d) Explain the procedure for designing a FIR filter using the Kaiser window.

OR

What is impulse invariant technique? Obtain the mapping formula for the impulse invariant transformation.

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Roll No .....

EC-603

B.E. VI Semester

Examination, December 2016

Digital Signal Processing

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv) Except Numericals, Derivation, Design and Drawing etc.

Unit-I

1. a) Define and explain discrete time linear time invariant system.

   b) Determine if the following system is time invariant or time variant $y(n) = x(n) \cos w_0 n$

   c) Explain and differentiate the following :

      i) Causal versus noncausal system

      ii) Linear Versus nonlinear system

   d) Show that for a linear time invariant system, if the input sequence is $x(n)$ and impulse response is $h(n)$, then the output $y(n)$ is given by $y(n) = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$

OR

Determine the output $y(n)$ of a relaxed linear time invariant system with impulse response $h(n) = a^n u(n), |a| < 1$ when the input is a unit step sequence that is $x(n) = u(n)$

Unit-II

2. a) Define Z-transform and explain its use.

   b) Define Region of convergence and explain the significance of ROC in Z-plane.

   c) Determine the Z-transform of the signal $x(n) = \left(\frac{1}{2}\right)^n u(n)$.

   d) State and prove the following properties of Z-transform.

      i) Time shifting

      ii) Convolution

OR

Determine the system function and the unit sample response of the system described by the difference equation $y(n) = \frac{1}{2} y(n-1) + 2x(n)$.

Unit-III

3. a) Define DFT for a sequence $x(n)$.

   b) Define circular convolution. What is the difference between circular and linear convolutions.

   c) State and prove the following property of DFT.

      i) Periodicity

      ii) Linearity

   d) A finite duration sequence of length L is given as

$$x(n) = \begin{cases} 1 & 0 \le n \le L-1 \\ 0 & otherwise \end{cases}$$

Determine the N-point DFT of this sequence for $N \ge L$

OR

Compute the DFT of the four point sequence $x(n) = (0\,1\,2\,3)$

Unit-IV

4. a) Why is FFT called so?

   b) State the computational requirements of FFT.

   c) Explain the difference between decimation in time and decimation in frequency FFT algorithm.

   d) Draw the flow graph of an eight point decimation in time FFT algorithm.

OR

Given $x(n) = \{1,2,3,4,4,3,2,1\}$ find $X(k)$ using decimation in time FFT algorithm.

Unit-V

5. a) Define FIR filter and IIR filter.

   b) Compare FIR filter with IIR filters.

   c) What is bilinear transformation method of designing IIR filter? Explain.