10. a) Explain window technique for designing FIR digital filter.

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.

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**Roll No** .....

# EC-603

## B.E. VI Semester

Examination, December 2014

## Digital Signal Processing

***Time : Three Hours***

***Maximum Marks : 70***

***Note:*** i) Attempt one question from each unit.
ii) All questions carry equal marks.

### Unit - I

1. a) What are discrete time signals and systems? What do you mean by linearity and time invariance of these systems?

b) Define and explain causal and non causal discrete time LTI system. How can the condition of causality be translated to a condition on impulse response? Derive the condition.

OR

2. a) Derive the equation for the convolution sum as applicable to DTLTI systems.

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

$$x(n)=\begin{cases}\alpha^n, & -3\le n\le 5\\ 0, & \text{else where}\end{cases}$$

$$h(n)=\begin{cases}1, & 0\le n\le 4\\ 0, & \text{else where}\end{cases}$$

## Unit - II

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

   b) Find the Z-transform of the following:

   i) $n^2 e^{-2n}$

   ii) $na^n u(n)$

OR

4. a) Using long division method find inverse of Z-transform of $X(z) = \dfrac{1+2z^{-1}}{1-2z^{-1}+z^{-2}}$

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

   ii) $x(n)$ is anti causal.

   b) Compute the convolution $x(n)$ of the signals using Z-transform

   $x_1(n) = \{1, -2, 1\}$

   $x_2(n) = \begin{cases} 1, & 0 \le n \le 5 \\ 0, & \text{elsewhere} \end{cases}$

## Unit - III

5. a) State and prove the following properties of DFT.

   i) Even and odd properties.

   ii) Circular frequency shift.

   b) Show that multiplication of two DFT's is circular convolution in time domain.



OR

6. a) How DFT can be used to perform high speed convolution? Explain giving example.

   b) Define DFT of a given time sequence $x(n)$ and hence write five different properties of DFT by giving suitable illustrations.

## Unit - IV

7. a) Discuss radix of FFT algorithm. Find the number of computations required for 1024 point DFT using normal method.

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

OR

8. a) Discuss decimation in time algorithm for FFT and how it differs from the decimation in frequency algorithm.

   b) Draw and explain the flow graph for decimation in frequency FFT algorithm for N = 8 show various stages of decimation.

## Unit - V

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

   b) Discuss Bilinear transformation method for designing digital filters.

OR