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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2016
(2008 Scheme)
08.604 : DIGITAL SIGNAL PROCESSING (R)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Test whether the signals (i) $x(t) = e^{\sin t}$ and (ii) $x(t) = te^{\sin t}$ are periodic.

2. Sketch the signals (i) $x\left(4 - \frac{t}{2}\right)$ (ii) $u(3 - n)$.

3. Find DTFT of $x[n] = \{1, \underset{\uparrow}{2}, -3, 4, 1\}$.

4. State and prove time shifting property of Z-transform.

5. Find the step response of the system having impulse response $h[n] = 2^n u(n-1)$.

6. Obtain the circular convolution of sequences $x[n] = \{1, -1, -2\}$ and $h[n] = \{3, -2, 1\}$.

7. Explain any three benefits of DSP.

8. Compare IIR and FIR filters.

9. Explain the terms node, sink node and closed path associated with signal flow graph.

10. Realize the system function $H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$ using minimum number of multipliers. **(10×4=40 Marks)**

P.T.O.

PART – B

Answer **any one** question from **each** Module. **Each** question carries **20** marks.

Module – I

11. a) Derive the condition for stability of an LTI system in terms of impulse response. 6

    b) Given a causal system $y(n) - y(n-1) = x(n) + x(n-1)$. Find the response of the system for the inputs

    i) $x(n) = u(n)$ ii) $x(n) = 2^{-n}\, u(n)$. 8

    c) A system is represented by the difference equation $y(n) = y(n-1) - nx(n) + 5x(n-1) - 2x(n-2)$; $n \geq 0$. Check whether the system is linear, shift invariant and causal. 6

12. a) Check the linearity, causality and time invariance of systems

    i) $y(n) = nx(n)$ and ii) $y(n) = \sum_{k=n-2}^{n+2} x(k)$. 9

    b) Determine the impulse response of the system characterized by the difference equation $y(n) = 2.5\, y(n-1) - y(n-2) + x(n) - 5x(n-1) + 6x(n-2)$. 5

    c) Express impulse function in terms of step function and vice versa. Derive the steps. 6

Module – II

13. a) The first eight points of the 14 point DFI of a real valued sequences are $\{12, -1 + j3, 3 + j4, 1 - j5, -2 + j2, -2 - j3, 10, 11\}$. (i) Determine the remaining points. Derive the property used (ii) Evaluate the following functions of x[n] without computing the IDFT of X(k)

    1) $x(0)$ 2) $\sum_{n=0}^{13} x(n)$. 12

    b) Find all possible inverse Z-transform of the function $X(z) = \dfrac{(z + 0.3)}{(z + 0.2)(z + 0.5)}$. 8

14. a) Using Z-transform, determine the time domain response of the system

$y(n) = x(n) + \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2)$ when the input is $x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$. 10

b) Given $x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$. Obtain the linear convolution of the sequences using DFT. Verify the result. 10

Module – III

15. Realize the following digital filters in cascaded and parallel form using first order and second order sections :

a) $H(z) = \frac{z + 0.6}{(z - 0.8)(z + 0.8)(z^2 + 0.1z + 0.8)}$ 10

b) $H(z) = \frac{z^3 - z}{(z + 0.5)(z^2 + z + 0.5)}$. 10

16. a) Realize the following system with minimum multipliers

$H(z) = 1 + \frac{1}{2}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{2}z^{-3} + z^{-4}$. 7

b) Realize as a cascade of one second order and one third order section $H(z) = (1+0.8\ z^{-1})^5$. 7

c) What do you understand by canonical form of realization of transfer function ? Obtain the canonical realization of the transfer function

$H(z) = \frac{(1 + 0.2z^{-1})}{(1 - 0.5z^{-1} + 0.3z^{-2})(1 + 0.25z^{-1})}$. 6

(3×20=60 Marks)