



**KINGS**

COLLEGE OF ENGINEERING



**DEPARTMENT OF INFORMATION TECHNOLOGY**

**Subject Code :EC1205**

**Subject Name:Signals and Systems**

**Year/Sem:II/III**

**UNIT-I**

**PART-A(2 MARKS)**

1. Difference between the Energy and power signals.
2. Determine whether each of the following sequences are periodic (or) not, if so find their Fundamental period.
  - (i)  $X(n) = \cos(0.1n)$  (ii)  $X(n) = \sin(n/8)$  (iii)  $X(t) = 2\cos 100\pi t + 5\sin 10\pi t$
  - (iv)  $X(t) = 2\cos t + 3\cos t/3$ .
3. Define Random and deterministic signal.
4.  If  $X(n) = \{ 0, 2, -1, 0, 2, 1, 1, 0, -1 \}$ , Find  $X(n-3)$ ,  $X(-n)$ ,  $X(n+2)$ ,  $X(n+3)$ .
 

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5. Give the dirichlet conditions for existence of Fourier series of a function  $f(t)$ .
6. Check whether the signal Even (or) odd (i)  $X(t) = \sin 3t$ , (ii)  $X(t) = \cos \pi t$  (ii)  $X(t) = t \sin \pi/2t$ .
7. Short notes on signals & system.
8. Short notes on CT signals and DT signals.
9. Classification of signals.
10. Classification of Elementary signals.
11. Write Basic equation of the power & Energy signal along with for CT & DT.
12. What is mean by transformation of independent variable with example?
13. Explain periodicity properties of discrete time complex exponential signal.
14. Basic equation of Fourier series representation of CT & DT signals.
15. Define periodic & non periodic and Even and odd signals.
16. Define Energy & power signal.

17. State time shifting property for continuous time periodic signals.
18. State Parseval's theorem for continuous time periodic signals.
19. Write down the sine form, trigonometric form, triangular, Rectangular (or) square wave form of the Fourier series Representation of a periodic signal.
20. Define unit step, unit ramp, unit impulse & exponential signals.

**PART-B(16 MARKS)**

1. Define and Explain about the properties of continuous time Fourier series
- 2(a). Determine the Fourier series coefficient of exponential representation of
$$x(t) = \begin{cases} 1, & -T_1 < t < T_1 \\ 0, & T_1 < t < T_1/2 \end{cases} \quad (8)$$
  - (b). Explain the classification of signal with examples. (8)
- 3(a). Find the cosine Fourier series of an half wave rectified sine function (8)
  - (b). Find the Fourier series coefficient of the given signal
$$X(t) = 1 + \sin 2\omega t + \cos(3\omega t = \pi/3) \quad (8)$$
4. Explain & Derive the discrete time Fourier series along with properties
- 5(a). Find the Fourier series coefficient of the given signal
$$X(t) = 1 + \sin 2\omega t + \cos(3\omega t = \pi/3) \quad (8)$$
  - (b). Determine the Fourier series representation of the signal  $X(t) = t^2$  for all values of 't' which exists in the interval (-1,1). (8)
6. Find which of the following signals are energy (or) power signals
  - (i)  $X(t) = e^{-3t} u(t)$  (4)
  - (ii)  $X(t) = e^{-j(2t + \pi/4)}$  (4)
  - (iii)  $X(n) = \cos(\pi/4 n)$  (4)
  - (iv).  $X(n) = |\sin \pi n|$  (4)
7. Give the Examples & equations of all Elementary signals with sketch for CT & DT.

