TE-Sem-V - OU-EXTC - SS 27/5/16

QP Code : 29292

(3 Hours) **[Total Marks : 100**

N.B. :- i) Question no. 1 is compulsory
ii) Solve any Four questions from remaining Q.2 to Q.7
iii) Marks shows on right hand side for each questions
iv) Any assumptions made should be clearly stated

Q.1 a) Determine whether the signal is periodic or not [20]

(i) $x(t) = 2\sin\frac{3\pi t}{4} + 6\sin\frac{3\pi t}{5}$

(ii) $x[n] = \frac{1}{14}\cos 3\pi n$

b) Determine the impulse response for the cascade of two LTI systems having impulse responses $h_1[n] = \left(\frac{1}{3}\right)^n u[n]$ and $h_2[n] = \left(\frac{1}{4}\right)^n u[n]$

c) State and discuss the properties of region of convergence for Z-transform

d) Determine whether the signal is energy signal or power signal

(i) $x(t) = 1.2\cos 7\Omega t$

(ii) $x[n] = \left(\frac{1}{4}\right)^n u[n]$

e) Determine whether y[n] = x[-n] is (i) Memory less (ii) Causal (iii) Linear (iv) Time invariant

Q. 2 a) Find the inverse Laplace transform of [10]

(i) $X(s) = \frac{2}{s(s+1)(s+2)}$

(ii) $X(s) = \frac{2}{(s+1)(s^2+s+1)}$

b) Using Z - Transform perform deconvolution of the impulse response h[n] = {1, 2, 1, -1} and response y[n] = {1, 4, 8, 8, 3, -2, -1} and to extract the input x[n]. [10]

Q.3 a) For a continuous time signal x (t) = 8cos 100πt. Find out [10]
i) Nyquist sampling rate

(ii) If fs = 800 H_Z, what is discrete time signal?

(iii)If fs = 200 H_Z, what is discrete time signal?

b) Realize Discrete Form I, Direct Form II, first order cascade and first order parallel structure if [10]

$$H(z) = \frac{8z^3-4z^2+11z^3}{\left(z-\frac{1}{4}\right)\left(z^2-z+\frac{1}{2}\right)}$$

Q. 4 a) The state space representation of a discrete time system is given by [10]

$A=\begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$; $B=\begin{bmatrix} 1 \\ 2 \end{bmatrix}$; $C=[1 \quad 3]$; $D=[3]$

Derive the transfer function of the system

b) State and prove convolution theorem for Z-Transform [5]

c) Derive the relation between Laplace transform and Fourier transform [5]

Q.5 a) Determine the response of the discrete time LTI system governed by the 10M difference equation $y[n] - 2y[n-1] - 3y[n-2] = x[n] + 4x[n-1]$ for the input $x[n] = 2^n u[n]$ with initial condition $y(-2) = 0, y(-1) = 5$ [10]

b) Find out the Fourier transform of the periodic signal $x(t) = \cos(2\pi ft)\, u(t)$ [10]

Q. 6 a) (i) Using Laplace transform determine the total response of the system described by the equation [10]

$$\frac{d^2y(t)}{dt^2} + \frac{5y(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

The initial conditions are $y(0)=0$ and $\frac{dy(t)}{dt} = 1$ for $t=0$. The input to the system is $x(t)=e^{2t}\, u(t)$

(ii) Also find the impulse response of the above system assuming initial condition as zero.

[TURN OVER

b) Find the Fourier transform of x(n) [10]

Where $x(n) = 1 \quad ; \quad |t| < T_1$

$= 0 \quad ; \quad T1 < |t| < T/2$

Q. 7 a) Draw the Direct Form structure of the FIR system described by the Transfer Function [10]

$$H(z) = 1 + \frac{1}{2} z^{-1} + \frac{3}{4} z^{-2} + \frac{1}{4} z^{-3} + \frac{1}{8} z^{-4} + \frac{1}{8} z^{-5}$$

b) Perform convolution of [10]

(i) 2u(t) with u(t)

(ii) $e^{3t} u(t)$ with $e^{-7t} u(t)$

(iii) t u(t) with $e^{-3t} u(t)$