**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. Find even and odd part of following continuous time signals
   i) $X(t) = 3 + 2t + 5t^2$. ii) $x_2(t) = \sin 2t + \cos t + \sin t \cos 2t$

b. Determine energy and power of the unit step signal

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

d. Construct the block diagram of discrete time systems whose input output relations are described by following difference equations

   i. $Y_1(n) = 0.5x(n) + 0.5x(n-1)$
   ii. $Y_2(n) = 0.25y_1(n-1) + 0.5x(n) + 0.75x(n-1)$

e. Test the given system for linearity, causality, stability, memory and time variant.

$$y(t) = x(t^2)$$

f. Give advantages of state space analysis for system analysis

Q2. Perform convolution of $x_1(t) = e^{-3t}u(t)$ and $x_2(t) = tu(t)$ using mathematical method and also by graphical method.   20

Q3.a. Determine the sequence x[n] associated with Z-Transform   10
$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

b. Find the impulse response h(n) of the system if the spectrum is given by   10
$H(e^{jw}) = \frac{1}{3}(1 + \cos w)$.

Q4.a. Explain the procedure to obtain transfer function of system from state model of the system.   10

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b. Find exponential Fourier series for x(t)   10
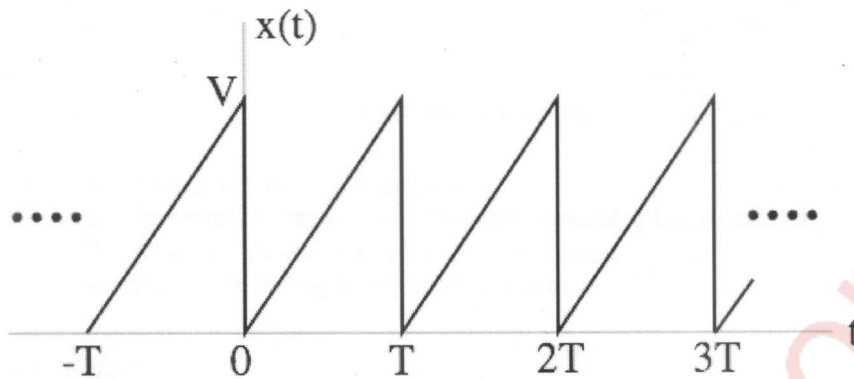
Q5.a Determine Fourier transform of gate function given by $x(t) = A$ for $|t| \leq \frac{\tau}{2}$ 8

b. Find Laplace transform of $x(t) = u(t) - u(t - a)$.   4

c. Find Initial and final value using Laplace transform   8
$$X(s) = \frac{7s + 6}{s(3s + 5)}$$

Q6. Write short note on **any two:**   20

a. Relation of ESD, PSD with auto-correlation

b. ROC in Z-Transform and Laplace Transform

c. Feedforward Control system

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