidate the architecture of Human Machine Interface. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 4. | a. | Elaborate about Motor Skills. | CO4 | U | 8 |
|  | b. | Justify the human factors involved in human motor interactions. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Write a Case study on IoT based robot control. | CO5 | C | 10 |
|  | b. | What is meant by surgical robotics? Explain its types and surgery methods. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 6. | a. | Explain the types of Links and Joints. | CO1 | R | 8 |
|  | b. | Write the role of Path planning in robotics surgery field. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Write a case study on uses of programmable controller in robotics surgery | CO3 | C | 10 |
|  | b. | Explain in detail how robotics helped in diagnostic the malfunction in human. | CO5 | U | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Write down the applications of smart materials. | CO6 | U | 10 |
|  | b. | Discuss the design of intraocular robot surgery in ophthalmology field. | CO6 | An | 10 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 8 | - | 8 | - | - | 24 |
| CO2 | 4 | - | - | 20 | - | - | 24 |
| CO3 |  | 8 |  | 8 |  | 10 | 26 |
| CO4 | - | 8 | 8 | - | - |  | 16 |
| CO5 | - | 12 | - | - | - | 10 | 22 |
| CO6 | - | 10 | - | 10 | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **21BM3028** | **Duration** | **3hrs** |
| **Course Name** | **ARTIFICIAL INTELLIGENCE IN HEALTHCARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Sketch the schematic for an artificial intelligence based biomedical system approach. | CO1 | A | 5 |
|  | b. | Write the significance of artificial intelligence in healthcare network with an example. | CO1 | A | 15 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the various state space representations for three problem domains in search strategy. | CO2 | R | 10 |
|  | b. | Illustrate the role of AI to handle constraint satisfaction problems. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | Explain in detail about the working principle of K nearest neighbor algorithm with an example. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe the functional elements involved in First Order Predicate Logic. | CO3 | R | 12 |
|  | b. | Enumerate the characteristics of semantic networks with necessary diagram. | CO4 | R | 8 |
|  |  |  |  |  |  |
| 5. |  | Analyze the steps involved for real time disease diagnosis by artificial intelligence with an example. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate the various steps involved in decision tree learning method. | CO5 | U | 14 |
|  | b. | Indicate the use of rule-based systems in healthcare applications. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 7. |  | Discuss in detail about the popular mechanisms for agent communication and their semantics. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Summarize the features of various types of an agent architecture with necessary diagram. | CO4 | E | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Design an AI based robot control system for surgical application with hardware and software architectures. | CO6 | C | 20 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of Artificial Intelligence. |
| CO2 | Summarize the appropriate search algorithms for medical problem. |
| CO3 | Represent a problem using behavioral logics. |
| CO4 | Apply AI problem solving techniques. |
| CO5 | Develop simple intelligent system for medical diagnosis. |
| CO6 | Application development for healthcare problems in society. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 | 10 | 10 |  |  |  |  | 20 |
| CO3 | 12 |  |  |  |  |  | 12 |
| CO4 | 28 |  |  | 20 | 20 |  | 68 |
| CO5 | 20 | 20 |  |  |  |  | 40 |
| CO6 |  |  |  |  |  | 20 | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **INTRODUCTION TO BIOMEDICAL ENGINEERING** | **Duration** | **3hrs** |
| **Course Name** | **22BM2008** | **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. | Write the other name of Mitochondria. | | CO1 | R | 1 |
| 2. | What is the cisternae that modifies the proteins? | | CO1 | U | 1 |
| 3. | How many proteins are contained in the ribosomes? | | CO2 | U | 1 |
| 4. | Define Leukocytes. | | CO2 | U | 1 |
| 5. | What is the network of the endoplasmic reticulum (ER)? | | CO3 | R | 1 |
| 6. | Identify the Latin meaning for Nucleus. | | CO3 | U | 1 |
| 7. | How many nucleus contained most of the cells? | | CO4 | U | 1 |
| 8. | Expand ISO and IEC. | | CO5 | R | 1 |
| 9. | X-rays devices should be operated by \_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | Mention the type of radiation produced by X-rays. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss the responsibilities of a Biomedical Engineer. | | CO1 | U | 3 |
| 12. | Discuss the functions of respiration system. | | CO2 | U | 3 |
| 13. | Classify the types of mode in ultrasound imaging. | | CO3 | An | 3 |
| 14. | Discuss about the heart structure. | | CO4 | R | 3 |
| 15. | Recall the importance of good Laboratory Practices. | | CO5 | An | 3 |
| 16. | Compare Morality and Ethics. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Define Biomedical Engineering. | CO1 | U | 3 |
|  | b. | Discuss Roles of Biomedical Engineer in hospital. | CO1 | U | 4 |
|  | c. | Explain about the recent advancement in biomedical engineering. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. | a. | Compare Signal and noise. | CO2 | U | 4 |
|  | b. | Explain the block diagram for signal processing. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 19. | a. | Define MRI. | CO3 | U | 3 |
|  | b. | Discuss about the Magnetic resonance imaging acquisition method. | CO3 | An | 9 |
|  |  |  |  |  |  |
| 20. | a. | Explain about the electrical activity of heart. | CO4 | U | 8 |
|  | b. | Illustrate the PQRS waveform in the ECG. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Define standard. | CO5 | U | 2 |
|  | b. | Discuss about the Medical standards and regulations. | CO5 | U | 10 |
|  |  |  |  |  |  |
| 22. | a. | Define morality | CO6 | U | 2 |
|  | b. | Explain the Code of ethics for bio engineers. | CO6 | An | 10 |
|  |  |  |  |  |  |
| 23. | a. | Discuss about the benefits of professional society. | CO1 | U | 4 |
|  | b. | Explain any one modern tool available in Biomedical engineering. | CO1 | A | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain about the X-ray production. | CO3 | U | 6 |
|  | b. | Discuss about the X-ray modification in the modern biomedical engineering field | CO3 | An | 6 |

