Total No. of Questions :5] *[Total No. of Printed Pages :2*

Roll No .....

MEDC-103

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

Examination, June 2016

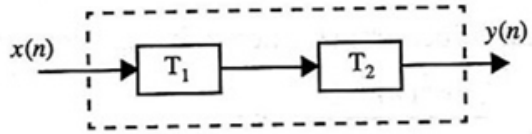
DSP Application

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt all questions.
ii) All questions carry equal marks.
iii) Attempt any two parts from each questions.

1. a) Two discrete - time systems T_1 and T_2 are connected in cascade to gorm a new system T as shown in figure. If T_1 and T_2 are LTI, test whether interchanging the orders of T_1 and T_2 does not change the system T.



$T = T_1 T_2$

b) The discrete - time system
$y(n) = ny(n-1) + x(n)\ n \geq 0$
is at rest [i.e. $y(-1) = 0$]. Check if the system is linear time invariant and BIBO stable.

c) Determine the zero - input response of the system described by the second - order difference equation.
$x(n) - 3y(n-1) - 4y(n-2) = 0$

2. a) Determine one-sided Z-transform of
$y(n) + 0.5y(n-1) - 0.25y(n-2) = 0$
given that $y(-1) = y(-2) = 1$

b) State and prove the following properties of Z-transform :
i) Time shifting ii) Differentiation

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c) Determine the inverse of Z-transform of causal

$$X(z) = \frac{4 - 8z^{-1} + 6z^{-2}}{\left(1 - 2z^{-1}\right)2\left(1 + z^{-1}\right)}$$

3. a) State and prove shifting property of DFT.

b) Find the convolution of the two signals

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

c) How do you linear filtering by FFT using save-add method.

4. a) Obtain the Direct form II
$y(n) = -0.1(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252\,x(n-2)$

b) Convert the analog filter $H(s) = \frac{0.5(s+4)}{(s+1)(s+2)}$ using impulse invariant transformation T = 0.31416s.

c) Write the characteristics features of Hanning window.

5. a) An ideal Hilbert transformer with impulse response

$$h[n] = \begin{cases} \dfrac{2\sin^2(\pi n/2)}{\pi n}, & n \neq 0, \\ 0, & n = 0, \end{cases}$$

has input xr[n] and output $x_i[n] = x_r[n] * h[n]$, where $x_r[n]$ is a discrete-time random signal. Find an expression for the cross-correlation sequence $\Phi_{x_r x_i}[m]$. Show that in this case $\Phi_{x_r x_i}[m]$ is an odd function of m.

b) Write short note on spectrum estimation.

c) Explain how power spectrum can be estimated from the AR model.

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