TE ELX sem-V (CBSGS) Sub:- SS. Date-13/12/16.

QP Code : 591402

(3 Hours) **[Total Marks : 80**

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** out of remaining **five** questions.
(3) Assume suitable data wherever necessary.

1. (a) Justify the need of z-Transform for the analysis of DT system and Laplace Transform for the analysis of CT system in transform domain. **5**
(b) Show that the O/P of LTI system is linear convolution of input signal x(n) and impulse response h(n). **5**
(c) Find the autocorrelation of $x(n) = (0.2)^n u(n)$ and comment on the value of autocorrelation function at n = 0. **5**
(d) Derive the expression for power of a periodic signal using Parseval's theorem. Calculate the average power of the following signal x(t). **5**
$x(t) = \sin(3000 \pi t) + \cos(2000 \pi t)$

2. (a) Classify the following signals as periodic/Non periodic. If periodic then find period. **4**
(i) $x(t) = 12 \cos(3t) + 31 \sin(7t)$
(ii) $x(n) = 2.3 \sin(0.4 \pi n) + 4.5 \cos(0.3 \pi n)$

(b) Classify the following signals as energy signal/power signal/neither energy nor power signal **4**
(i) $x(t) = e^{-2t} u(t)$
(ii) $x(n) = n\, u(n)$

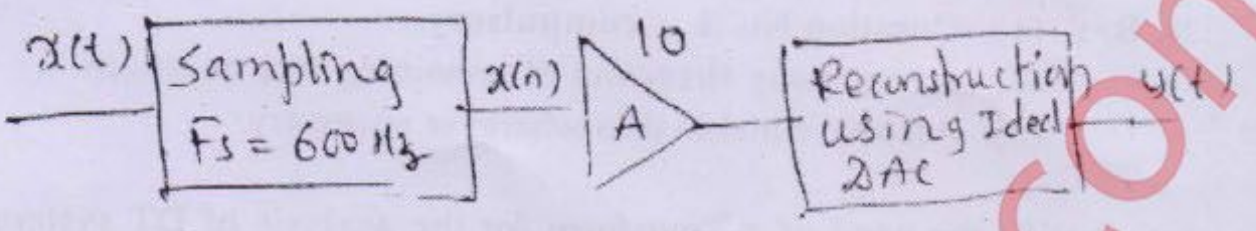
(c) Classify the following systems as linear/non-linear system, Time invariant/time variant system, Static/dynamic system **12**

(i) $y(t) = 4\, x(t) + 2 \frac{dx(t)}{dt}$

(ii) $y(n) = x(2n) + x(n-1) + 10$

3. (a) Given that $x_1(t) = e^{-at}$ $0 \le t \le T$
$x_2(t) = 1$ $0 \le t \le 2T$
Perform the convolution of $x_1(t)$ and $x_2(t)$ using Graphical method. **10**

(b) The signal $x(t) = 10 \sin(720 \pi t) + 40 \sin(480 \pi t)$ is sampled with sampling freqency Fs = 600 Hz and the sampled signal is upscaled by a factor of 10 as shown in figure below **10**



Find the reconstructed continuous Time signal y(t) using ideal interpolation technique of reconstruction.

4. (a) The Differential equation of system is given below

$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = \frac{d\,x(t)}{dt} + 2.x(t)$$

(i) Find impulse response of system. **5**

(ii) Find step response of system. **5**

(b) Determine the compiete response of the system described by the equation **10**

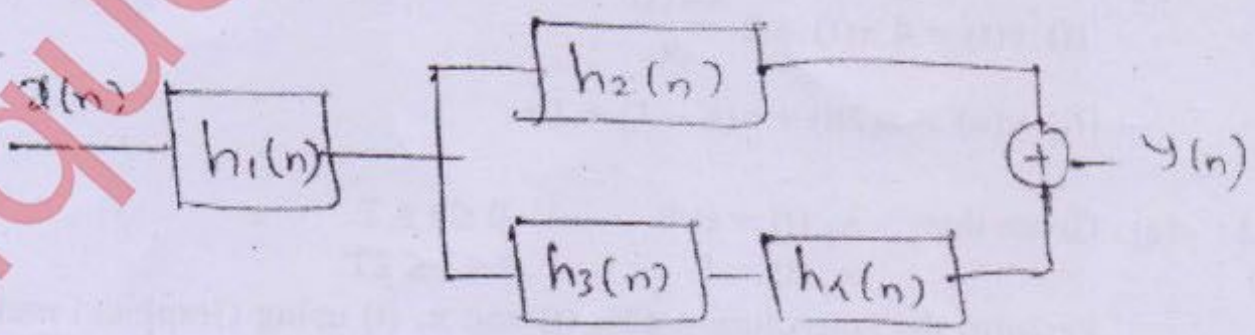
$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{d\,x(t)}{dt}$$

With initial conditions $y(0) = 0$

$$\left.\frac{dy(t)}{dt}\right|_{t=0} = 1$$

and input $x(t) = e^{-2t}\,u(t)$

5. (a) Consider a DT system as shown in figure below **10**



Given that $h_1(n) = \{1, 2, 4\}$
$\uparrow$

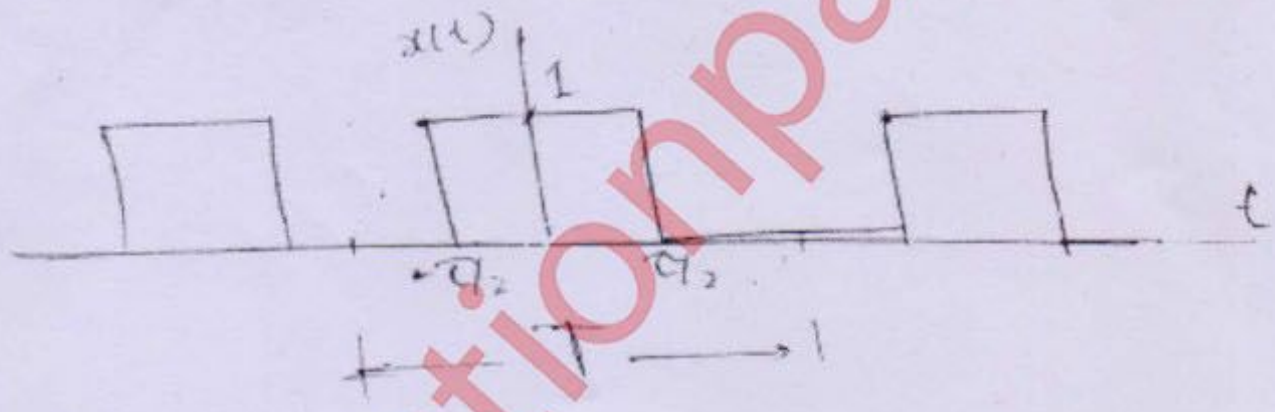
$h_2(n) = u(n) - u(n-3)$
$h_3(n) = \delta(n-1)$
$h_4(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-3)$
Find overall transfer function of system. 10

(b) A certain LTI system is given below

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Specify ROC and determine h(n) for the following cases :
Case 1 System is causal
Case 2 System is stable 10

6. (a) Determine the Fourier series representation of the periodic pulse function given below with period T = 1 sec and pulse width $\tau = 0.25$ sec. Plot magnitude spectrum.



10

(b) Find Fourier transform of the following signal using properties of Fourier Transform.