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

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|  | **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 | Outline 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 15 | 13 |  |  |  | 29 |
| CO2 |  | 17 |  |  |  |  | 17 |
| CO3 | 1 | 10 |  | 18 |  |  | 29 |
| CO4 | 3 | 13 |  |  |  |  | 16 |
| CO5 | 2 | 12 |  | 3 |  |  | 17 |
| CO6 | 1 | 7 |  | 8 |  |  | 16 |
|  | | | | | | | **124** |



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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** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define diffusion current. | | CO1 | U | 1 |
| 2. | Name the diode that maintains a constant dc output voltage irrespective of the fluctuations in ac input voltage or load current. | | CO1 | U | 1 |
| 3. | Calculate the peak voltage of a HWR circuit if its RMS value is 5V. | | CO2 | AN | 1 |
| 4. | Draw the symbol of Varactor diode. | | CO2 | R | 1 |
| 5. | TRIAC behaves as unidirectional Switch.True/False. | | CO4 | R | 1 |
| 6. | Name the diode that is widely used for high frequency switching applications. | | CO3 | R | 1 |
| 7. | What is the efficiency of full wave rectifier? | | CO4 | R | 1 |
| 8. | Name the type of power amplifier that has good efficiency but poor signal quality. | | CO3 | U | 1 |
| 9. | List the diodes that exhibit negative resistance effect. | | CO5 | R | 1 |
| 10. | What will be the phase shift in an oscillator if the circuit has three RC network? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If the drift velocity of holes under a field gradient of 200v/m is 10m/sec. Find its mobility. | | CO1 | AP | 3 |
| 12. | When a reverse current of a Zener diode ranges from 10mA to 15mA and Zener voltages range from 6V to 7.2V. Calculate the impedance of the device. | | CO2 | AP | 3 |
| 13. | Draw the output characteristics graph of CE configuration of a BJT and Justify the statement that BJT is a current control device. | | CO3 | U | 3 |
| 14. | Draw the schematic of a Zener shunt regulator. | | CO4 | U | 3 |
| 15. | Consider a 2-stage RC oscillator which has of equal resistors. Assume the capacitance value as 0.1pF capacitors. As the frequency of oscillation is given as 4kHz, calculate the value of the resistors. | | CO6 | AP | 3 |
| 16. | List the characteristics of a Oscillator. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Elaborate on the different methods of electron hole generation and recombination. | CO1 | R | 6 |
|  | b. | Compare Instrinsic and Extrinsic semiconductors. | CO1 | R | 6 |
| 18. | a. | With neat diagram explain the construction and working of PN junction and Zener diode. | CO1 | U | 8 |
| 18. | b. | A bipolar NPN transistor has a DC current gain value , β = 100. Calculate the base current Ib required to switch a resistive load of 2mA. Also calculate current gain α. | CO1 | AN | 4 |
| 19. | a. | Describe in detail about Silicon Controlled Rectifier. | CO5 | U | 6 |
|  | b. | Elaborate on the construction, working and application of a diode which is known as Esaki diode. | CO6 | U | 6 |
| 20. | a. | Derive the efficiency and ripple factor of a half wave rectifier circuit | CO2 | AN | 6 |
|  | b. | An a.c. supply of 230 V is applied to a half-wave rectifier circuit through a transformer of turn ratio 10 : 1. Find (i) the output d.c. voltage and (ii) the peak inverse voltage. Assume the diode to be ideal. | CO4 | U | 6 |
| 21. | a. | With a neat diagram explain a power supply and justify the need of voltage regulators in it. | CO2 | U | 8 |
| 20. | b. | A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 10 Ω. The transformer r.m.s. secondary voltage from center tap to each end of secondary is 50 V and load resistance is 980 Ω. Find : (i) the mean load current (ii) the r.m.s. value of load current. | CO5 | AP | 4 |
| 22. | a. | Compare series and shunt voltage regulators with neat diagram. | CO5 | U | 6 |
|  | b. | Discuss how a transistor is used as a series voltage regulator. | CO3 | U | 6 |
| 23. | a. | Elaborate on any two classes of power amplifiers. | CO3 | U | 8 |
|  | b. | Comment on the need of differential amplifiers. | CO4 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain in detail the construction and working of a RC phase shift Oscillator and derive the expression for calculating the frequency of oscillation. | CO6 | U | 12 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 8 | - | 4 | - | - | 22 |
| CO2 | 1 | 17 | 3 | 3 | - | - | 24 |
| CO3 | 4 | 10 | 8 | - | - | - | 22 |
| CO4 | 2 | 13 | - | 4 | - | - | 19 |
| CO5 | 1 | 12 | 4 | - | - | - | 17 |
| CO6 | 4 | 16 | - | - | - | - | 20 |
|  | | | | | | | **124** |



