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Eighth Semester B.E. Degree Examination, June/July 2011
Biomedical Signal Processing

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.

PART - A

- 1 a. Explain briefly how action potentials are generated and propagated in a human body. (10 Marks)
- b. Define EEG. Briefly explain 10 – 20 system of electrode placement for clinical EEG recording. (04 Marks)
- c. Describe the difficulties encountered in acquisition and analysis of biomedical signal. (06 Marks)
- 2 a. Explain briefly the physiology of the heart and elaborate on how action potentials propagate through the heart giving rise to different segments of ECG. (10 Marks)
- b. Explain in detail classification of electrodes in a 12 – lead ECG system. (10 Marks)
- 3 a. What is a digital filter? What are the different elements of a digital filter? Mention advantages of digital filters over analog filters. (10 Marks)
- b. Explain briefly pole – zero plot on a Z – plane. Consider the transfer function:

$$H(z) = \frac{1 - Z^{-2}}{1 - 1.0605Z^{-1} + 0.56Z^{-2}}$$
 Locates poles and zeros in the Z – plane and show the rubber membrane for azimuth angle (Az) = 180°, deviation (EL) = 0°. (10 Marks)
- 4 a. What are the advantages of an adaptive filter? Design an adaptive filter using LMS algorithm. (10 Marks)
- b. Discuss briefly the different applications of adaptive filters. (10 Marks)

PART - B

- 5 a. Show that a signal averaging improves the signal to noise ratio (SNR) by a factor of \sqrt{M} . (10 Marks)
- b. i) In a signal averaging application the amplitude of uncorrelated noise is initially 16 times as large as the signal amplitude. How many sweeps must be averaged to give a resulting signal to noise ratio of 4:1? (03 Marks)
- ii) With a neat block diagram, explain a typical signal averager. (07 Marks)
- 6 a. What is a data reduction algorithm? Explain lossy and lossless data compression. Classify the four data reduction algorithms into these categories. (06 Marks)
- b. Explain briefly the FAN algorithm. (08 Marks)
- c. Given a sequence of 28 data points {1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 6, 6, 7}. Illustrate Huffman coding. Also calculate the expected code word length. (06 Marks)
- 7 a. Explain briefly the QRS detection algorithm. (10 Marks)
- b. With a neat sketch, explain the power spectrum of an ECG. Explain in detail one of the template matching techniques for QRS detection. (10 Marks)
- 8 Write short notes on :
 - a. VLSI sensors for biomedical signals. (06 Marks)
 - b. ST – segment analyzer. (06 Marks)
 - c. Portable arrhythmia monitor. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing identification, appeal to evaluator and /or equations writt eg, 42+8 = 50, will be treated as malpractice.

