Seventh Semester B.Tech. Degree Examination, June 2018
(2008 Scheme)
08.703: DIGITAL SIGNAL PROCESSING (E)

Time: 3 Hours
Max. Marks: 100

PART - A

Answer all questions from Part - A:

1. State and explain sampling theorem.

2. Check whether \( x(n) = (\frac{1}{2})^n u(n) \) is an energy signal or power signal.

3. Prove that \( x(n) * u(n) = \sum_{k=-\infty}^{\infty} x(k) u(n-k) \).

4. Compare zero order hold and first order hold.

5. State and prove initial value theorem w.r.t. z-transforms.

6. Explain the properties of ROC w.r.t. z-transforms.

7. Explain the advantages of FFT compared to direct evaluation of DFT.

8. Obtain the direct form realisation for a system with \( h(n) = \delta(n) + \frac{1}{2} \delta(n-1) + \frac{1}{4} \delta(n-2) \).

9. Explain frequency warping and how can it be avoided.

10. What is a linear phase filter? What are the conditions to be satisfied by the impulse response of an HR system in order to have linear phase?

(10x4=40 Marks)

P.T.O.
PART – B

Answer one full question from each Module.

Module – I

11. a) Given the sequence \( x(n) = \{0, 1, 2, 3, 3\} \). Sketch the following sequences
   \( (1) \) \( x(n-2) \) \( (2) \) \( x(n+2) \) \( (3) \) \( x(2n) \) \( (4) \) \( x(-n) \).

   \[ \text{10} \]

   b) Find linear convolution sum of two sequences, \( x(n) = \{1, 4, 3, 2\} \), \( h(n) = \{1, 3, 2, 1\} \).

   \[ \text{10} \]

12. a) Obtain the OTFT for \( x(n) = (0.5)^n u(n) + 2^n u(-n-1) \).

   \[ \text{10} \]

   b) Consider a discrete LTI system with \( h(n) = (\frac{1}{2})^n u(n) \). Use DTFT to determine the response of the system to the following signal given by \( x(n) = (\frac{3}{4})^n u(n) \).

   \[ \text{10} \]

Module – II

13. a) An LTI system is described by the system function \( H(z) = \frac{3-4z^{-1}}{(1-\frac{1}{2}z^{-1})(1-3z^{-1})} \).

   Specify the ROC of \( H(z) \) and determine \( h(n) \) for (1) the system is stable (2) the system is causal (3) the system is anticausal.

   \[ \text{10} \]

   b) Compute the 4-point DFT of the sequence \( x(n) = \{1, 0, 1, 0\} \) using DIT-FFT radix-2 algorithm.

   \[ \text{10} \]

14. a) Find the 8-point DFT of the sequence \( x(n) = \{1, 2, 2, 2, 1, 0, 0, 0\} \). Use DIF-FFT radix-2 algorithm.

   \[ \text{10} \]

   b) Determine the transient, steady state and total response of the system described by \( y(n) = 0.5y(n-1) + x(n) \) when input \( x(n) = u(n) \). Assume that system is initially at rest.

   \[ \text{10} \]

Module – III

15. a) Determine the direct form – I and direct form – II realisation for

   \[ H(z) = \frac{8z^3-4z^2+11z-2}{z^3-(\frac{5}{4})z^2+(\frac{3}{4})z-\frac{1}{6}} \]

   \[ \text{10} \]

   b) Given the system function \( H(z) = 1+\frac{3}{4}z^{-1}+\frac{17}{4}z^{-2}+\frac{3}{4}z^{-3}+z^{-4} \). Is this an IIR or FIR system? Why? Also realise \( H(z) \) using minimum number of multipliers.

   \[ \text{10} \]

16. a) For the analog transfer function, \( H(s) = \frac{2s}{s^2+0.2s+1} \), obtain \( H(z) \) using bilinear transformation (a) Assume \( T = 1 \) sec (b) \( T = 0.1 \) sec.

   \[ \text{12} \]

   b) Compare analog and digital filters.

   \[ \text{8} \]