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| **Course Code** | **22BM2016** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL CIRCUIT ANALYSIS** | **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. | State Kirchhoff’s current law. | | CO1 | R | 1 |
| 2. | Recite the formula used to calculate the individual current in a current division circuit. | | CO1 | R | 1 |
| 3. | Write down the mathematical representation of Tellegan’s theorem. | | CO2 | A | 1 |
| 4. | Recognize the linear circuit that can be used as an equivalent circuit for single voltage source and a series resistance. | | CO2 | R | 1 |
| 5. | Calculate the resonance frequency of a series RLC series circuit with R=1000Ω, L=100mH, C=10pF and supply voltage 100V. | | CO3 | A | 1 |
| 6. | List the initial conditions of RLC parallel circuit. | | CO3 | R | 1 |
| 7. | Name the diagram to repreesnt a sine wave in terms of its magnitude and angular position. | | CO4 | R | 1 |
| 8. | Calculate the positive phase angle in the given phasor diagram. | | CO4 | A | 1 |
| 9. | Identify the Laplace transform of DC step signal. | | CO5 | R | 1 |
| 10. | Write the expression for an admittance parameter. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the dual network for the given circuit. | | CO1 | A | 3 |
| 12. | Write down the steps involved in the processing of Thevenins theorem. | | CO2 | A | 3 |
| 13. | Discuss the overdamped condition of RLC series circuit. | | CO3 | U | 3 |
| 14. | Examine the root mean square of the sinusoidal wave. | | CO4 | A | 3 |
| 15. | Estimate the initial and final values of time domain function, i(t)=5e-2t. | | CO5 | U | 3 |
| 16. | Determine the z parameters for the given circuit. | | 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. | Determine the current through each resistor in the given circuit. | CO1 | A | 4 |
|  | b. | Calculate the nodal voltage in the circuit shown. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 18. | a. | Construct the Norton’s equivalent circuit between the terminals a and b for the network shown below. | CO2 | A | 9 |
|  | b. | Illustrate the features of reciprocity theorem based on the circuit given below. | CO2 | U | 3 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the transient response of RL series circuit with necessary diagram. | CO3 | An | 10 |
|  | b. | Differentiate transient and steady state response. | CO3 | U | 2 |
|  |  |  |  |  |  |
| 20. | a. | Determine the instantaneous and average power of a pure inductive circuit. | CO4 | A | 4 |
|  | b. | Calculate the following parameters of a given circuit.   1. Circuit current 2. Phase angle 3. Power factor 4. Real power 5. Reactive power | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. | a. | Determine the frequency response of given RL series circuit with R=5Ω and L=2H. | CO5 | A | 9 |
|  | b. | Examine the initial value of the Laplace transform function, V(s)=. | CO5 | A | 3 |
|  |  |  |  |  |  |
| 22. |  | Discuss the conversion process of star to delta network with neat diagram. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Determine the frequency response of RLC series circuit with neat diagram. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain in detail the different interconnections of two port network. | CO6 | U | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend and design AC/DC circuits. |
| CO2 | Develop and understand AC/DC circuits. |
| CO3 | Evaluate AC/DC circuits. |
| CO4 | Analyse electrical circuits. |
| CO5 | Apply circuit theorems in real time. |
| CO6 | Apply network theorems to DC circuits. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | - | 15 | - | - | - | 17 |
| CO2 | 1 | 15 | 13 | - | - | - | 29 |
| CO3 | 1 | 5 | 13 | 10 | - | - | 29 |
| CO4 | 1 | - | 16 | - | - | - | 17 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 12 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |



