

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

Fourth Semester

Artificial Intelligence and Data Science

20AIPC402 - BIOMEDICAL SIGNAL AND IMAGE PROCESSING

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	Marks	K- Level	CO
1. A continuous time function $x(t)$ is periodic with period T . The function is sampled uniformly with a sampling period T_s . In which one of the following cases is the sampled signal periodic? (a) $T=2T_s$ (b) $T=1.2T_s$ (c) Always (d) Never	1	K2	CO1
2. Which of the following cannot be the Fourier series expansion of a periodic signal? (a) $x(t)=2\cos t+3\cos 3t$ (b) $2\cos \pi t+7\cos t$ (c) $\cos t+0.5$ (d) $2\cos 1.5\pi t+\sin 3.5\pi t$	1	K2	CO1
3. The recording of the electrical activity associated with the functioning of the ----- is known as Electroencephalography (a) Heart (b) Muscles (c) Brain (d) None	1	K1	CO2
4. EMG deals with _____ (a) study of brain activity (b) Study of Myocardial activity (c) study of muscular activity (d) study of central nervous system	1	K1	CO2
5. Medical x rays are used to generate images of ----- inside the body. (a) tissues (b) Structures (c) Both tissues and structures (d) None of the mentioned	1	K1	CO3
6. ----- is primarily used for diagnosing health problems and secondarily for the monitoring of existing health conditions. (a) Computer Tomography (b) MRI (c) Ultrasound Imaging (d) x rays	1	K1	CO3
7. Derivative-based operators is a time-domain technique to remove base-line drift in the ECG signal. (a) synchronized averaging (b) Moving average filters (c) Derivative based operators (d) All of the mentioned	1	K1	CO4
8.eliminates low-frequency regions while retaining or enhancing the high-frequency components. (a) Low Pass filtering (b) High Pass filtering (c) Median filtering (d) Band Pass filtering	1	K1	CO4
9. The DFT of the two-dimensional circular convolution of 2 arrays is the ----- of their DFTs. (a) Sum (b) Difference (c) Division (d) Product	1	K1	CO5
10. ----- is the simplest and most commonly used method of segmentation (a) Thresholding (b) Edge-based (c) Region- based (d) All of the mentioned	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Distinguish between Continuous and Discrete time signals.	2	K1	CO1
12. Draw the step signal with their mathematical expression.	2	K2	CO1
13. Define (a) Resting Potential. (b) Action Potential.	2	K1	CO2
14. Define – Conduction Velocity.	2	K1	CO2
15. Enumerate the properties of x-rays.	2	K1	CO3
16. Define the importance of Bucky grids.	2	K1	CO3
17. Specify the basic components of image processing systems.	2	K1	CO4

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| 18. Write the steps involved in frequency domain filtering. | 2 | K1 | CO4 |
| 19. What is an edge? | 2 | K1 | CO5 |
| 20. Show the expression for finding the number of bits required to store a digital image. | 2 | K2 | CO5 |
| 21. What is inverse filtering? | 2 | K1 | CO6 |
| 22. List the types of interpolation. | 2 | K1 | CO6 |

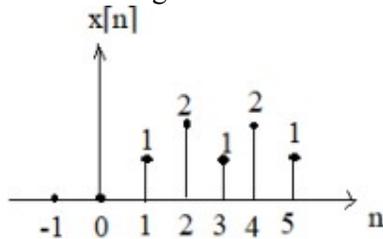
PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) | Illustrate the relation between the following signals.
(i) unit ramp and unit step signals.
(ii) unit step and unit impulse signals. | 11 | K2 | CO1 |
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| b) | Given the signal | 11 | K2 | CO1 |
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Sketch and label carefully each of the following signals.

- (i) $x[n-2]$
(ii) $x[n+1]$

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| 24. a) | Discuss the development of action potential and muscular contraction. | 11 | K2 | CO2 |
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| b) | Write down the 'Nernst Equation' and 'Goldman Equation' and explain about the constants used. | 11 | K2 | CO2 |
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| 25. a) | Explain the production of x-rays with detail description of construction of x-ray tubes. | 11 | K2 | CO3 |
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| b) | Outline the various steps involved in back projection algorithm used in CT. | 11 | K2 | CO3 |
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| 26. a) | Explain synchronized averaging and moving average filters with suitable examples. | 11 | K2 | CO4 |
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| b) | Discuss derivative-based operators used for removing low-frequency artifacts. | 11 | K2 | CO4 |
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| 27. a) | State and explain sampling theorem in 2D & also Write about aliasing in Images. | 11 | K2 | CO5 |
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| b) | Illustrate the 2D Fourier transform and its pair. State and prove any two properties. | 11 | K2 | CO5 |
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| 28. a) | Explain different noise models in image processing. | 11 | K2 | CO6 |
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| b) | Explain degradation model in detail. | 11 | K2 | CO6 |
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