

(3 Hours)

Total Marks: 80

- N.B. : (1) Question No. 1 is compulsory.  
 (2) Solve any **Three** questions from question no. 2 to question no. 6.  
 (3) Assume suitable data if required.

1. Solve any **four** questions .

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(a) Write all the properties of the Fourier transform and derive differential, convolution property and frequency shift property.

(b) Prove that:

$$\int_{-\infty}^{\infty} x^2(t) dt = \int_{-\infty}^{\infty} x_e^2(t) dt + \int_{-\infty}^{\infty} x_o^2(t) dt$$

(c) If  $x_1(n)$  &  $x_2(n)$  are two periodic sequences given below, find the convolution between them.

$$X_1(n) = (1, -2, 0, 1) \quad \& \quad x_2(n) = (2, 1, 1, 0)$$

(d) Find initial & final value of

$$F(s) = \frac{0.8}{s(s^2 + 0.6s + 0.2)}$$

(e) Find the Fourier transform of Signum function.

2. (a)  $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 6y(t) = x(t)$

10 Find a)  $H(s)$  (b)  $h(t)$  and (c) step response of the system.

(b) A C.T. signal  $x(t)$  is given as follows:

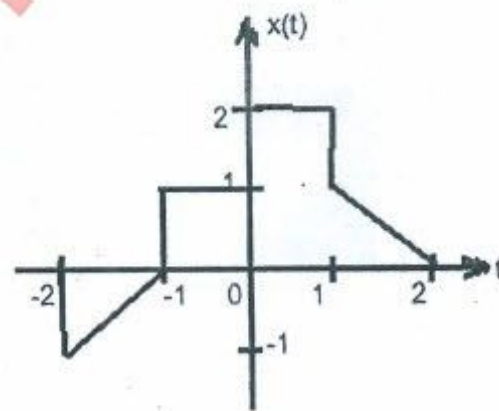
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Sketch the following for this signal

i)  $x(4 - t/2)$

ii)  $x(2t+1)$

iii)  $x(t) \cdot u(t)$



3. (a) Find out the system response without using Laplace transform if input  $x(t)$  & impulse response  $h(t)$  are as follows:

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$$x(t) = te^{-2t} u(t)$$

$$h(t) = u(t)$$

(b) Check whether following signals are power or energy or neither signals. Find energy and power of signals.

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i.  $X[n] = n \quad n \geq 0$

$$0 \quad n < 0$$

ii.  $X(t) = Ae^{-5t} u(t)$

**TURN OVER**

(c) Determine whether signals are periodic or not. Find out fundamental period. 4

i.  $X(t) = 2 \cos \left( \frac{9\pi t}{2} \right)$

ii.  $X[n] = \cos \frac{n\pi}{2} - \sin \frac{n\pi}{8} + 3 \cos \left[ \frac{n\pi}{4} + \frac{\pi}{3} \right]$

4. (a) Find Z.T. and R.O.C. of the following. 10

i.  $X[n] = (0.6)^n u[n] + 0.9^n u[n]$

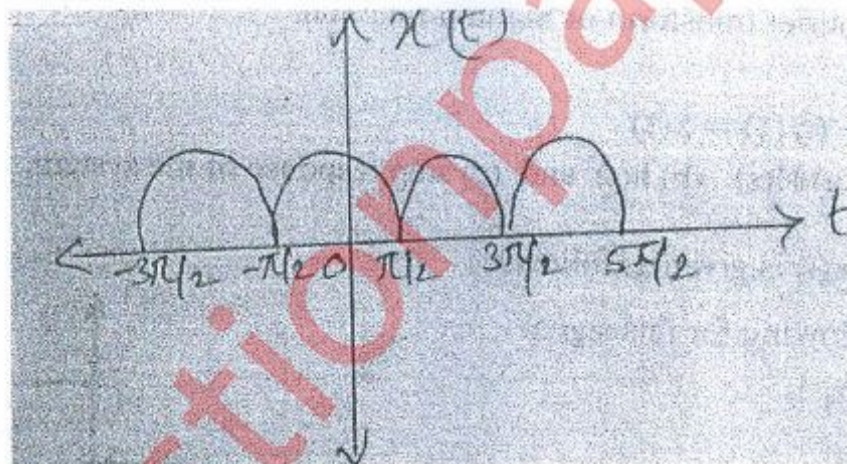
ii.  $X[n] = (2/3)^n u[n+2]$

(b) Determine whether following systems are static or dynamic, linear or non-linear, time variant or invariant, causal or non causal & stable or unstable. 10

i.  $y[n] = 2x(2^n)$

ii.  $\frac{dy(t)}{dt} + t y(t) = x(t)$

5. (a) Find exponential form of Fourier series of following signal 10



(b) Find inverse Laplace transform for all possible ROCS. 10

i.  $X(S) = \frac{5S-10}{9S^2-16}$

ii.  $X(s) = \frac{s+3}{s^3+3s^2+6s+4}$

6. (a) Find out impulse response of 10

$$H[z] = \frac{5z^2}{(z-0.1)(z-0.5)}$$

(b) Find odd and even part of given signal. 04

$$x(t) = (1+t^3) (\cos^3 10 t)$$

(c) State and prove Parseval's theorem. 06