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**CS/B.Tech (BME) (Supple)/SEM-7/BME-701/09****BIO-SIGNAL PROCESSING****SEMESTER - 7**

Time : 3 Hours]

[Full Marks : 70

GROUP - A**(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10
- i) The number of data samples needed in Prony's method involves fitting p exponentials is
- a) p b) $p/2$
- c) $2p$ d) p^2 .
- ii) The mean square estimation error of a signal is estimated by
- a) convolution b) cross-correlation
- c) auto-correlation d) none of these.
- iii) The AZTEC algorithm converts raw ECG samples into
- a) lines and dots b) dots and plateaus
- c) points and curves d) slopes and plateaus.
- iv) The signal averaging technique is used to
- a) increase the SNR
- b) decrease the SNR
- c) increase the amplitude of the signal
- d) decrease the amplitude of the signal.



v) Data compression technique

- a) increase the image quality
- b) decrease the image quality
- c) first increase then decrease the image quality
- d) does not affect the image quality.

vi) In linear prediction filter, its inverse filter transfer function $H(z)$ characterized by the representation of

- a) all zero
- b) all poles
- c) poles and zeros
- d) none of these.

vii) Stage-3 of sleep is characterized by

- a) low voltage of 2-7 Hz with occasional sharp vertical wave
- b) sharp spindles and K-complexes
- c) Delta wave exceeding $75\mu\text{V}$ with 20-50% of tme
- d) Delta wave exceeding $75\mu\text{V}$ with greater than 50% of tme.

viii) The signals are said to be fully correlated if

- a) there wave shapes does not match
- b) there wave shapes tending to match
- c) there wave shapes completely match
- d) none of these.



ix) The Prony spectrum of the prosthetic mitral heart valve sound is characterized by peaks.

- a) six
- b) four
- c) two
- d) three
- e) many.



x) Which of the following weight adjustment formulas corresponds to the steepest descent algorithm ?

- a) $h(n+1) = (1 - 2\mu)h(n) + 2\mu h_{opt}$
- b) $h(n+1) = (1 - 2\mu)h(n) + 2\mu r$
- c) $h(n+1) = (1 - 2\mu)h(n) + 2\mu R_h$
- d) $h(n+1) = (1 - 2\mu)h(n) - 2\mu h_{opt}$

xi) Low pass filter transfer function $H(z)$ for high speed QRS detection technique is

- a) $(1 - z^{-6}) / (1 - z^{-1})$
- b) $(1 - z^{-6})^2 / (1 - z^{-1})^2$
- c) $(1 - z^{-32}) / (1 - z^{-1})$
- d) $(1 - z^{-16}) / (1 - z^{-1})$

xii) Adaptive filters are basically

- a) Low pass filters
- b) Notch filters
- c) Noise cancellers
- d) None of these.

xiii) In Linear Prediction model the present probability is predicted from its

- a) Previous output
- b) Past value
- c) Current value
- d) None of these.

**GROUP – B****(Short Answer Type Questions)**Answer any *three* of the following.

3 ∞ 5 = 15

2. What is the meaning of noise in physiological signals ? Define Johnson noise with its mathematical expression. 1 + (2 + 2)

3. Determine the energy of the following signal :

$$x(n) = \left(\frac{1}{2}\right)^n \text{ for } n \geq 0$$

$$= 0 \text{ for } n < 0.$$

5

4. After applying AZTEC algorithm to a signal. The saved array is

$$\{ 4, 50, -4, 30, -6, 40, -6, 25, -4, 50, 2, 50 \}$$

- a) Reconstruct the signal waveform.
- b) What is the peak-to-peak amplitude of the signal reconstructed from the data ?
- c) What is the amount of data compression achieved ? 2 + 1\frac{1}{2} + 1\frac{1}{2}
5. Describe cepstral analysis of a biosignal. 5
6. Write a note on feature extraction and pattern recognition of ECG. 5
7. What are the different types of arrhythmia encountered in human physiology ? 5

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following.

3 ∞ 15 = 45

8. How the ECG signal is generated ? What are the different parameters of an ECG wave ? Describe shortly the QRS detection technique. 2 + 3 + 10
9. Show the different lead system of the ECG wave. Briefly describe the Turning Point algorithm. 5 + 10



10. What is auto correlation function ? Give the different frequency range of the EEG spectra. Shortly discuss about linear prediction theory for EEG analysis. 2 + 3 + 10
11. Briefly describe about the Data Acquisition System and make the classification of different sleep stages. Briefly describe about the Hypnogram Model parameter. 8 + 7
12. Briefly discuss how the EMG signal is recorded. Describe about signal averaging technique. Discuss about arrhythmia analysis monitoring. 5 + 5 + 5
13. Write notes on the following : 3 × 5
- Data acquisition of EMG signal
 - Dynamics of sleep-wake transitions
 - Properties of Linear Prediction Theory.

END