



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 101608

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15
BIOMEDICAL SIGNAL PROCESSING

Time : 3 Hours]

[Total Marks : 100

Note : Answer all five questions.

1 Answer any four parts of the following : 4×5=20

(a) Find the Z-transform of the sequence

$$x(n) = \alpha^n u(n)$$

(b) Find the Z-transform of

$$x(n) = 2^n u(n) + 3 \left(\frac{1}{2} \right)^n u(n)$$

(c) Find the H-point DFT of the sequence

$$x(n) = (-1)^n \quad 0 \leq n \leq N-1$$

where N is an even number.

(d) Explain the difficulties in the acquisition of biomedical signals.

- (e) Explain use of digital computer in biomedical application and give some examples.
- (f) What is EEG ? Why is it much more difficult to recognize than ECG ?
- 2** Answer any four parts of the following : **4×5=20**
- (a) What is the most common artifact observed in ambulatory ECG ? Explain.
- (b) Explain the properties of Fourier Transform.
- (c) Determine whether or not the signal below are periodic and for each signal that is periodic, determine the fundamental period.
- (i) $x(n) = \cos(0.125 \pi n)$
- (ii) $x(n) = \sin(\pi + 0.2n)$
- (d) Find the z-transform of $\cos \omega_0 n$.
- (e) What is the use of MATLAB on various bio-medical signals ?
- (f) What is the difference between energy and power signal ? Explain with examples.
- 3** Attempt any two parts of the following : **2×10=20**
- (a) Find the Fourier transform of $e^{-at} u(t)$ with its magnitude and phase spectrum.
- (b) Find the Kaiser window parameters, β and N to design a low pass filter with a cut off frequency $\omega_c = \pi/2$, a stop band ripple $\delta_s = 0.002$ and a transition bandwidth no larger than 0.1π .

- (c) State and prove sampling theorem with its spectrum.

4 Attempt any two parts of the **2×10=20** following :

- (a) Let $x(n)$ be a sequence of length 1024 that is to be convolved with a sequence $h(n)$ of length L . For what values of L is it more efficient to perform the convolution. Directly than it is to perform the convolution by taking the inverse DFT of the product $X(k) H(k)$ and evaluating the DFTs using a radix -2 FFT algorithm.
- (b) Give details about Auto correlation and cross correlation.
- (c) Write short note on Analog to Digital conversion.

5 Attempt any two parts of the **2×10=20** following :

- (a) Find two different continuous time signals that will produce the sequence $x(n) = \cos(0.15n\pi)$ when sampled with a sampling frequency of 8 kHz.
- (b) Design a low pass filter using Kaiser window.
- (c) The input to 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

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

Find the system function $H(z)$ of the filter.
