 Roll No .....

MEDC-103

M.E./M.Tech., I Semester

Examination, December 2014

DSP Application

Time : Three Hours

Maximum Marks : 70

Note: 1. Attempt any five questions.
2. All questions carry equal marks.

1. a) What is LTI System? How discrete time LTI System differs from continuous time LTI System? Derive the equation for the convolution sum as applicable to DTLTI System.

b) Compute the convolution $y(n)$ of the signals

$$x(n) = \begin{cases} a^n & , \quad -3 \le n \le 5 \\ 0 & , \quad elsewhere \end{cases}$$

$$h(n) = \begin{cases} 1 & , \quad 0 \le n \le 4 \\ 0 & , \quad elsewhere \end{cases}$$

2. a) What is Causal System? How the condition of causality is transformed to condition on impulse response?

b) Show that a relaxed linear system is causal if and only if for any input $x(n)$ such that

$x(n)=0$ for $n<n_0 \Rightarrow y(n)=0$ for $n<n_0$

3. a) Prove the property of time shifting and time reversal as applicable to Z-transform.

b) Show that Z-transform of the sequence.

$$x(n)=\begin{cases}\frac{a^n}{n!}, & n\geq 0\\ 0, & n<0\end{cases}$$

is $e^{a/z}$. Sketch the sequence for the first few values of n, for the case $a=1$.

4. a) Using long division, determine the inverse Z-transform of $X(z)=\frac{1+2z^{-1}}{1-2z^{-1}+z^{-2}}$.

If (i) $x(n)$ is causal and (ii) $x(n)$ is anticausal

b) Compute Z-transform for the following

i) $x(n) = (n\,a^n \sin\omega_0 n)\ u(n)$

ii) $x(n) = n^2\ u(n)$

5. a) Differentiate:

i) Circular convolution and linear convolution.

ii) DFT and DCT. Discuss relationship between them.

b) Draw the flow graph for decimation in time FFT algorithm for N=8. using radix-2. Show various steps of decimation.

6. a) What are the desirable and undesirable features of FIR filters? Differentiate between FIR filters and IIR filters.

b) Explain mapping of a analog filter from S-plane to digital filter in Z-plane using Bilinear transformation. Also investigate the characteristics of the Bilinear transformation.

7. a) Describe response of linear systems to random signals.

b) Explain Basic principles of spectrum estimation. Estimate auto covariance, power spectrum, cross covariance and cross spectrum.

8. Write short notes on any two of the following.

i) Recursive and non-Recursive system.

ii) Design of FIR filter by windowing techniques.

iii) Effect of finite register length in filter design.

iv) Haar transform.