



# P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

**Eighth Semester, B.E. - Electronics and Communication Engineering**

**Semester End Examination; July - 2021**

**Biomedical Signal Processing**

Time: 3 hrs

Max. Marks: 100

**Note:** Answer any **FIVE** full questions.

- 1 a. Explain basic ECG with PQRS and T waves. 10
- b. Explain EEG and its characteristics. 10
- 2 a. Explain the major objectives of biomedical signal analysis. 10
- b. With neat diagram, briefly explain computer aided diagnosis based upon biomedical signal. 10
- 3 a. Propose a time domain techniques to remove random noise given the possibility of acquiring multiple realization of the signal/event of interest. 10
- b. Develop a time domain techniques to remove baseline drift in the ECG signal. 10
- 4 a. Design a frequency domain filter which can remove low frequency noise minimal loss of signal component in a specified pass band. 10
- b. If  $y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n)$ 
  - i) Determine the response of the causal systems 10
  - ii) Determine output for input signal  $x(n) = \delta(n) - \frac{1}{4}\delta(n-1)$
- 5 a. Determine the optimal value 'h' that minimize the mean square error  $E[e^2(n)]$  and also find the value of mean square errors for the following characteristics:  
 $E[y^2(n)] = 1$ ,  $E[x^2(n)] = 4$  and  $E[x(n)y(n)] = 1$  for the given figure
 10
- b. Explain the cancellation of 60 Hz interference in an ECG signal using adaptive filters. 10
- 6 a. Explain the basic requirement for the need of data compression. 4
- b. Classify the different data reduction techniques and explain the turning point algorithm used for ECG data reduction. 10
- c. Explain data compression using DPCM with block diagram. 6
- 7 a. Why model based approaches are preferred in EEG analysis? Explain. 7
- b. Explain the three different ways to remove the correlation from the LP signal. 3
- c. Describe adaptive segmentation algorithm and how it is applied for EEG analysis? 10

- 8 a. Explain the high speed QRS detection algorithm with a block diagrams. 10
- b. Describe the various types of Arrhythmias. 10
- 9 a. With the help of single exponent case, describe Prony's exponential model. 8
- b. Explain original Prony problem and the computation steps in it. 12
- 10 a. Describe clinical application of Prony's method by considering suitable example. 8
- b. Explain the steps involved in solving Prony's problem using covariance linear prediction method. 12

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