Printed Pages : 3 TEC-034

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0390 Roll No.

B. Tech.

(SEM. VIII) EXAMINATION, 2007-08

BIOMEDICAL SIGNAL PROCESSING

Time : 3 Hours] *[Total Marks : 100*

Note :
(1) Attempt **all** questions.
(2) All question carry **equal** marks.
(3) Be precise in your answer.
(4) No Second Answer book will be provided.

1 Attempt any **four** parts of the following:

(a) What are bio-potentials? Name six types of bio-potentials sources with their amplitude and frequency range.

(b) Explain various ECG lead systems and Einthoven triangle. Also name the types of interferences which occur during recording the ECG

(c) Do you think the electroencephalogram is subject to frequency discrimination? Explain.

(d) Explain polarization, deploarization and repolarization phenomenon with the help of waveform.

(e) When does it require to record the potentials from the muscle ? Explain special features of electromyogram.

(f) A cardiologist records a patient's ECG on a machine that is suspected of being defective. He notices that QRS complex of a normal patient's ECG has a lower peak-to-peak amplitude than the one recorded on a good machine.

2 Attempt any **four** parts of the following :

(a) Explain the difference between interpreted, compiled and integrated-environment compiled languages. Give examples of each type.

(b) Explain the principle of computerized axial tomography and compare its method of visualization with conventional X-ray methods.

(c) The derivative algorithm used in a real time QRS detector has the difference equation y ($nT = 2x(nT)$ - x (nT-T) - x (nT - $3T$) - x (nT - $4T$). (i) Draw its bolck diagram (ii) What is its output sequence in response to a unit step input? (iii) Draw the output waveform.

(d) How can QRS complexes in abnormal waveforms be detected using cross correlation method?

(e) Show the relative power spectrum of QRS complex, P and T waves, muscle noise and motion artifacts based on an average of 150 beats.

(f) In arrhythmia analysis, the RR inter and QRS duration for each best are mapped into a two dimensional space. How is the location of the center of the box marked *Normal* established.

3 Attempt any **two** parts of the following :

(a) Explain the meaning of lossless and lossy data compression. Classify the data reduction algorithms. Give the algorithm for any one of the lossless techniques.

(b) Explain why an AZTEC reconstructed waveform is unacceptable to a cardiologist. Suggest ways to alleviate the problem.

(c) AZTEC encodes a signal from an 8-bit analog-to-digital converter as (2, 50, -4, 30, -6, 30, -4, 50, 2, 50).
   (i) What is the amount of data reduction?
   (ii) What is the peak-to-peak amplitude of a signal reconstructed from these data?

4 Attempt any **two** parts of the following:

(a) Illustrate the principle of adaptive segmentation of an EEG signal, explain its need.

(b) Where does one use Yule-Walker equation in EEG analysis? Why? Explain in detail.

(c) Justify the Markov model for studying sleep EEG Why may not it be appropriate when dealing with influence factors that effect sleep? Explain.

5 Attempt any **two** parts of the following :

(a) Explain the Principal Noise Canceler model. Design an adpaptive filter using the LMS algorithm.

(b) In a signal averaging application, the noise amplitude is initially 4 times as large as the signal amplitude. How many sweeps must be averaged to give resulting signal to noise ratio of 4:1?

(c) Show that when the impulse response of the adaptive linear combiner is optimal then the error signal $e(n)$ is uncorrelated with (orthogonal) the obseervational vector Y.

(c) AZTEC encodes a signal from an 8-bit analog-to-digital converter as (2, 50, -4, 30, -6, 30, -4, 50, 2, 50).
(i) What is the amount of data reduction?
(ii) What is the peak-to-peak amplitude of a signal reconstructed from these data?

4 Attempt any **two** parts of the following:

(a) Illustrate the principle of adaptive segmentation of an EEG signal, explain its need.

(b) Where does one use Yule-Walker equation in EEG analysis? Why? Explain in detail.

(c) Justify the Markov model for studying sleep EEG Why may not it be appropriate when dealing with influence factors that effect sleep? Explain.

5 Attempt any **two** parts of the following :

(a) Explain the Principal Noise Canceler model. Design an adpaptive filter using the LMS algorithm.

(b) In a signal averaging application, the noise amplitude is initially 4 times as large as the signal amplitude. How many sweeps must be averaged to give resulting signal to noise ratio of 4:1?

(c) Show that when the impulse response of the adaptive linear combiner is optimal then the error signal $e(n)$ is uncorrelated with (orthogonal) the obseervational vector Y.