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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Medical Electronics Engineering **Duration: 3 hrs.**

Course Code: 23MD6PCBSP / 22MD6PCBSP **Max Marks: 100**

Course: Biomedical Signal Processing

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Design an optimal Filter to remove noise from a signal, given that the signal and noise processes are independent, stationary, random processes.	*CO2*	*PO3*	**10**
	b)		Describe in detail how adaptive filtering can be applied for muscle artifact removal in ECG recordings. Include an example or case study.	*CO2*	*PO3*	**10**
			OR			
2	a)		Explain the process of adaptive noise cancellation with the help of a block diagram. Apply it to remove maternal ECG interference from fetal ECG signals.	*CO2*	*PO3*	**08**
	b)		How does moving average filtering work in the time domain?	*CO2*	*PO3*	**04**
	c)		Explain the principle of Least Mean Squares (LMS) algorithm used in adaptive filtering.	*CO2*	*PO3*	**08**
			UNIT - II			
3	a)		Differentiate between lossy and lossless compression. Write an expression for the Percent Root Mean Square difference (PRD)	*CO2*	*PO6*	**08**
	b)		Discuss various data compression techniques used in ECG signal processing. Compare at least two methods with respect to compression ratio, complexity, and signal distortion	*CO2*	*PO3*	**12**
			OR			
4	a)		Determine the efficiency of the Huffman code. Given the following data set {1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7} derive the code words for the data using Huffman coding and compute the average word length required in Huffman coding	*CO3*	*PO2*	**10**

		b)	Describe how the Pan–Tompkins algorithm works for QRS detection.	*CO3*	*PO3*	**10**
			UNIT - III			
	5	a)	Design a system for real-time ECG acquisition and processing, including signal filtering, QRS detection, and heart rate monitoring	*CO3*	*PO3*	**10**
		b)	Explain and implement a method to detect arrhythmias from ECG signals using RR interval analysis.	*CO2*	*PO3*	**10**
			OR			
	6	a)	Illustrate the principle of working of a differentiation based QRS detection with suitable diagrams and equations	*CO2*	*PO3*	**10**
		b)	What do you mean by arrhythmia and with relevant block diagram explain portable arrhythmia monitoring system	*CO2*	*PO3*	**10**
			UNIT - IV			
	7	a)	Explain how linear prediction can be used to reduce noise or artifacts in EEG recordings.	*CO2*	*PO3*	**10**
		b)	Describe the process of estimating AR coefficients using the Yule-Walker method.	*CO2*	*PO3*	**10**
			OR			
	8	a)	Explain the correlation analysis of EEG signals and provide relevant applications	*CO2*	*PO3*	**10**
		b)	Discuss the use of matched filters and explain it's application in detecting P waves in ECG.	*CO2*	*PO3*	**10**
	9	a)	Explain in detail about the probabilistic model suggested to estimate the occurrences of certain event and time spent in any stage of sleep?	*CO2*	*PO3*	**10**
		b)	How does the PSD elimination method help detect events and wave?	*CO2*	*PO3*	**10**
			OR			
	10	a)	Explain the characteristics of EEG in sleep stages. Name one time-domain and one frequency-domain feature used for sleep stage classification	*CO2*	*PO3*	**10**
		b)	How can Markov Chains be used in modeling sleep stages using EEG data?	*CO2*	*PO3*	**10**

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