8. a) Using long division, determine the inverse z transform of $X(z) = \frac{1+2z^{-1}}{1-2z^{-1}+z^{-2}}$, if (a) x (n) is causal, (b) x (n) is anticausal. 14

OR

b) Determine stability region for the causal system $H(z)=\frac{1}{1-a_1z^{-1}+a_2z^{-2}}$ by computing its poles and restricting them to be inside the unit circle. 14

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Roll No .....

MEDC - 103

M.E./M.Tech., I Semester

Examination, June 2014

DSP Application

Time : Three Hours

Maximum Marks : 70

Note : 1. Attempt any five questions.
2. All questions carry equal marks.

1. a) Give the frequency response of the moving average system. 14

$$h[n]\begin{cases}\frac{1}{M1+M2+1}, -M1\le n\le M2,\\ 0, otherwise\end{cases}$$

Also draw its magnitude and phase spectrum.

OR

b) Find the frequency response $H(e^{jw})$ of linear time invariant system whose input and output satisfy the difference equation. 14

$Y[n] - 1/2y[n-1] = x[n] + 2x[n-1] + x[n-2]$

2. a) Consider the system 14

$$H(z)=\frac{1-2z^{-1}+2z^{-2}-z^{-3}}{(1-z^{-1})(1-.5z^{-1})(1-.2z^{-1})}\text{ ROC:}0.5|z|>1.$$

Sketch the poles and zeros of the system and determine the impulse response of the system.

OR

b) Determine the Z transform for $x(n) = \cos w_0 (n)\, u(-n)$ and $x(n) = \sin w_0 (n)\, u(-n)$. 14

3. a) Write a note on : 14

i) Filtering of long data sequences.

ii) Relationship between DCT and DFT

OR

b) Compute the 16 point DFT of the sequence $x(n) = \cos \frac{\pi}{2} n$ using radix-4 decimation in time algorithm. 14

4. a) Write a note on multirate signal processing. 14

OR

b) Write a note on power spectrum estimation with respect to discrete time random signals. 14

5. a) Design a discrete time low pass filter using the bilinear transformation on a continuous time ideal low pass filter. Assume that the continuous time prototype filter has cut off frequency $\Omega_c = 2\Pi\ (2000)$ rad/s and the bilinear transformation parameter T = 0.1 ms. What was the cut off frequency Ω_c for the prototype continuous time filter? 14

OR

b) Use Kaiser window method to design a discrete time filter with generalized linear phase that meets specification of the form : 14

$$0.95 \le \begin{array}{lllll} |H(e^{j\omega})| & \le 0.01 & , & 0 \le & |\omega| \le .25\pi \\ |H(e^{j\omega})| & \le 1.05 & , & 0.35\pi \le & |\omega| \le .6\pi \\ |H(e^{j\omega})| & \le 0.01 & , & 0.65\pi \le & |\omega| \le \pi \end{array}$$

i) Determine the minimum length (M + 1) of the impulse response and the value of the Kaiser window parameter β for a filter that meets the preceding specifications.

ii) What is the delay of the filter?

6. a) Write a note on finite register length in filter design. 14

OR

b) Write a note on discrete time random signals. 14

7. a) Determine the direct form II realization for the following LTI system. 14

i) $2y(n) + y(n-1)\, 4y(n-3) = x(n) + 3x(n-5)$

ii) $y(n) = x(n) - x(n-1) + 2x(n-2) - 3x(n-3)$

OR

b) Determine circular convolution as well as linear convolution for the sequences $x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4, 5\}$. 14