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Roll No .....

MEVD - 104

M.E./M.Tech. I Semester

Examination, December 2014

Digital Signal Processing

Time : Three Hours

Maximum Marks : 70

Note : 1. Attempt any five questions out of the following.
2. Each questions carries equal marks.

1. a) Find the Impulse Response for the system given by

$$y(n)+4y(n-1)+4y(n-2)=x(n)$$

b) Verify whether the following Impulse responses describe Causal, stable or LTI systems. Give reasons for your answers.
i) $h(n) = e^{-0.6n}\,u(n)$ ii) $h(n) = u(n-2) - u(n+3)$

2. a) Write the properties of Z-transform. Also give the necessary proofs for them.
b) Determine the cross-correlation sequence $rx_1, x_2\,(l)$ of the sequences
$x_1(n) = (1, 2, 3, 4)$
$x_2\,(n) = (4, 3, 2, 1)$
Determine the Z-transform and its ROC of the sequence given by

$$x(n)=\begin{cases} 2^n & n<0 \\ \left(\frac{1}{2}\right)^n & n=0,2,4---- \\ \left(\frac{1}{3}\right)^n & n=1,3,5----- \end{cases}$$

3. Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ find $X(k)$ using DIT and DIF FFT algorithm.

4. The following transfer function characteristics FIR filter (M = 11). Determine the magnitude response and show that the phase and group delays are constant.

$$H(z)=\sum_{n=0}^{M-1} h(n)z^{-n}$$

5. A low pass filter is to be designed with the following desired frequency response

$$H_d\left(e^{j\omega}\right)=\begin{cases} e^{-j2\omega} & -\pi/4 \le \omega \le \pi/4 \\ 0 & \pi/4 < |\omega| \le \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$\omega(n)=\begin{cases} 1 & 0 \le n \le 4 \\ 0 & otherwise \end{cases}$$

6. a) Determine H(z) using the impulse Invariant technique for the analog system function

$$H(s)=\frac{1}{(s+0.5)\left(s^2+0.55+2\right)}$$

b) Convert the analog filter with system function $H(s)=\frac{s+0.1}{(s+0.1)^2+9}$ into digital IIR filter using bilinear transformation the digital filter should have a resonant frequency of $\omega_r = \pi/4$.

7. a) Explain signal design and ambiguity functions.
b) Expláin Airborne surveillance Radar for Air traffic control.

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