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Roll No.....

MEVD-104

M.E./M.Tech. I Semester

Examination, June 2017

Digital Signal Processing

Time : Three Hours

Maximum Marks : 70

Note: Answer any five questions. All question carry equal marks. Assume suitable data if missing.

1. a) Prove that

   i) $\sin \omega n u(n) = \dfrac{z \sin \omega}{z^2 - 2z\cos\omega + 1}$

   ii) $-a^n u(-n) = \dfrac{a}{(z-a)}$

   b) Determine the convolution of the sequences

   $$x_1(n) = \left(\frac{1}{2}\right)^n u(n);\ x_2(n) = \left(\frac{1}{3}\right)^{n-2} u(n-2)$$

   Using convolution property of Z-transform.

2. a) Find the inverse Z-transform of the following

   $$X(z) = \frac{z(z-1)}{(z+1)^3(z+2)};\ ROC\,|z| > 2$$

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   b) Find all possible inverse Z-transform of the following function $X(z) = \dfrac{z(z^2 - 4z + 5)}{z^3 - 6z^2 + 11z - 6}$

3. a) Write a difference equation that characterizes a system whose frequency response is

   $$H(\omega) = \frac{1 - e^{-j\omega} - 3e^{-jz\omega}}{1 + \left(\frac{1}{3}\right)e^{-j\omega} + \frac{1}{6}e^{-jz\omega}}$$

   b) Find the frequency response of the following causal system

   $$y(n) - y(n-1) + \frac{3}{16}y(n-2) = x(n) - \frac{1}{2}x(n-1)$$

4. A causal LTI system is described by the difference equation

   $$y(n) - \alpha y(n-1) = bx(n) + x(n-1)$$

   Where 'a' is real and less than 1 in magnitude. Find a value of b ($b \neq a$) such that the frequency response of the system satisfies $|H(w)| = 1$ for all w (an all pass system, the magnitude of the frequency response is constant independent of frequency).

5. a) List differences between Fourier transform of a discrete time signal and analog signal.

   b) What is sufficient condition for existence of DTFT?

6. a) Compute the DFT of the 3-point sequence $x(n) = \{2, 1, 2\}$. Using the same sequence compute the 6-point DFT and compare the two DFTS.

   b) Find the IDFT of the following sequence $x(n) = \{1, 2, 1, 0\}$

7. Obtain H(z) and Ha(s) when T = 1 and $Ha(s) = \dfrac{3s}{s^2 + 0.5s + 2}$

   Using Bilinear transformation.

8. Write short notes on the following (any two)

   i) Parallel processing

   ii) Finite register length in FIR

   iii) VLSI and digital signal processing

   iv) Buttermorth approximation

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