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Invigilator's Signature :	
CS/B.Tech	n/BME/SEM-7/BME-701/2012-13

CS/B.Tech/BME/SEM-7/BME-701/2012-13 2012

BIOSIGNAL PROCESSING

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following:

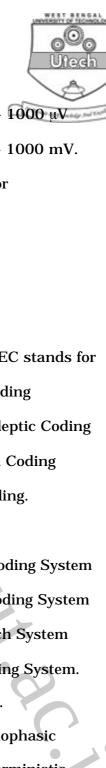
 $10 \times 1 = 10$

- i) Auto-correlation function is an
 - a) Even function
- b) Odd function
- c) Energy function
- d) none of these.
- ii) Cepstral analysis is a process of
 - a) Convolution
- b) Cross-correlation
- c) Auto-correlation
- d) De-convolution.
- iii) What is the frequency range of alpha (α) wave?
 - a) 0.5 3.5 Hz
- b) 7.5 12.5 Hz
- c) 3.5 7.5 Hz
- d) 0 40 Hz.

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- iv) The amplitude range of EEG signal is
 - 10 100 V a)
- 10 1000 μV b)
- $10 100 \mu V$
- 10 1000 mV. d)
- Cross-correlation technique is used for
 - **QRS** detection a)
 - R-R interval detection b)
 - S-T segment detection c)
 - P-wave detection. d)
- The data compression technique AZTEC stands for vi)
 - Arrhythmia Zone Time-Epoch Coding a)
 - **Amplitude Zone Transversal-Epileptic Coding** b)
 - Altitude Zone Transversal-Epoch Coding c)
 - Amplitude Zone Time-Epoch Coding. d)
- **CORTES** stands for
 - Coordinate-Resolution-Time Encoding System a)
 - **Coordinate-Reduction-Time Encoding System** b)
 - **Coordinate-Reduction-Time Epoch System** c)
 - Coordinate-Rational-Time Encoding System. d)
- viii) EEG signal is a signal.
 - a) **Biphasic**
- b) Monophasic
- Random c)
- Deterministic. d)



- ix) The compression ratio of TP Algorithm is
 - a) 2:1

b) 10:

c) 3:1

- d) 5:1.
- x) Theta (θ) waves are at the stage of
 - a) Alert condition
- b) Dreaming
- c) Dreamless sleep
- d) Drowsiness.

GROUP - B (Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$

- 2. What is the method of characterize the signal in terms of parameter? Describe that process with proper mathematical equations. 1+4
- 3. Why the Fourier transform of a Stationary random process is not possible? Hence, what is the solution? 1+4
- 4. Differentiate between correlation and convolution techniques. How will you convert a correlation sequence to a convolution sequence? 2+3
- 5. Compute the auto-correlation of the following signal

$$x(n) = a^n u(n)$$
, for $0 < a < 1$

Also find out the Normalized auto-correlation sequence of the above signal. $\begin{tabular}{ll} $4+1$ \end{tabular}$

6. Write the significance of Karhunen-Loeve Transform.

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



 $3 \times 15 = 45$

7. What is the principle of Adaptive Filtering? Explain the operating principle of Adaptive Noise Canceller. How do you remove the power line interference in Electrocardiography?

$$5 + 5 + 5$$

- 8. Describe the ECG QRS detection technique.
- 9. Write down both the data reduction techniques of AZTEC algorithm. How CORTES algorithm overcomes the limitations of TP and AZTEC algorithms? Reconstruct the original signal by the following AZTEC coded data:

$$\{15, 80, 5, 100, -8, -200, -5, 150, 25, 150\}.$$
 $7 + 3 + 5$

10. Write down the least-mean-square algorithm for one weight case with a neat sketch. Describe the different sleep characteristics of EEG. Briefly explain the hypnogram model parameters. 5+5+5

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