Reg. No.															

Question Paper Code	14084

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Artificial Intelligence and Data Science

24AIPW301 – BIOMEDICAL SIGNAL AND IMAGE PROCESSING WITH LABORATORY

Regulations- 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following is not an example of a discrete-time signal? (a) Marks of students in a class (b) Speech signal (c) Population count of a country (d) Text data	1	K1	CO1
2.	Signals that can be fully represented by mathematical equations are referred to as _____. (a) Continuous signals (b) Discontinuous Signals (c) Deterministic signals (d) Non-Deterministic signals	1	K1	CO1
3.	An instrument used to obtain and record the electrocardiogram is called an ---------- (a) Electrocardiograph (b) Electroencephalograph (c) Electromyograph (d) Electroretinograph	1	K2	CO2
4.	-------- is due to the relaxation of the heart muscle and its pressure is 80 mm of Hg? (a)Systole (b)Diastole (c) Both systole & Diastole (d) None	1	K2	CO2
5.	The purpose of a moving average filter is to_____ (a) Enhance high-frequency content (b) Smooth out short-term fluctuations (c) Remove structured noise (d) Detect QRS complexes	1	K1	CO3
6.	Which of the following is an artifact in ECG signals? (a) P-wave (b) Baseline wander (c) QRS complex (d) T-wave	1	K1	CO3
7.	If the sampling rate is less than twice the highest frequency component of the image, it results in _____ (a) Quantization error (b) Aliasing (c) Image smoothing (d) Edge sharpening	1	K2	CO4
8.	The ability of an imaging system to reproduce details is measured by____ (a) Noise power spectrum (b) Image fidelity criteria (c) Contrast enhancement (d) Histogram equalization	1	K1	CO4
9.	Histogram equalization improves image quality by____ (a) Increasing quantization error (b) Redistributing pixel intensities evenly (c) Removing low-frequency noise (d) Increasing the number of pixels	1	K2	CO5
10.	Wiener filtering is preferred over inverse filtering because_____ (a) It uses only histogram information (b) It accounts for both degradation and noise (c) It enhances only edges (d) It requires no prior knowledge	1	K2	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Calculate the power and RMS value of a signal $x(n)= e^{(j2\pi/3)n}$	2	K2	CO1
12.	Define energy and power of a signal.	2	K1	CO1
13.	State the importance of biological amplifiers.	2	K1	CO2
14.	List the lead systems used in ECG recording.	2	K1	CO2
15.	Differentiate between time-domain filtering and frequency-domain filtering.	2	K2	CO3

16.	Explain how a low-pass filter helps remove EMG noise in ECG.	*2*	*K2*	*CO3*
17.	Define Modulation Transfer Function (MTF) of the visual system.	*2*	*K1*	*CO4*
18.	State the Nyquist sampling criterion for image sampling.	*2*	*K1*	*CO4*
19.	Compare MRI and CT in terms of tissue contrast.	*2*	*K2*	*CO5*
20.	Write any two functions of histogram equalization.	*2*	*K1*	*CO5*
21.	What is the main purpose of inverse filtering?	*2*	*K1*	*CO6*
22.	Mention the advantage of Wiener filtering over inverse filtering.	*2*	*K1*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a) (i)	Elaborate the term signal with an example.	*04*	*K2*	*CO1*
	(ii)	Explain different type of signals with example.	*07*	*K2*	*CO1*
		OR			
	b) (i)	Examine the fundamental period T of the continuous time signal: $x(t) = 2\cos(3\pi t)+7\sin(9t)+3\cos 7t$	*06*	*K2*	*CO1*
	(ii)	Check the Periodicity of the Discrete time signal: $x(n) = 30\cos 4\pi n$	*05*	*K2*	*CO1*
24.	a)	Explain the development of action potential and resting protentional for muscular contraction.	*11*	*K2*	*CO2*
		OR			
	b)	With a neat block diagram, explain the working of ECG recorder.	*11*	*K2*	*CO2*
25.	a)	Describe stationary and non-stationary processes in biomedical signal analysis.	*11*	*K3*	*CO3*
		OR			
	b)	Identify the use of derivative-based operators in eliminating baseline wander.	*11*	*K3*	*CO3*
26.	a)	Apply the concept of MTF to analyze the visual system's ability to perceive fine details in medical images.	*11*	*K3*	*CO4*
		OR			
	b)	Describe two-dimensional sampling theory and explain its relevance in digital image representation.	*11*	*K2*	*CO4*
27.	a)	Describe the principle of ultrasound imaging and explain its advantages.	*11*	*K2*	*CO5*
		OR			
	b)	Explain the principle of MRI imaging and discuss how tissue contrast is obtained.	*11*	*K2*	*CO5*
28.	a)	Explain the working of Wiener filtering with its advantages.	*11*	*K2*	*CO6*
		OR			
	b)	Explain gradient-based methods for edge detection.	*11*	*K2*	*CO6*