BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER :**
BRANCH: ECE **SESSION : SP/2023**

SUBJECT: EC571 BIOMEDICAL SIGNAL PROCESSING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Classify the deterministic and stochastic signals. Explain the transport mechanism of bio signals in a cell.	[5]	CO1	L2
Q.1(b)	Draw and explain the electrocardiogram system. Draw a typical ECG waveform corresponding to two typical cardiac cycles and indicate the following waves and periods. (a) the P, QRS and T wave, (b) the RR interval, (c) atrial contraction, (d) atrial relaxation (e) ventricular contraction and (f) ventricular relaxation.	[5]	CO1	L2,L3
Q.2(a)	Define a random signal. Discuss how the randomness of a biomedical signal is tested. Distinguish between ensemble averages and temporal (time) averages.	[5]	CO2	L1,L2, L4
Q.2(b)	List some potential sources of instrumentation and physiological artifacts in recording the ECG signal. Describe the moving average filter used to remove the artifact. Explain how it differs from Synchronized averaging filter.	[5]	CO2	L1,L2
Q.3(a)	Two filters with transfer functions $H_1(z)=\frac{1}{3}\left(1+z^{-1}+z^{-2}\right)$ and $H_2(z)=\left(1-z^{-1}\right)$ are cascaded. (a) What is the transfer function of the complete system? (b) What is its impulse response?	[5]	CO2	L3
Q.3(b)	A biomedical signal sampled at 500 Hz was found to have a significant amount of 60 Hz interference. (a) Design a notch filter with two zeros to remove the interference. (b) What is the effect of the filter if a signal sampled at 100 Hz is applied as the input?	[5]	CO3	L5,L6
Q.4(a)	Explain the Pan-Tompkins algorithm for QRS detection.	[5]	CO4	L2
Q.4(b)	List out different rhythms, waves and transients of EEG signal. Suggest some methods to detect the EEG rhythm.	[5]	CO3	L1,L5
Q.5(a)	Explain the Principal component analysis. Justify, how it will be useful in biomedical signal processing.	[5]	CO4	L3
Q.5(b)	Compare the supervised and unsupervised classification with examples. Write the steps to construct a neural network-based architecture for classifying the epileptic and non-epileptic patient's EEG.	[5]	CO5	L4,L6

:::::28/04/2023 E:::::