



Name :
Roll No. :
Invigilator's Signature :

CS/B.TECH(BME)/SEM-7/BME-701/2011-12

2011

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)

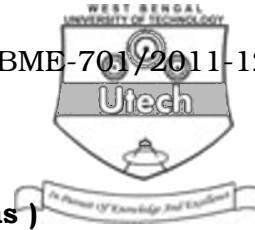
1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) Adaptive filter is a
- a) High-pass filter b) Low-pass filter
- c) Band-pass filter d) Band-reject filter.
- ii) Spikes and waves of EEG signal have frequency range of
- a) 2 – 3 Hz b) 2.5 – 3.5 Hz
- c) 1.5 – 2.5 Hz d) 2.5 – 3.0 Hz.
- iii) In Adaptive Noise Canceller reference signal is
- a) Noise b) P-Q-R-S-T Curve
- c) EMG Signal d) EEG Signal.



- iv) Theta (θ) waves at the stage of
- a) Alert Condition
 - b) Dreaming
 - c) Dreamless Sleep
 - d) Drowsiness.
- v) PRD is a parameter for measuring _____ of an algorithm.
- a) Accuracy
 - b) Predictability
 - c) Efficiency
 - d) Convergency.
- vi) Maximum efficiency of TP algorithm is
- a) 50%
 - b) 40%
 - c) 72%
 - d) 27%.
- vii) Cepstral analysis is used for
- a) Convolution
 - b) Cross-Correlation
 - c) Auto-Correlation
 - d) De-Convolution.
- viii) The amplitude range of EEG signal is
- a) 10-100 V
 - b) 10-1000 μ V
 - c) 10-100 μ V
 - d) 10-1000mV
- ix) Modern Prony's method is based on fitting N-available data points with
- a) Unit Impulse Model
 - b) Damped Sinusoidal Model
 - c) Continuous Sinusoidal Model
 - d) Unit Step Model.
- x) Cross-correlation technique is used for
- a) QRS detection
 - b) R-R interval detection
 - c) S-T segment detection
 - d) P-wave detection.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

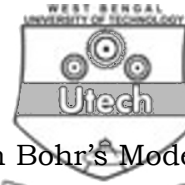
2. Using frequency shifting property, compute the F.T of modulating signal $x_1(n) = na^n$, where the original signal has been frequency modulated.
3. How can we detect the QRS complex from an ECG signal using Automata technique ?
4. Briefly explain the Hypnogram Model Parameters.
5. What is evoked potential ? How Prony's method is used for the analysis of evoked potential ? 1 + 4
6. Construct a curve fitting graph from the CORTES data set :-
 $\{ 1, 3, 2, -4, *0, 2, 5, -4, ** -3, 5, -2, -2, 1, 0 \}$
 where * indicates transition from AZTEC to TP, and ** indicates transition from TP to AZTEC.
7. What is Cepstral Analysis ? Why is it necessary in biomedical signal processing ? What is Real Cepstrum ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. 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. What is the principle of Adaptive Filtering ?
 Write the LMS Algorithm for one weight case. 4 + 1 + 5 + 5



9. How will you compare the Markov Model with Bohr's Model ? Explain the Markov Chain with an example. Discuss the linear prediction theory used for neurological signal processing. 3 + 5 + 7
10. i) Draw a flowchart / develop code function for the detection of Arrhythmia from a filtered ECG signal.
ii) In an ECG signal, if the peaks are detected at intervals 70 and 180, sampled at 120 times per second, then, calculate Heart rate in bpm.
iii) How can you separate EMG from baseband noise ? 8 + 2 + 5
11. i) Describe the exponential modeling and parameter estimation of Prony's Method.
ii) What is *K*-complex in steep EEG ? 10 + 5
12. Write the CORTES algorithm for data reduction technique. How does CORTES algorithm overcome the limitations of TP and AZTEC algorithm ? Reconstruct the ECG signal by the following CORTES data, where ** is the mark separating AZTEC data from TP and *** is the mark separating TP from AZTEC. 7 + 3 + 5
13. Write short notes on (any *three*) 3 × 5
- a) Developing code for TP algorithm
 - b) Simple High Speed based QRS width detection algorithm
 - c) Mel Bank filtering
 - d) Spectral estimation and Spectral analyzer
 - e) Dynamic of sleep-wake transition.
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