No. of Pages: 2

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER MTECH DEGREE EXAM DECEMBER 2017
ELECTRONICS AND COMMUNICATION ENGINEERING
SIGNAL PROCESSING
01EC6315: BIOMEDICAL SIGNAL PROCESSING

Max. Marks : 60 marks

Duration:3Hrs

Answer *any two full* questions from *each* part

Limit answers to the required points

PART A

1. (i) Propose a time domain technique to remove random noise if you are given realizations from a series of related events. How you will tackle the same situation if only one realization of the same event is available. Make suitable assumptions wherever you need. **(6)**

   (ii) Explain the various artifacts encountered while analyzing a biomedical signal. **(3)**

2. (i) Design a frequency-domain filter which has minimum computational complexity to remove high frequency noise with minimal loss of signal components in the specified pass-band given below. Cut off frequency f_c= 40 Hz, Sampling frequency f_s = 200 Hz. Choose the order of the filter to be N = 4. Assume the data which are not given. **(6)**

   (ii) Explain the objectives of biomedical signal analysis. **(3)**

3. (i) How adaptive filter theory can be used to remove maternal ECG artifact from fetal ECG signal? **(6)**

   (ii) Discuss on EEG rhythms, waves and transients. **(3)**

PART B

4. (i) How can you remove a periodic artifact with fundamental frequency 60 Hz and odd harmonics at 180 Hz, 300 Hz, and 420 Hz from an ECG signal. Design a suitable filter to remove this artifact. Given sampling frequency fs = 1,000 Hz. **(5)**

(ii) How muscle noise encountered during ECG acquisition can be rectified using signal processing technique? **(4)**

5. (i) How could we improve the performance of the basic first order difference operator as a filter to remove low frequency noise or baseline wander without distorting the QRS complex? **(6)**

   (ii)Write short notes on brain computer interface. **(3)**

6. (i) Purpose a method for detection of spike and wave complexes (indicators of epileptic seizures) in EEG signals. **(3)**

   (ii) Devise a suitable method to detect RR-interval for an arrhythmia classification system. **(6)**

PART C

7. (i) Explain correlation analysis of EEG channels. Propose a method to detect the presence of the α rhythm in an EEG channel. How would you extend the method to detect the presence of the same rhythm simultaneously in two EEG channels ? **(6)**

   (ii) Discuss on the methods to remove artifacts in EEG signals. **(6)**

8. (i) How matched filters can be used in the waveform analysis of EEG? **(6)**

   (ii)How amplitude estimation of surface EMG signals can be done? **(6)**

9. (i) Why are model based approaches preferred in EEG analysis? **(3)**

   (ii) Justify the use of linear prediction analysis in EEG modeling. **(3)**

   (iii)How signal processing techniques helps in EMG waveform decomposition **(6)**