



SCHOOL OF HEALTHCARE SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST -I
FALL SEMESTER 2025-2026

SLOT: A2+TA2

Programme Name & Branch : B.Tech BHT
Course Code : BHST202L
Course Name : Signal Processing for Healthcare application
Faculty Name(s) : Dr. Kishor Lakshminarayanan
Class Number(s) : VL2025260100963
Date of Examination : 17/08/2025
Exam Duration : 90 minutes

Maximum Marks: 50

Q. No	Question	Marks
1.	Compare the characteristic waveforms, typical frequency ranges and primary clinical uses of ECG, EEG, EMG and PPG signals.	10
2.	Explain why rigorous analysis of biomedical signals is essential for clinical decision-making and contrast two cases where poor analysis could lead to misdiagnosis or treatment errors.	10
3.	Apply the sampling theorem to determine the minimum sampling rate needed to digitize a 0.5–50 Hz EEG signal without aliasing, and explain the consequences of sampling below this rate.	10
4.	A 10-bit ADC with input range -1 V to $+1\text{ V}$ samples the following successive EEG voltages (in volts): $[-0.78, -0.12, 0.53, 0.99, -0.45]$ (a) Compute the quantization step size Δ. (b) Determine the signed integer code for each sample. (c) Find the quantized voltage and the quantization error for each reading.	10
5.	During a brief EEG recording, three scalp channels produced these voltages (in μV) at four equally spaced time points: Fp1: $[-10, 15, -5, 8]$ Fp2: $[-8, 14, -6, 6]$ Cz: $[12, 9, -3, 3]$ (a) Form the 4×3 data matrix X (rows=time points, cols=channels) and mean-center it. (b) Compute the 3×3 covariance matrix. (c) Perform eigen decomposition: find eigenvalues and normalized eigenvectors. (d) Give the first principal component (PC_1) as a linear combination of the channel voltages, normalized to unit length.	10