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



Time : 3 Hours]

[Full Marks: 70

INSTRUCTIONS TO THE CANDIDATES :

- 1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
- 2. a) In **Group A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
 - b) For Groups B & C you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of Group B are Short answer type. Questions of Group C are Long answer type. Write on both sides of the paper.
- 3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
- 4. Read the instructions given inside carefully before answering.
- 5. You should not forget to write the corresponding question numbers while answering.
- 6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- 7. Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.
- 8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
- 9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained																		
		Group – A								Group – B Group – C				oup -	- C			
Question Number																	Total Marks	Examiner's Signature
Marks Obtained																,		

Head-Examiner/Co-Ordinator/Scrutineer

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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 : $10 \propto 1 = 10$
 - i) The number of data samples needed in Prony's method involves fitting p exponentials is

b)

p/2

- a) p
- 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.

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- 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

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- 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 $75\mu V$ with 20-50% of tme
 - d) Delta wave exceeding $75\mu V$ 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.

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- 5 The Prony spectrum of the prosthetic mitral heart valve sound is characterized by ix) peaks. a) six b) four three c) d) two e) many Which of the following weight ajdustment formulas corresponds to the steepest X) descent algorithm ? $h(n+1) = (1-2\mu)h(n) + 2\mu h_{opt}$ a) $h(n+1) = (1-2\mu)h(n) + 2\mu r$ b) $h(n+1) = (1-2\mu)h(n) + 2\mu R_h$ c) $h(n+1) = (1-2\mu)h(n) - 2\mu h_{opt}$. d) Low pass filter transfer function H(z) for high speed QRS detection technique is xi) ($1-z^{-\,6}$) 2 /($1-z^{-\,1}$) 2 $(1-z^{-6})/(1-z^{-1})$ a) b) $(1-z^{-16})/(1-z^{-1}).$ $(1 - z^{-32})/(1 - z^{-1})$ d) c) Adaptive filters are basically xii) Low pass filters b) Notch filters a)
- In Linear Prediction model the present probability is predicted from its xiii)

d)

None of these

Previous output Past value a) b)

Noise cancellers

Current value d) None of these. c)

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c)



GROUP – B

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(Short Answer Type Questions)

 $3 \propto 5 = 15$

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- Answer any *three* of the following.
- 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 singal :

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

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

- 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.
- 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 <i>three</i> of the following.		$3 \propto 15 = 45$
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- 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

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- 10. What is auto correlation function ? Give the different frequency range of the EEGspectra. Shortly discuss about linear prediction theory for EEG analysis.2 + 3 + 10
- Briefly describe about the Data Acquisition System and make the classification of different sleep stages. Briefly describe about the Hypnogram Model parameter. 8 + 7
- 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 :

 $3 \propto 5$

- a) Data acquisition of EMG signal
- b) Dynamics of sleep-wake transitions
- c) Properties of Linear Prediction Theory.

END

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