PAPER ID-420212

Subject Code: KOE082

Roll No: | | | | | | | | | | | | | |

**BTECH**
**(SEM VIII) THEORY EXAMINATION 2021-22**
**BIO MEDICAL SIGNAL PROCESSING**

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

**Notes:** Assume any missing data.

## SECTION-A

**Q.1 Attempt all parts. Write answer of each part in short. (2 x 10=20)**

**(a)** Enumerate different types of biomedical transducer?
**(b)** Define the terms: bradycardia, tachycardia and arrhythmia in electrocardiography.
**(c)** What is ERG?
**(d)** Define Joint probability
**(e)** Write the name of different biomedical signal.
**(f)** Enumerate the differences between direct and indirect measurement of blood pressure.
**(g)** What does maximum entropy method state?
**(h)** Name and explain the type of amplifier used in ECG that amplifies the ECG signal while not essentially amplifying the disturbance signal.
**(i)** What are the different patterns of brain wave?
**(j)** What you mean by EP estimation?

## SECTION-B

**Q.2 Attempt any three questions from this section. (10 x 3=30)**

**(a)** What is most common artifact observed in ambulatory ECG? Explain
**(b)** Propose an algorithm to detect QRS complexes in an ongoing ECG signal.
**(c)** Explain how time frequency analysis is helpful in biomedical signal processing.
**(d)** Discuss the electric activity of the heart. What is the significance of the Einthoven's triangle?
**(e)** Design a low pass filter using Kaiser window.
**(f)** Write short notes on:
- **i.** Use of MATLAB on biomedical signals.
- **ii.** Laser applications in bio-medical field.

## SECTION-C

**Q.3 Attempt any one questions from this section. (10 x 1=10)**

**(a)** After applying the AZTEC algorithm to a signal, the saved data array is {2, 50, -4, 30, -6, 50, -6, 30, -4, 50, 2, 50}.
- **i.** Draw the waveform that AZTEC would reconstruct from these data.
- **ii.** What is the amount of data reduction?
- **iii.** What is the peak-to-peak amplitude of a signal reconstructed from these data?

**(b)** Explain the principles of Adaptive noise canceller with an example.

**Q.4 Attempt any one questions from this section. (10 x 1=10)**

**(a)** Given a biomedical signal, identify discrete signal epochs and correlate them with events in the related physiological processes.
**(b)** Explain briefly the different methods used for EEG analysis by spectral estimation

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**Q.5 Explain any one questions from this section.** **(10 x 1=10)**

**(a)** The details about auto correlation and cross correlation.
**(b)** Write short note on Analog to Digital conversion.

**Q.6 Explain any one questions from this section.** **(10 x 1=10)**

**(a)** The input of a casual linear shift-invariant system is

$$x(n) = u(-n-1) + \left(\frac{1}{2}\right)^n u(n).$$

The Z-transform of the output of this system is

$$y(z) = \frac{\frac{-1}{2}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)(1+z^{-1})}$$

Find the system function H(z) of the filter.
**(b)** Explain the principles of Adaptive noise canceller with suitable example

**Q.7 Explain any one questions from this section.** **(10 x 1=10)**

**(a)** The table below shows a set of 20 data points of an ECG sampled with an 8-bit analog-to-digital converter.

| Number | Frequency of occurrence | Huffman code |
|---|---|---|
| -10 | 2 | |
| 0 | 10 | |
| 10 | 3 | |
| 20 | 4 | |
| 60 | 1 | |

(i) Draw a Huffman binary tree including the probabilities of occurrence for this set of data.
(ii) From the binary tree, assign appropriate Huffman codes to the numbers in the data array.
**(b)** Write short note on Wavelet detection and Adaptive wavelet detection.