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06EC834

Eighth Semester B.E. Degree Examination, June 2012
Biomedical Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Discuss the difficulties encountered during biomedical signal acquisition and analysis. **(08 Marks)**

b. With the help of a block diagram, explain the objectives of biomedical signal analysis. **(06 Marks)**

c. Explain the following biomedical signals, draw the waveforms and give the frequency ranges relevant to these signals:
i) ECG ii) EEG. **(06 Marks)**

2 a. Starting from mesh equations of potential differences between the links RA, LA & LL derive the expressions for aV_R , aV_L and aV_F. Also represent relationships between these standard and augmented lead voltages using vector diagram. **(08 Marks)**

b. Explain the different bandwidths that are used in ECG. Describe the principal applications for each of these bandwidths. **(06 Marks)**

c. What are the two types of electrodes used in ECG? Which of them is popular? Why? **(06 Marks)**

3 a. Compare analog and digital filters. What are the types of digital filters? **(08 Marks)**

b. The z-transform of a filter is given by

$$H(z) = \frac{1 - z^{-2}}{1 - 1.0605z^{-1} + 0.5625z^{-2}}$$

What is its i) amplitude response ii) Phase response? **(12 Marks)**

4 a. With a block diagram and relevant expressions, explain LMS algorithm used in noise canceller model. **(10 Marks)**

b. What are the main advantages of adaptive filters over fixed filters? Explain how a sine wave model is used for 60 Hz adaptive cancellation. **(10 Marks)**

PART – B

5 a. Mention the characteristics of noise and signal in signal averaging techniques. Explain a typical signal averager with the help of block diagram. **(10 Marks)**

b. Show that signal averaging improves the SNR by a factor of $\sqrt{m}$, where m is the number of sweeps considered. What are the limitations of signal averaging? **(10 Marks)**

6 a. Explain the turning point algorithm and fan `algorithm, each with an example. **(10 Marks)**

b. For the given data set

{ 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7 }

Derive the codewords for the data using Huffman coding. What is the codeword length (average codeword length). Also depict the merging operation in a binary tree. **(10 Marks)**

7 a. Explain a real time algorithm for QRS detection. Explain how heart rate is measured using R-R interval using the same algorithm. **(10 Marks)**

b. With the help of a diagram of an ECG signal with tokens and of state transition diagram, explain automata based template matching of QRS detection. **(10 Marks)**

8 a. Explain the portable arrhythmia monitor, with a block diagram. **(10 Marks)**

b. Write short note on ST segment analysis. **(06 Marks)**

c. Describe the differences between a general purpose microprocessor & DSPs. **(04 Marks)**

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