

3 Hours

Total marks: 80

- Question no. 1 is compulsory
- Attempt any Three questions from remaining

Q1. Answer any 4 questions from the given questions:

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- If system matrix $A = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix}$ find the state transition matrix.
- Find the fundamental frequency of the signal

$$x(t) = \cos\left(\frac{10\pi}{3}t\right) + \sin\left(\frac{5\pi}{4}t\right)$$
- Explain the application of Signals and System in Multimedia Processing.
- i. Express the signals shown in Fig 1 in terms of unit step function

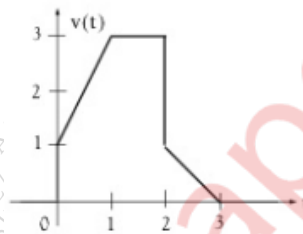


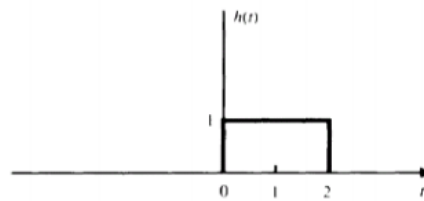
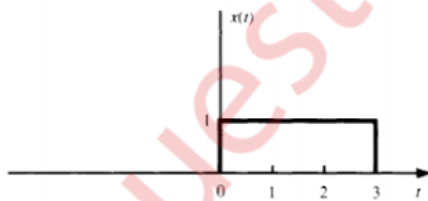
Fig. 1

- ii. Explain Energy and power of a signal.
- Test the given system for linearity, causality, stability, memory and time variant.

$$y(t) = x(t^2)$$
- Explain the application of Signals and System in Multimedia Processing.

Q2. Evaluate $y(t) = x(t) * h(t)$, where $x(t) = u(t) - u(t-3)$ and $h(t) = u(t) - u(t-2)$
 (a) by an analytical technique, and (b) by a graphical method.

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Q3.a. Determine the sequence $x[n]$ associated with Z-Transform using residue method.

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$$X(z) = \left\{ \frac{(1-e^{-a})z}{(z-1)(z-e^{-a})} \right\}$$

b. State and Prove Parseval's Theorem with respect to DTFT.

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Q4.a. Determine the state model of the system governed by the equation

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$$y[n] = -2y[n-1] + 3y[n-2] + 0.5y[n-3] + 2x[n] + 1.5x[n-1] + 2.5x[n-2] + 4x[n-3]$$

b. Find Fourier series for $f(x) = x^3(-\pi, \pi)$

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Q5.a Determine DTFS for the sequence $x(n) = \cos^2((\pi/8)n)$ 8

b. Find Laplace transform of $\frac{d}{dt} \sin(t) u(t)$. 8

c. Find Inverse Laplace transform using convolution 4

$$L^{-1} = \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$$

Q6. Write short note on any two: 20

a. Feedforward Control system

b. ROC in Z-Transform and Laplace Transform

c. Relation of ESD, PSD with auto-correlation