

(3 Hours)

[Total Marks: 80]

N.B.:

1. Question No.1 is compulsory.
2. Attempt any three questions out of the remaining five.
3. Assume suitable data wherever necessary.

Q1 Answer the following

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- a) Determine discrete time Fourier series of $x(n) = \cos 2\left(\frac{\pi}{6}n\right)$
- b) Explain in brief Region of convergence (ROC) for Laplace transform.
- c) Test the causality of the following system.
 - 1) $y(t) = x(t) - x(t-1)$
 - 2) $y(t) = x(t) + 3x(t+4)$
- d) Sketch signal $e^{-6t}u(t)$ and determine power and energy of signal
- e) State and prove linearity property of Z-transform

Q2. a) Obtain bilateral inverse Laplace transform of the function:

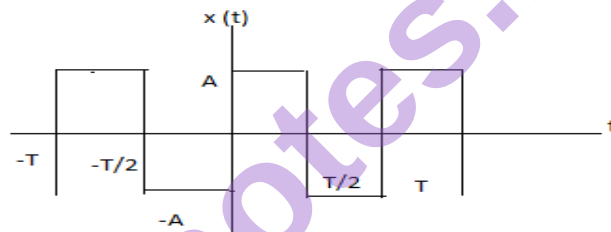
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$$X(s) = \frac{3s+7}{(s^2-2s-3)}$$

Find ROC of $\text{Re}(s) > 3$

b) Determine the Fourier series of the following signal:

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Q3. a) Compute the convolution $y(n) = x(n) * h(n)$ using tabulation method

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Where $x(n) = \{1, 1, 0, 1, 1\}$ and $h(n) = \{1, -2, -3, 4\}$

b) Determine the Fourier transform of following continuous time domain signal.

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$$i) \ x(t) = 1 - t^2 \quad ; \quad \text{for } |t| < 1 \\ = 0 \quad ; \quad \text{for } |t| > 1$$

Q4. a) A stable system has input $x(t)$ and output $y(t)$. Determine transfer function and Impulse response $h(t)$ by using Laplace transform.

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$$x(t) = e^{-2t}u(t) \quad ; \quad y(t) = -2e^{-t}u(t) + 2e^{-3t}u(t)$$

b) State and prove following properties of Fourier transform.

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- (i) Time shifting property
- (ii) Time Reversal Property

Q5. a) An LTI system is described by the equation:

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$y(n) = x(n) + 0.8x(n-1) + 0.8x(n-2) - 0.49y(n-2)$, determine the transfer function of the system and also sketch the poles and zeros on the z-plane.

- b) Obtain and sketch the impulse response of the shift invariant system described by $y(n] = 0.4 x(n) + x(n-1) + 0.6 x(n-2) + x(n-3) + 0.4 x(n-4)$ 10

- Q6. a) Using Z- transform, determine the response of the LTI system with impulse response, $h(n) = \{ 1, -1, 1 \}$, for an input $x(n) = \{-2, 3, 1\}$ 10

- b) Explain Gibbs Phenomenon 05
c) List the properties of ROC for Z- transform. 05

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