

Reg. No.

Question Paper Code

12493

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023**

Third Semester

**Electronics and Communication Engineering**

(Common to Computer and Communication Engineering)

**20ECPC303 - SIGNALS AND SYSTEMS**

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

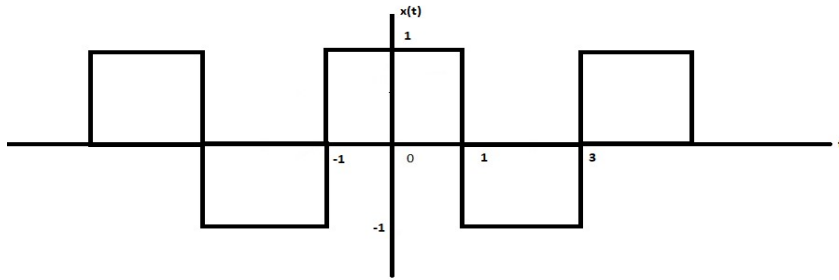
- |  | <i>Marks,<br/>K-Level, CO</i> |
|--|-------------------------------|
| 1. Find the energy and power of a unit step signal.                                      | <i>2,K2,CO1</i>               |
| 2. Draw the signal $u(t - 2) - u(t - 5)$ .   | <i>2,K2,CO1</i>               |
| 3. What are Dirichlet's conditions for existence of Fourier Series?                      | <i>2,K2,CO2</i>               |
| 4. Write the equations for trigonometric Fourier series and its Co-efficients.           | <i>2,K1,CO2</i>               |
| 5. State the initial and final value theorems of Laplace Transform.                      | <i>2,K1,CO3</i>               |
| 6. Find the Laplace transform of $x(t) = e^{-5t}u(t) + e^{-3t}u(t)$ and specify its ROC. | <i>2,K2,CO3</i>               |
| 7. Find the poles and zeros for $H(s) = \frac{s(s+5)}{(s+2)(s+3)(s+4)}$ .                | <i>2,K2,CO4</i>               |
| 8. What are the Properties of Convolution?   | <i>2,K1,CO4</i>               |
| 9. State sampling theorem.   | <i>2,K1,CO5</i>               |
| 10. What is meant by ROC in Z transform?   | <i>2,K1,CO5</i>               |

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

- |   |                  |
|---|------------------|
| 11. a) (i) Identify whether the following systems are linear or not.  | <i>7,K2,CO1</i>  |
| (a) $y(t) = e^{x(t)}$   |                  |
| (b) $y(t) = t^2x(t)$  |                  |
| (ii) Examine whether the following systems are time invariant or not. | <i>6,K2,CO1</i>  |
| (a) $y(n) = x(-n)$  |                  |
| (b) $y(n) = x(n+1) + x(n) + x(n-1)$                                   |                  |
| <b>OR</b>   |                  |
| b) Draw the waveforms represented by the following step function.     | <i>13,K2,CO1</i> |
| $x_1(t) = 2u(t-1)$ ;  |                  |
| $x_2(t) = 2u(t-2)$ ;  |                  |
| $y_1(t) = x_1(t) + x_2(t)$ ;  |                  |
| $y_2(t) = x_1(t) - x_2(t)$ ;  |                  |

12. a) Calculate the trigonometric Fourier Series for the periodic signal *13,K2,CO2* shown in figure.



**OR**

- b) State and prove the properties of Continuous Time Fourier Series. *13,K2,CO2*
13. a) (i) Find the Fourier transform of signal  $x(t) = e^{-a|t|}$  *6,K2,CO3*  
(ii) State and prove the properties of time shifting and convolution in Fourier Transform. *7,K2,CO3*

**OR**

- b) Find the inverse Laplace transform of  $X(s) = \frac{4}{(s+2)(s+4)}$  if the *13,K2,CO3*  
ROC is  
(a)  $-2 > \text{Re}\{s\} > -4$   
(b)  $\text{Re}\{s\} < -4$
14. a) The impulse response of an LTI system is  $h(t) = 2e^{-3t}u(t)$ . Find the *13,K3,CO4*  
response of the system for the input  $x(t) = 2e^{-5t}u(t)$  using Fourier Transform.

**OR**

- b) The input-output of a causal LTI system are related by the differential *13,K3,CO4*  
equation  $\frac{d^2}{dt^2}y(t) + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$ .  
(i) Find the impulse response  $h(t)$ .  
(ii) Find the response  $y(t)$  of this system if  $x(t) = u(t)$ .  
Hint: Use Fourier transforms.

15. a) Find the inverse z-transform of  $X(z) = \frac{z^{-1}}{1 - 0.25z^{-1} - 0.375z^{-2}}$ . *13,K2,CO5*  
For (i) ROC  $|z| > 0.75$  and (ii) ROC  $|z| < 0.5$

**OR**

- b) (i) State and prove sampling theorem for a band limited signal. *6,K2,CO5*  
(ii) Given signal  $x(t) = 5 \cos(2000\pi t) + 10 \cos(1000\pi t) + 20 \cos(10000\pi t)$  *7,K2,CO5*  
Determine (a) Minimum sampling rate to avoid aliasing  
(b) Discrete time signal if sampling rate  $f_s = 16$  kHz  
(c) Discrete time signal if sampling rate  $f_s = 8$  kHz.

**PART - C (1 × 15 = 15 Marks)**

16. a) Find the transposed structure for the system given by difference equation *15, K3, CO6*

$$y(n) = (1/2)y(n-1) - (1/4)y(n-2) + x(n) + x(n-1).$$

**OR**

- b) Rephrase the following system using direct form – I and direct form –II *15, K3, CO6*

$$y(n) = a_1 y(n-1) + x(n) + b_1 x(n-1).$$