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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is called the Power factor? | | CO1 | U | 1 |
| 2. | Define Ohm’s Law | | CO1 | R | 1 |
| 3. | What is the use of Commutator in DC generators ? | | CO2 | R | 1 |
| 4. | What is an electric motor ? | | CO2 | R | 1 |
| 5. | Differentiate Intrinsic & Extrinsic Semiconductors. | | CO3 | U | 1 |
| 6. | Sketch the symbol for Variable Resistor. | | CO3 | R | 1 |
| 7. | Differentiate the POS & SOP form. | | CO4 | U | 1 |
| 8. | Convert 78 decimal number to binary. | | CO4 | R | 1 |
| 9. | List the functional elements of an instrument. | | CO5 | U | 1 |
| 10. | Summarize about Electrocardiogram paper. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Draw the symbols for Dependent & Independent Current sources. | | CO1 | An | 3 |
| 12. | Differentiate between Generators & Motors. | | CO2 | U | 3 |
| 13. | A capacitor has given the value of 104.Calculate the value of Capacitor. | | CO3 | An | 3 |
| 14. | Perform 8 4 2 1 BCD code addition : 64+56. | | CO4 | U | 3 |
| 15. | Outline the advantages of moving iron instruments. | | CO5 | An | 3 |
| 16. | Describe the manual blood pressure measurement. | | 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. | Find the power loss in 10 ohm resistor using Mesh analysis. | CO1 | U | 5 |
|  | b. | A solenoid with resistance 30ohm and inductance of 200mH is connected to 230V 50 Hz Ac power supply. Calculate  a. Solenoids impedance  b. the current consumed by the solenoid  c. the phase angle between the current and the applied voltage  d. average power consumed by the solenoid | CO1 | U | 7 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate in detail the working of a DC motor. | CO2 | A | 6 |
|  | b. | Derive the EMF equation for the DC Generator. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Classify the different types of Capacitors with neat diagrams. | CO3 | U | 6 |
|  | b. | A P-N junction diode is having the forward voltage 0.3 v. What type of diode is it and explain its working in forward biased condition. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Simplify using K-map : y=∑f(0,1,3,4,5,6,7).Express the output using logic gates. | CO4 | A | 6 |
|  | b. | Prove that the excess three code is self-complementing code. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate in detail the working principle of moving coil instruments. | CO5 | R | 7 |
|  | b. | Compare moving coil and moving iron instruments. | CO5 | An | 5 |
|  |  |  |  |  |  |
| 22. | a. | Draw a diagram showing the constructional details of Silicon controlled Rectifier. Describe the working with the effect of increasing the gate voltage in SCR. | CO3 | U | 7 |
|  | b. | Illustrate in detail the P-Channel JFET. | CO3 | R | 5 |
|  |  |  |  |  |  |
| 23. | a. | The message below coded in 7-bit Hamming code in even parity is transmitted through a noisy channel. Decode the message : 1001001011100111101100011011. | CO4 | R | 6 |
|  | b. | Illustrate in detail the different types of combinational logic circuits. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about Blood gas analyzers. | CO6 | R | 6 |
|  | b. | Summarize about Stethoscope. | CO6 | U | 6 |

CO – COURSE OUTCOME BL – BLOOMS’ LEVEL

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 13 | - | 3 | - | - | 17 |
| CO2 | 2 | 3 | 6 | 6 | - | - | 17 |
| CO3 | 6 | 14 | - | 9 | - | - | 29 |
| CO4 | 7 | 16 | 6 | - | - | - | 29 |
| CO5 | 7 | 1 | - | 8 | - | - | 16 |
| CO6 | 6 | 10 | - | - | - | - | 16 |
|  | | | | | | | **124** |