

IV B. TECH I SEMESTER REGULAR EXAMINATIONS, NOVEMBER - 2023
PRINCIPLES OF SIGNALS AND SYSTEMS
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3 hours

Max. Marks: 70

Note : Answer ONE question from each unit (5 × 14 = 70 Marks)

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UNIT-I

1. a) If  $x(t) = u(t) - u(t - 1)$ , plot  $y(t) = x(9t + 8)$ . [7M]  
 b) Find the even and odd parts of the signal  $x(t) = e^{-2t} \cos(3t)$ . [7M]

(OR)

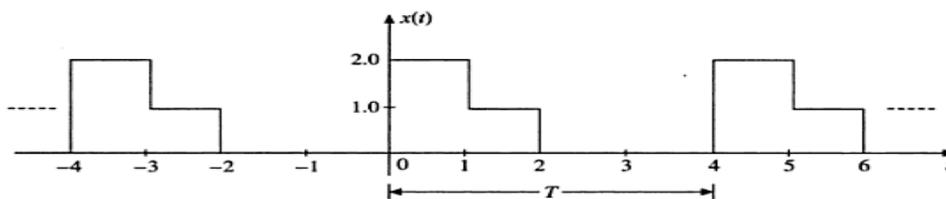
2. a) Check whether the following systems are Static, Causal, Time invariant, Linear, Stable: (i)  $y(t) = x(t - 3) + x(3 - t)$ , (ii)  $y(t) = x\left(\frac{t}{2}\right)$ . [7M]  
 b) Explain about Time scaling, Time shifting and Time reversal properties of signals with an example. [7M]

UNIT-II

3. a) Derive the relation between trigonometric Fourier series and exponential Fourier series. [7M]  
 b) Compute the Fourier Transform of [7M]  
 i)  $x(t) = \cos(\omega_0 t) e^{-at} u(t)$   
 ii)  $x(t) = e^{at} u(t)$

(OR)

4. a) Find the Exponential Fourier series expansion of the signal shown below [7M]



- b) State and prove the following properties of Fourier Transform. [7M]  
 (i) Time Shifting (ii) Frequency Differentiation.

UNIT-III

5. a) State and prove sampling theorem for band-limited signals [7M]  
 b) Determine the Nyquist rate for the given continuous time signal: [7M]  
 $x(t) = 6 \cos(50\pi t) + 20 \sin(300\pi t) + 10 \cos(100\pi t)$ .

(OR)

6. a) What is meant by convolution? Find the convolution of following signals by graphical method [7M]

$$x(t) = u(t + 3) \text{ and } h(t) = e^{-3t}u(t)$$

- b) Derive the conditions for distortion less transmission of a signal through a system [7M]

UNIT-IV

7. a) A causal LTI system is described by [7M]

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t). \text{ Find } H(S) \text{ and } y(t) \text{ for } x(t) = 2u(t).$$

- b) Briefly explain the Constraints on ROC for various classes of continuous time signals of Laplace Transform. [7M]

(OR)

8. a) Find the Laplace transform of the signal using properties of Laplace transform  $x(t) = \frac{e^{at} - \cos(3t)}{t}$ . [7M]

- b) Obtain the relation between Laplace transform and Fourier transform. [7M]

UNIT-V

9. a) State and prove the following properties using Z transform [7M]

- i) Differentiation in Z domain  
ii) Convolution of two sequences

- b) Obtain the Z-transform of  $x(n)$  given by [7M]  
(i)  $x(n) = a^n u(n)$  (ii)  $x(n) = -a^n u(-n - 1)$

(OR)

10. a) Check whether the corresponding linear time invariant system characterized by the system function [7M]

$$H(z) = \frac{-1 - 0.4z^{-1}}{1 - 2.8z^{-1} + 1.6z^{-2}} \text{ is stable and causal, if the ROC is}$$

- (i)  $|z| > 2$ , (ii)  $|z| < 0.8$ , (iii)  $0.8 < |z| < 2$ .

- b) Use contour integration to determine the sequence  $x(n)$  whose [7M]

$$z\text{-transform is given by } X(z) = \frac{1 - \frac{1}{4}z^{-1}}{1 - \frac{1}{6}z^{-1} - \frac{1}{6}z^{-2}}, |z| > \frac{1}{2}$$

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