**UNIT-I I**  
**PART-A(2 MARKS)**

1. Define Fourier transform pair.

2. Write short notes on dirichlet conditions for fourier transform.
3. Explain how periodic & A periodic signal can be represented by Fourier transform.
4. State convolution property in relation to Fourier transforms.
5. State parseval's relation for continuous time Fourier transforms.
6. Find the Fourier transform of (i)  $\delta(t-2)$  (ii)  $\delta(t)$ .
7. State convolution property for Fourier transforms.
8. State parseval's property for Fourier transforms.
9. Differentiation & Integration property for Fourier transform.
10. Define continuous time system.
11. What is the important of laplace transform.
12. Give laplace transform pair & Explain.
13. Give the Relation b/w Laplace transform & Fourier transform.
14. What are the type of laplace transform & Explain?
15. What is pole zero plots.
16. State initial value theorem & final value theorem for L.T.
17. State convolution property of laplace transforms.
18. Define linearity & non linearity with example.
19. Give classification (or) properties of continuous time system.
20. Define causal & noncausal with example.
21. Define time invariant & time variant of the system.
22. Define stable & inverse of the system.
23. Define Roc of the system.
24. Define invertible of the system.
25. Define memory & memory less system.
26. What is superposition property?
27. Find the Fourier transform of  $X(t) = \cos(\Omega_0 t)$ .
28. Basic equation of convolution integral.
29. Condition for stability, causality & step response of LTI, system.
30. Properties of convolution of LTI system.
31. Define the transfer function from differential equation.

32. Give short notes on network Analysis using laplace transform.

**PART-B(16 MARKS)**

1. Explain all properties of Fourier transform.
- 2.(a).Explain Rayleigh energy theorem. (8)  
(b).Explain periodic signal contribution of Fourier transform. (8)
3. Explain all properties (or) classification of system.
- 4(a). Explain periodic signal contribution of Fourier transform. (8)  
(b).Derive the Relationship b/w laplace transform & Fourier transform and periodic signals of laplace transform. (8)
- 5.Find the fourier transform given signal
  - a). Square (4)
  - b).Triangular (4)
  - c). $e^{at}$  (4)
  - d).  $te^{-at}$ . (4)
- 6.Explain all properties of laplace transform.
- 7.,Find the laplace transform of
  - a)  $t^3 e^{2t}$  (4)
  - b)  $\sinh 3t$  (4)
  - c)  $e^{-4t} \cosh 4t$ . (4)
  - d)  $e^{-t} \sin 5t$ . (4)
- 8.(a) Derive the Relationship b/w laplace transform & Fourier transform and periodic signals of laplace transform. (8)  
(b).Find laplace transform of  $\delta(t) - e^{3t} \sinh 3t + e^{-3t} \cos t + t^2 \cosh 2t$ . (8)
- 9.(a) Find the inverse laplace transform of  $\frac{s^2 + 4s + 4}{(s + 1)(s + 2)}$  (8)  
(b) Find the inverse laplace transform of  $\frac{s + 1}{(s + 1)(s + 2)^2}$  (8)
10. Check Linearity, Time in variant, causal, stable, memory of the given system

(a)  $5x + \cos t$

(b)  $t^2 x^2(t)$

(c)  $2x(t+1)$

11. Find convolution of the signal  $h(t) = u(t)$ ,  $x(t) = e$ .

### UNIT-III

#### PART-A(2 MARKS)

1. What is the relation b/w Z – transform and Fourier transform of discrete time signal?
2. What is the Z – transform of  $a^n u(n)$ .
3. Define region of convergence with respect to Z – transform.
4. State initial & final value of Z – transform.
5. What is the difference b/w the spectrum of the CT signal and spectrum of the sampled signal?
6. Define one sided and two sided Z – transform.
7. What is meant by aliasing? How it can be avoided.
8. Find the Z transform of the given sequence.  $X(n) \{1, 0 < n < 10$   
 $0, \text{ otherwise}\}$
9. State any 4 properties of Roc for Z – transform.
10. Find the Z – transform for  $X(n) = a^{n-1} u(n-1)$ .
11. State sampling theorem.
12. Give properties of Z – Transform.
13. In what ways inverse Z – Transform can be obtained?

