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: **20**

a. If system matrix A= [-3, 1 ; -2, 0] find the sate transition matrix.

b. Find the fundamental frequency of the signal
$$x(t) = \cos\left(\frac{10\pi}{3} t\right) + \sin\left(\frac{5\pi}{4} t\right)$$

c. Explain the application of Signals and System in Multimedia Processing.

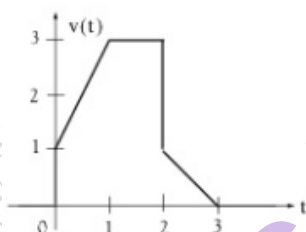d. i. Express the signals shown in Fig 1 in terms of unit step function

Fig. 1

ii. Explain Energy and power of a signal.

e. Test the given system for linearity, causality, stability, memory and time variant.
$$y(t) = x(t^2)$$

f. 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 $h(t) = u(t) - u(t-2)$ **20**
(a) by an analytical technique, and (b) by a graphical method.
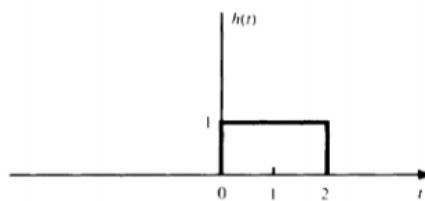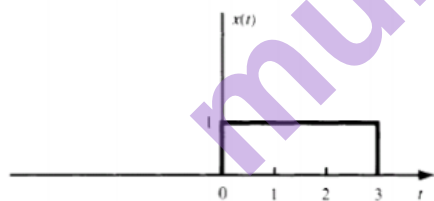
Q3.a. Determine the sequence x[n] associated with Z-Transform using residue method.   **10**
$$X(z) = \left\{ \frac{(1-e^{-a})z}{(z-1)(z-e^{-a})} \right\}$$

b. State and Prove *Parseval's* Theorem with respect to DTFT.   **10**

Q4.a. Determine the state model of the system governed by the equation   **10**
y[n]= -2y[n-1]+3y[n-2]+0.5y[n-3]+2x[n]+1.5x[n]+1.5x[n-1]+2.5x[n-2]+4x[n-3]

b. Find Fourier series for $f(x)=x^3(-\pi,\pi)$ **10**

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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**

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

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