(3 Hrs) **Total Marks: 80**

NOTE: 1) Question number 1 is compulsory.
2) Attempt any three questions from the remaining five questions.
3) Assume suitable data wherever necessary.

Q.1 a) Prove the shifting property of Z transform. (5)

b) Distinguish between power and energy signals. Is x(t) = cos(wt) is energy or power signal? (5)

c) Check for the Dynamicity, Linearity, Time Variance, Causality and Stability $\mathbf{y(t) = e^{t\,x(t)}}$ (5)

d) Determine the Nyquist rate of the following signals $x(t) = \sin^2(200\pi\, t)$ (5)

Q.2 a) Determine the fundamental period of the following signals: (5)

(i) $x(t) = 2\cos\frac{2\pi}{3}t + 3\cos\frac{2\pi}{7}t$

(ii) $x(n) = \cos^2\{\frac{\pi}{4}n\}$

b) Find and sketch the even and odd components of the following: (5)

$x(t) = t, \quad 0 \le t \le 1$

$x(t) = 2 - t, \quad 1 \le t \le 2$

c) Obtain direct form I and II realization of a system described by (10)

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

Q.3 a) Obtain x(n) for all possible ROC conditions. Also plot the ROC comment on causality at the system. (10)

$$X(Z) = \frac{1 - 2Z^{-1}}{1 - \frac{7}{12}Z^{-1} + \frac{1}{12}Z^{-2}}$$

b) Perform the following convolution operation of two functions in time domain. $x_1(t) = u(t)$ $x_2(t) = e^{-t}\,u(t)$; $t \ge 0$ (10)

Q.4 a) A C.T LTI system is initially relaxed and is represented by the equation (10)

$y''(t) + 3\,y'(t) + 2\,y(t) = 2\,x(t)$

i) Determine Transfer function of the system.

ii) Determine impulse response of the system.

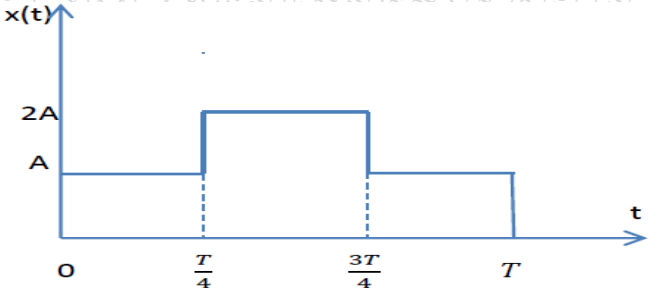
iii) Find the response of the system to an input $x(t) = 4\,e^{-3t}\,u(t)$

b) Find the response of the time invariant system with impulse response (10)

$h(n) = \{1,2,1,-1\}$ to an input signal $x(n) = \{1,2,3,1\}$

Q.5 a) Determine trigonometric form of the Fourier series of the ramp signal shown in figure. (10)

b) Obtain Fourier transform by using properties of Fourier transform only. (10)



Q.6 a) Prove Parseval's theorem of fouries series (05)

b) Determine Fourier transform of signum Signal. (05)

c) Obtain system function H(z) for (05)

$$\mathbf{y(n) + \frac{1}{2}y(n-1) = x(n) - x(n-1)}$$

Determine the poles and zeros and draw a pole zero plot.

d) Explain the causality and stability conditions for LTI systems. (05)

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