#### PART-B(16 MARKS)

- 1.(a) Find the inverse Z – transform of  $X(z) = \frac{z+4}{z^2 - 4z + 3}$  (8)  
(b) Find the Z – transform of  $x(n) = a^n \sin \omega n u(n)$  (8)
- 2.(a) Find the inverse Z – transform of  $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$  (8)  
(b) Write 5 properties of Z – transform and explain. (8)

- 3.(a) Find the Z- transform of sequence  $x(n) = (1/2)^n u(n) - (1/4) u(n-1)$  (8)  
 (b) Obtain the relation b/w Z – transform & DTFT. (8)
- 4.(a) Find the final value of the given signal  $W(Z) = \frac{1}{1 + 2z^{-1} - 3z^{-2}}$  (8)  
 (b). Find the Z – transform of  $\cos(\omega n)$  (8)
5. Find Z- transform of  $x(n) = (2/3)^n u(n) + (-1/2)^n u(n)$  & plot the Roc and pole – zero of  $X(Z)$ .
6.  $x(t) = \cos 2000\pi t + 10\sin 10000\pi t + 20\cos 5000\pi t$   
 (a) find Niquist.  
 (b) find Niquist interval  
 (c) if sampling rate is 5000 samples per second find DT signal after sampling.

**UNIT-IV**  
**PART-A(2 MARKS)**

1. In the o/p sequence of an LTI system finite (or) infinite when the j/p  $x(n)$  is finite? Justify
2. Define DTFT pair.
3. Define stability & Linearity of DT system
4. Define time variant & invariant of DT system
5. Define causal & non causal of DT system
6. What are the 4 steps to obtain convolution
7. State periodicity of DTFT.
8. Define FIR.
9. Define IIR.
10. Difference between FIR and IIR.

**PART-B(16 MARKS)**

1. (a) What is linear convolution of the two signal  $\{2,3,4\}$  &  $\{1,-2,1\}$ . Using Graphical method. (8)  
 (b) Find the linear convolution of  $x(n) = \{1,2,3,4,5,6\}$  with  $h(n) = \{2,-4,+6,-8\}$   

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using tabulation method. (8)

2.(a).Verify whether the system is linear time invariant & Causal

$$y(n) = x(n) + nx(n-1) \quad (8)$$

(b).Find the linear convolution of  $x(n) = \{1,1,0,1,1\}$  with  $h(n) = \{1,-2,-3,-4\}$  using tabulation & Multiplication method. (8)

3. Find the linear convolution of  $x(n) = \{1,1,1,1\}$  with  $h(n) = \{2,2\}$  using graphical, Tabulation & multiplication method.

4. Determine the convolution of the signals  $x(n) = \cos(\pi n) u(n)$  and  $h(n) = (1/2)^n u(n)$

## UNIT-V

### PART-A(2 MARKS)

1. Give the general difference equation relating input & output of a system.
2. Write the difference equation & the transfer function of the system for given figure.
3. Relation between IIR & FIR systems.
4. Why direct form –II structure is called as canonic structure?
5. Give direct form I structure of  $Y(n) = 2x(n-1) -x(n) + 2x(n-1)$
6. Draw the general block diagrams of the parallel & Cascade structures.
7. Differentiate natural response and recursive system.
8. Differentiate recursive and non recursive system.
9. Differentiate D-I & D-II Structures.
10. Define transposed structure.

### PART-B(16 MARKS)

1. Draw D-I & D-II structure of  $y(n) -3/4 y(n-1) + 1/8 y(n-2) + x(n) + 1/2 x(n-1)$
2. obtain the direct form-I, direct-II cascade and parallel form realization for the following system  

$$y(n) = 0.75 y(n-1) - 0.125 y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$$
3. Determine

(a) D-I form(8)

(b) D-II form (8)

4. Obtain D-I , D-II , cascade & parallel form of

$$Y(n) = 0.75y(n-1) - 0.125 y(n-2) + 6x(n) + 7x(n-1) + x(n-2).$$

5. The transfer function of a discrete causal system is given as follows:

$$H(z) = \frac{1-z^{-1}}{1-0.2z^{-1}-0.15z^{-2}}$$

(a) Find the difference equation.(8)

(b) Draw cascade and parallel realization.(8)

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