SHRI ANGALAMMAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An ISO 9001:2008 Certified Institution)

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FS 81504

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

EC1202 SIGNALS AND SYSTEMS

UNIT I

CLASSIFICATION OF SIGNALS AND SYSTEMS

PART-A (2 Marks)

1. Define a Signal.
2. Define a System.
3. Define CT signals with examples. 4.
Define DT signal with examples.
5. Define unit step, ramp and delta functions for CT.
6. State the relation between step, ramp and delta functions(CT). 7.
State the classification of CT signals.
8. Define deterministic and random signals. 9.
Define power and energy signals.
10. Compare power and energy signals. 11.
Define odd and even signal.
12. Define periodic and Aperiodic signals.
13. State the classification or characteristics of CT and DT systems. 14.
Define linear and non-linear systems.
15. Define Causal and non-Causal systems.
16. Define time invariant and time varying systems.
17. Define stable and unstable systems.

18. Define Static and Dynamic system.

PART B (16 Marks)

1.a. Discuss the classification of DT and CT signals with examples. (8)

b. Discuss the classification of DT and CT systems with examples. (8)

2. Find whether the following signals are periodic or not

i. $x(t)=2\cos(10t+1)-\sin(4t-1)$ (8)

ii. $x(t)=3\cos 4t+2\sin t$ (8)

3.Check whether the following system , $y(n)=\text{sgn}[x(n)]$, is

i. Static or dynamic (4) ii. Linear or non-linear(4)

iii. Causal or non-causal (4) iv. Time invariant or variant (4)

4.a.For the systems represented by the following functions. Determine whether every system is (1) stable (2) Causal (3) linear (4) Shift invariant

(i) $T[x(n)]= e^{x(n)}$ (8)

(ii) $T[x(n)]=ax(n)+6$

b. Determine whether the following systems are static or Dynamic, Linear or Non-linear, Shift variant or Invariant, Causal or Non-causal, Stable or unstable. (8)

(i) $y(t) = x(t+10) + x^2(t)$

(ii) $dy(t)/dt + 10\, y(t) = x(t)$

5..Explain about the classifications of continuous time system. (16)

6.a.The input and output of a causal LTI system are related by the differential equation, $d^2y(t)/dt^2+6dy(t)/dt+8y(t)=2x(t)$ (8)

i) Find the impulse response of the system.

ii) What is the response of this system if $x(t) = t\, e^{-2t}\, u(t)$

b. Explain the Classification of signals with examples. (8)

UNIT II

ANALYSIS OF CT SIGNALS

PART-A (2 Marks)

1.Define CT signal

2. Compare double sided and single sided spectrums. 3.

Define Trigonometric Fourier Series.

4. Define polar Fourier series.

5. Define exponential Fourier series. 6.

State Dirichlets conditions.

7. State Parseval's power theorem. 8.

Define Fourier Transform.

9. State the conditions for the existence of Fourier series.

10. Find the Fourier transform of function x(t)=d(t) 11.

Define Laplace transform.

12. Obtain the Laplace transform of ramp function.

13. What are the methods for evaluating inverse Laplace transform. 14.

State final value theorem.

15. State the convolution property of Fourier transform.

16. What is the relationship between Fourier transform and Laplace transform.

17. Find out the Laplace transform of $f(t)=e^{at}$

PART- B

1. State and prove properties of Fourier transform. 2. a. (16)

State the properties of Fourier Series. (8)

b. Use the Fourier series analysis equation to calculate the coefficients a_k for the continuous-time periodic signal (8)

$$x(t) = \begin{cases} 1.5, & 0 \le t < 1; \\ -1.5, & 1 \le t < 2 \end{cases}$$

with fundamental frequency $\omega_0 = \pi$.

3. a.State and prove Parseval's power theorem and Rayleigh's energy theorem. (8)

b. Find the cosine Fourier series of an half wave rectified sine function. (8)

4. A system is described by the differential equation, (16)

$d^2y(t)/dt^2+3dy(t)/dt+2y(t)= dx(t)/dt$ if $y(0) =2; dy(0)/dt = 1$ and $x(t)=e^{-t}u(t)$

Determine the response of the system to a unit step input

applied at t=0.

