

[Time: 3 Hours]

[Marks:75]

- N.B.: 1. Question No.1 is compulsory.
 2. Attempt any three from remaining five questions.
 3. Assume suitable data if any required.

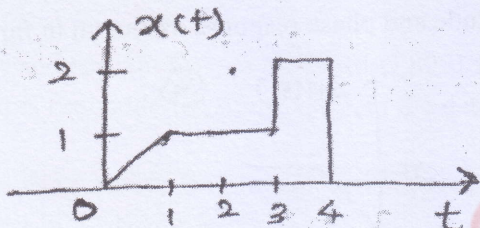
Q.1 Solve any four

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- State and prove the convolution property of Fourier transform.
- Determine initial and final value of $x(n)$ If $x(z) = \frac{z}{z^2 - \frac{3}{2}z + \frac{1}{2}} \quad |z| > \frac{1}{2}$
- State and prove the parsaval theorem.
- Explain Gibb's phenomenon.
- Sketch one sided and both sided magnitude and phase spectra
 $X(t) = 4 + 6 \sin\left(4\pi t - \frac{\pi}{3}\right) + 8 \cos\left(8\pi t - \frac{\pi}{4}\right)$

Q.2 a) Express the following signal in functional form.

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- Whether the following signal in energy or power. Also find its energy or power $x(n) = u(n)$
- Obtain the convolution of two continuous signal given below. Also sketch the result.

$$x(t) = 1 \quad \text{for } 0 \leq t \leq 1$$

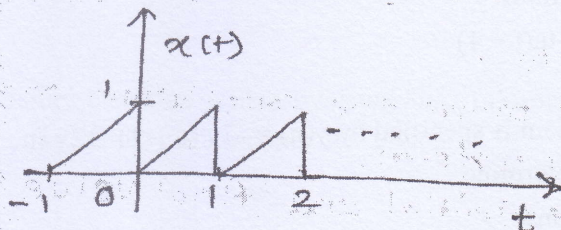
$$0 \quad \text{otherwise}$$

$$h(t) = 1 \quad \text{for } 0 \leq t \leq 1$$

$$-1 \quad \text{for } 1 \leq t \leq 2$$

Q.3 a) Find the exponential Fourier series coefficient of following signal.

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b) Given $\frac{d^2y(t)}{dt^2} + \frac{8dy(t)}{dt} + 15y(t) = 3x(t)$

determine

- i) Impulse response of system.
- ii) Response to the input $x(t) = 2e^{-3t}u(t)$

Q.4 a) Find the z-transform of $x(z)$ by using p. f. $x(z) = \frac{z}{z^2+z+1}$ 10

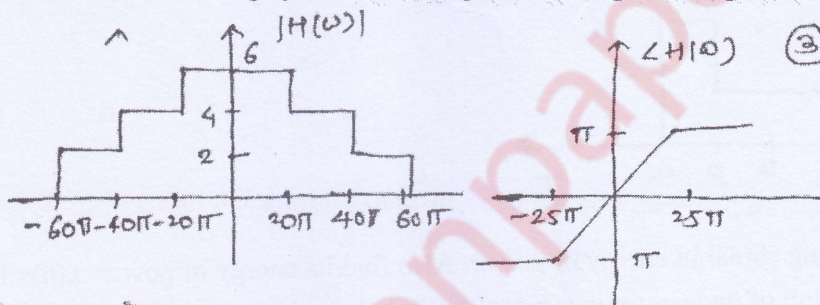
b) Find the following systems are linear / nonlinear, time variant / invariant, causal / noncausal, static or dynamic, stable or unstable. 10

$y(t) = t x(t)$

$y(n) = \cos wn x(n)$

Q.5 a) Find the inverse Laplace transform for all possible roc condition. $X(s) = \frac{s+3}{(s+1)(s+4)^3}$ 10

b) Consider the following system with magnetude and phase response as shown in figure. 05



Find the o/p for the input $x(t) = 4 \sin(307\pi t) + 6 \cos(50\pi t + \frac{\pi}{3})$

c) Find the fourier transform of signum function. 05

Q.6 Obtain 10

i) Z-transform of

$x(n) = n \left(\frac{1}{4}\right)^n u(n) + u(n-1)$

ii) Laplace transform of

$X(t) = te^{-4t}u(t) + tu(t+1)$

A discrete time LTI system is specified by $y(n) = -7y(n-1) - 12y(n-2) + 4x(n-1) - 2x(n)$ where $y(-1) = -2$ $y(-2) = 3$. Determine 10

- i. Zero input response
- ii. Zero state response where $x(n) = u(n)$
- iii. Total response.

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