Sem-V (Sem IV OTR) - EXTC 15/6/17

(02)

Q. P. Code : 586502

Maximum Marks : 100
Duration : 3 Hrs

N.B. : - i) Question No. 1 is **compulsory**.
ii) Answer any **four** questions out of remaining **six** questions.
iii) Figure to the **right** indicates **full marks**.
iv) **Illustrate** the answers with **sketches** wherever **required**.

Q.1. Solve **any four** 20M

a) Draw even and odd part of the following signals
i) $x(t) = 2\,r(t) - 2\,r(t-1) - 2\,u(t-3)$
ii) $x(t) = u(t) - r(t) + 2\,r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$

b) Explain whether the following signals are power signals or energy signals
i) $x(t) = 0.9e^{-3t}\,u(t)$
ii) $x(t) = A\sin t$

c) List the properties of Laplace transform.

d) Perform convolution of the following continuous time system using Laplace transform
$2u(t)$ with $u(t)$.

e) Find impulse response and plot $H(z) = \dfrac{2}{1+2Z^{-1}}$, $|z| < 2$

Q. 2

a) Find the even and odd components of 8M
i) $x(t) = \sin 2t + \cos t + \sin t \cdot \cos t$
ii) $x(t) = t^3 + 3t$

b) Convolute $x(n) = (1/3)^n\,u(n)$ with $h(n) = (1/2)^n$ using convolution sum formula and verify using Z transform 6M

c) Sketch the following signal : $x(t) = 2\,u(t) + 2\,u(t-2) - 2\,u(t-4) - 2\,u(t-6)$ 6M

Q.3.

a) Referring to the Figure 3 (a) as given below, sketch the following signal 9M
i) $x[4-n]$, ii) $x[2n+1]$, iii) $x[n].u[2-n]$

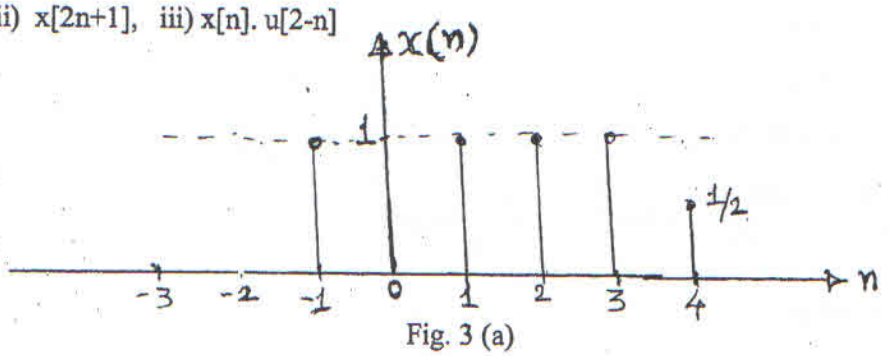

Fig. 3 (a)

TURN OVER

b) State and prove frequency shift property of Fourier transform 5M

c) List whether the following system is Dynamic, Causal, Linear, Time Invariant 6M

i) $y(t) = x(t^2)$

ii) $y(t) = x(t) \cdot \cos(100\pi t)$

Q.4.

a) Draw the Direct Form structure of the FIR system described by the transfer function 10M

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

b) What are the properties of ROC in Z-transform ? 4M

c) Obtain Direct Form-I, Direct Form-II realization of the LTI system governed by equation 6M

$$y(n) = x(n) + 0.5\,x(n-1) + 0.4\,x(n-2) - 0.6\,y(n-1) - 0.7\,y(n-2)$$

Q. 5.

a) A system has the following system function 10M

$$H(z) = \frac{1}{(z-0.25)(z-0.5)}$$

i) Find the impulse response of the system if the system is stable

ii) Find the step response of the system

b) Using Z transform solve the difference equation and find out impulse response of 5M

$$y[n] - 2\,y[n-1] + y[n-2] = x[n] + 3\,x[n-3]$$

c) Derive relationship between Z-transform and Fourier Transform 5M

Q. 6.

a) Consider a continuous time LTI system described by $\frac{dy(t)}{dt} + 2\,y(t) = x(t)$. Using Fourier transform find the o/p to each of the following input i) $x(t) = e^{-t}\,u(t)$, ii) $x(t) = u(t)$. 6M

b) Determine the state model of the system governed by equation 4M

$y(n) = -2\,y(n-1) + 2\,y(n-2) + 0.5\,y(n-3) + 2\,x(n) + 1.5\,x(n-1) + 2.5\,x(n-2) + 4\,x(n-3)$

c) Find the system output of a system having differential equation 10M

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + x(t)$$

With initial condition $y(0) = 2$; $\frac{dy(y)}{dt} = 1$; $x(t) = e^{-4t}\,u(t)$

TURN OVER

Q.7.

a) The State model of a discrete time system is given by 7M

$A=\begin{bmatrix}2 & 0\\ 3 & 1\end{bmatrix}$; $B=\begin{bmatrix}1\\ 2\end{bmatrix}$; $C=[1 \quad 3]$; $D=3$

Find the response of the discrete time system for the unit step input. Assume zero initial condition

b) Realize the given system in cascade and parallel form 7M

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

c) If the system matrix $A=\begin{bmatrix}-3 & 0\\ 0 & -2\end{bmatrix}$, Find the state transition matrix of discrete time System. 6M