5. Find the Fourier transform of triangular pulse (16)

$$x(t) = (t/m) = \begin{cases} 1-2|t|/m & |t|<m \\ 0 & \text{otherwise} \end{cases}$$

6. Determine the Fourier series coefficient of exponential representation of x(t)

$x(t) = 1, |t| < T_1$

$0, T_1 < |t| < T/2$

UNIT III

LTI- CT SYSTEMS

PART-A (2 Marks)

1. Define LTI-CT systems.
2. What are the tools used for analysis of LTI-CT systems?
3. Define convolution integral.
4. List the properties of convolution integral.
5. State commutative property of convolution.
6. State the associative property of convolution.
7. State distributive property of convolution.
8. When the LTI-CT system is said to be dynamic?
9. When the LTI-CT system is said to be causal? 10. When the LTI-CT system is said to be stable? 11. Define natural and forced response. 12. Define complete response.
13. Mention the advantages of direct form II structure over direct form I structure. 14. Define Eigen function and Eigen value.
15. Define Causality and stability using poles.
16. Find the impulse response of the system $y(t)=x(t-t_0)$ using Laplace transform.

17. The impulse response of the LTI CT system is given as $h(t)=e^{-t}u(t)$. Determine transfer function and check whether the system is causal and stable.

PART- B

1. a. Give the properties of convolution Integral (8)

   b. Determine the state Equations and Matrix representation of systems (8)

2. a. Describe the properties of impulse response (8)

   b. Determine y(t) by convolution integral if $x(t)=e^{at}u(t)$ and $h(t)=u(t)$ (8)

3. a. Find whether the system is causal or not?

   $h(t)=e^{-2t}u(t-1)$ (8)

   b. Give the summary of elementary blocks used to represent contineous time systems (8)

4. Find the natural and forced response of an LTI system given by (16)

   $10dy(t)/dt+2y(t)=x(t)$

UNIT-4

ANALYSIS OF DISCRETE TIME SIGNALS

PART-A

1. Define DTFT.
2. State the condition for existence of DTFT 3.
List the properties of DTFT.
4. What is the DTFT of unit sample? 5.
Define Zero padding.
6. Define circularly even sequence. 7.
Define circularly odd sequence.
8. Define circularly folded sequences. 9.
State circular convolution. 10. State
Parseval's theorem. 11. Define Z transform.
12. Define ROC.
13. Find Z transform of x(n)={1,2,3,4}
14. State the convolution property of Z transform.
15. What is z-transform of (n-m)?

PART B

1. Find the DTFT of x(n)={1,1,1,1,1,1,0,0}. (8)
2. Find the convolution of $x_1(n)$={1,2,0,1} , $x_2(n)$={2,2,1,1} 3. a. (8)
   State and prove the sampling theorem. (8)
3. Derive the Lowpass sampling theorem. (16)
4. Find the z-transform of x(n)= a^n u(n) and for unit impulse signal (8)
5. Give the relationship between z-transform and Fourier transform. (8)
6. Determine the inverse z transform of the following function
   a. x(z)=1/(1+z-1) (1-z-1)2 ROC :
      |Z>1|

UNIT-5

LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS

PART-A

1. Define convolution sum
2. List the steps involved in finding convolution sum
3. List the properties of convolution
4. Define LTI causal system 5.

Define LTI stable system

6. Define FIR system 7.

Define IIR system

8. Define nonrecursive and recursive systems
9. State the relation between Fourier transform and z transform
10. Define system function
11. How unit sample response of discrete time system is defined?
12. If u(n) is the impulse response of the system, What is its step response?
13. Convolve the two sequences x(n)={1,2,3} and h(n)={5,4,6,2}

PART-B

1. a. State and prove the properties of convolution sum. (8)
   b. Determine the convolution of x(n)={1,1,2} h(n)=u(n)-u(n-6) graphically (8)

2. Determine the parallel form realization of the discrete time system

$y(n) - 1/4y(n-1) - 1/8\, y(n-2) = x(n) + 3x(n-1) + 2x(n-2)$ (16)

3. a. Determine the transposed structure for the system given by difference equation

$y(n)=(1/2)y(n-1)-(1/4)y(n-2)+x(n)+x(n-1)$ (8)

b. Realize $H(s)=s(s+2)/(s+1)(s+3)(s+4)$ in cascade form (8)

4. a. Determine the recursive and nonrecursive system (8)

b. Determine the parallel form realization of the discrete time system is

$y(n) - 1/4y(n-1) - 1/8\, y(n-2) = x(n) + 3x(n-1) + 2x(n-2)$ (8)