Code No: 07A61103 **R07** **Set No. 2**

**III B.Tech II Semester Examinations,APRIL 2011**
**BIOMEDICAL SIGNAL PROCESSING**
**Bio-Medical Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Write the Properties of auto correlation.
   (b) Write the Properties of power spectral density. [8+8]
2. There are four different bandwidths that are used in electrocardiograph. Describe the principle and applications of these bandwidths? Draw the frequency response. [16]
3. (a) Explain atleast three potential sources of physiological artifacts in recording the EEG signal.
   (b) Explain the various sleep stages and specify their frequencies. [8+8]
4. (a) Expand AZTEC and explain the principle of operation of this technique.
   (b) Compare the performance of AZTEC and Turning point algorithm. [12+4]
5. Adaptive linear combiner characterized by following $E[r^2(n)]=1$, $E[x^2(n)]=4$ , $E[x(n)r(n)]=1$ where x(n) is primary signal and r(n) is reference signal. Determine
   (a)The optimum weight($W_{opt}$).
   (b)Mean square error. [8+8]
6. (a) Why prony's method suggested for modeling evoked potentials?
   (b) Explain the limitations of fast fourier transform. [10+6]
7. Show that Gaussian density function is a valid function and hence find maximum value of the density function. [16]
8. Explain, with a block diagram and necessary flowcharts, an automated system to calculate the heart rate from the ECG recording and determine if it is Tachycardia/Normal sinus rhythm/bradycardia. [16]

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Code No: 07A61103 **R07** **Set No. 4**

**III B.Tech II Semester Examinations,APRIL 2011**
**BIOMEDICAL SIGNAL PROCESSING**
**Bio-Medical Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Explain stationary random processes with an example.
   (b) Write the Properties of Characteristic function. [8+8]
2. According to autoregressive process derive the following parameters.
   (a) First order AR parameters.
   (b) Mean square error. [10+6]
3. (a) Analyze the phonocardiography signals using exponential modeling.
   (b) Explain the spectral characteristics of PCG signals. [10+6]
4. (a) How do you detect missing QRS complex?
   (b) How a right bundle block is detected using automated ECG analysis? [8+8]
5. (a) For a random variable, briefly explain what is meant by probability distribution function and probability density function.
   (b) List and briefly explain the properties of the density function. [10+6]
6. (a) Given the following data set{a,a,a,a,a,b,b,b,b,c,c,c,d,d,e}. Derive the code words for the data using Huffman coding. What is the average code word length.
   (b) Implement Turning Point algorithm on the given data{15,10,6,7,5,3,4,7,1,5,3} and prove that data compression is achieved. [8+8]
7. What are the limitations of the FFT method that are overcome by use of parametric analysis method? Explain with one example. [16]
8. When are signal and noise are stationary. Explain the technique to eliminate the noise? Give an example. [16]

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Code No: 07A61103 **R07** **Set No. 1**

**III B.Tech II Semester Examinations,APRIL 2011**
**BIOMEDICAL SIGNAL PROCESSING**
**Bio-Medical Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) What are the specifications of an ECG amplifier.
   (b) Explain about ECG data acquisition. [8+8]
2. (a) Draw a typical PCG waveform over one cardiac cycle indicating the important component waves, their typical durations.
   (b) Explain the motion artifacts in the ECG? Give an example. [10+6]
3. (a) Define cumulative distribution function with an example.
   (b) List out the properties of c d f. [8+8]
4. Apply the signal averaging technique on given data samples sets and draw the the waveforms. [16]

   $d_1$= { 0, 1, 2, 3, 5, 3, 2, 1, 0, -1, -2, -3, -5, -3,-2, -1, 0, 0, 1, 2, 3, 5, 3, 2, 1, 0, -1, -2, -3, -5, -3,-2, -1, 0}.
   $d_2$ ={ 0, 2, 4, 6, 7, 6, 4, 2, 0, 2, 4, 6, 7, 6, 4, 2, 0, 2, 4, 6, 7, 6, 4, 2, 0, 2, 4, 6, 7, 6, 4, 2, 0}.
5. (a) After applying AZTEC algorithm for the signal the saved array is {4,50,-4,30,-6,40, -6,25,-4,50,2,50}. What is the amount of data compression achieved?
   (b) Draw waveforms corresponding to the original and the saved data points.[8+8]
6. What are the neurological disorders in which EEG can be used as non invasive diagnostic tool? Explain with one example. [16]
7. A random process X(t)=A cos $\omega$ t, where $\omega$ is a constant and A is a random variable uniformly distributed over (-0, 1), find the auto correlation and auto covariance of X(t). [16]
8. Primary Signal x(n)= ECG+$\varepsilon$(n), y(n)= C.ECG where $\varepsilon$(n) is the noise and y(n) is the reference signal.
   (a) Find the optinum value of h that minimizes the mean square error.
   (b) Determine the Mean square error. [8+8]

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Code No: 07A61103 **R07** **Set No. 3**

**III B.Tech II Semester Examinations,APRIL 2011**
**BIOMEDICAL SIGNAL PROCESSING**
**Bio-Medical Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Discuss the selection of data compression algorithm for the ECG date compression.
   (b) What are drawbacks in Hoffman coding. [10+6]
2. (a) Explain the acquisition procedure of digital biological signal with one example.
   (b) During acquisition the signal frequency is 100Hz.what would be the sampling frequency. Expalin in detail. [8+8]
3. (a) Explain the different types of interferences present during acquisition of biological signals.
   (b) Write the acquisition of ECG signal from a heart transplant patient. [8+8]
4. (a) Write the different applications of Autoregressive process.
   (b) Explain the Yule-Walker method. [8+8]
5. A random process X(t)=A sin($\omega$ t+$\theta$), where A is a constant and $\theta$ is a random variable uniformly distributed over (-$\pi$,$\pi$),check whether X(t) is stationary or not. [16]
6. (a) Discuss how the EEG signals are generated. Give a model of EEG signal.
   (b) Explain the algorithm to detect the spikes and complexes using AR technique. [8+8]
7. (a) How do you identify ST segment and how is it analysed?Draw a flow chart?
   (b) Discuss an algorithm to determine the various amplitudes and durations of ECGwave form. [8+8]
8. A Gaussian random signal has a mean value of 10 and variance of 25.
   (a) What is the probability that an observed value of the signal is greater than zero?
   (b) What is the probability that an observed value of the signal is greater than the twice of the mean value?
   (c) What is the probability that an observed value of the signal is greater than zero but less than or equal to the mean value? [5+5+6]

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