MARWADI UNIVERSITY

Faculty of Engineering

[Information and Communication Technology]   **[B.Tech]**

SEM: **3**   MU FINAL EXAM   <u>December</u>: **2022**

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Subject: - **(Signals and Systems)** **(01CT0302)**   **Date:- 20/12/2022**

Total Marks:-100   **Time: -2:00PM to 5:00PM**

Instructions:
1. **All Questions are Compulsory.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Question: 1.

(a)   Choose an appropriate option for the following questions: [10]
  1. Which of the following is true in case of energy signal?
     a. E=0
     b. P=0
     c. E= infinity
     d. P=infinity
  2. Which kind of signal a $x(n) = u(n + 4) - u(n - 4)$ is?
     a. causal
     b. non-causal
     c. cannot be determined
     d. none
  3. $Y(t) = x(2t)$ is _____
     a. compressed signal
     b. expanded signal
     c. shifted signal
     d. amplitude scaled signal by a factor of 2
  4. The step function u (t) is integral of _____ with respect to time t.
     a. ramp function
     b. impulse function
     c. sinusoidal function
     d. exponential function
  5. To satisfy the sampling theorem, 100Hz sine wave should be sampled at
     a. 10Hz
     b. 100Hz
     c. 200Hz
     d. 50Hz
  6. A system which does not have a unique relation between its input and output is called
     a. non-linear system
     b. non-causal system
     c. time-variant system
     d. non-invertible system
  7. A random signal has
     a. no uncertainity
     b. uncertainity
     c. partial uncertainity
     d. none
  8. The ROC of a causal sequence is the _____of a circle of radius a
     a. Exterior

       b. Interior
       c. Both exterior & interior
       d. None

9. According to the convolution property of z-transform
    a. the z-transform of convolution of two sequences is the product of their respective z-transforms.
    b. the z-transform of convolution of two sequences is the convolution of their respective z-transforms.
    c. the z-transform of convolution of two sequences is the addition of their respective z-transforms.
    d. None

10. The property of Fourier Transform which states that the compression in time domain is equivalent to the expansion in the frequency domain is _____
    a. Duality
    b. Time scaling
    c. Frequency shifting
    d. none

(b)   Answer the following questions in short: [10]
1. Distinguish between periodic and aperiodic signals.
2. What do you mean by fundamental period of signal?
3. Distinguish between odd and even signals.
4. Does the impulse response of non-linear system characterize the system?
5. List the properties of LTI systems.
6. What do you mean by transfer function of a system?
7. Define time invariant system.
8. Differentiate between DTFT and CTFT.
9. What do you mean by ROC?
10. When does aliasing occur?

Question: 2.

(a)   Draw the block diagram of digital processing system and explain each major building blocks of DSP system in detail.

                                                                 [08]

(b)   Determine whether the following systems are causal or not:
    1. $y(t) = x\sin[2t]$
    2. $y(n) = x(n) + x(n-2)$
    3. $y(n) = \sin[x(n)]$
    4. $y(n) = x(-n$

                                                                 [08]

<div align="center">OR</div>

(b) Determine whether the following systems are dynamic or not:
    1. $y(t) = x(t-3)$
    2. $y(t) = x(2t)$
    3. $y(n) = x(n+2)$
    4. $y(n) = x(n-2) + x(n)$

                                                                 [08]

Question: 3.

(a) Classify various types of systems and explain linear, non-linear, time varying and time-invariant systems with suitable examples.

                                                                 [08]

(b) State the advantages of z-transform and derive time reversal and convolution properties o z-transform. [04]

(c) Discuss right sided, left sided and both sided sequences of z-transform with suitable examples. Also plot their ROCs.

[04]

OR

(a) Briefly explain continuous time and discrete time signals and s their how graphical, tabular, functional and sequence representation with suitable examples.

[08]

(b) Derive time shifting and linearity properties of z-transform.

[04]

(c) Distinguish between continuous time Fourier transform and Discrete time Fourier transform. [04]

Question: 4.

(a) Compute the convolution sum of the following:
1. $x(n) = \{1,1,1,1\}$ and $h(n) = \{1,1,1,1\}$
2. $x(n) = h(n) = \{1,2,-1,3\}$

[08]

(b) Obtain the z-transform of the following finite duration sequences. Also plot their ROCs.
1. $x(n) = \{1,2,4,5,0,7\}$, consider $x(n)$ is present from n=0 to n=5.
2. $x(n) = \{1,2,4,5,0,7\}$, consider $x(n)$ is present from n=-2 to n=3.

[08]

OR

(a) What is convolution integral? Mention the properties of convolution integral and compute convolution integral of unit step to unit step with graphical method.

[08]

(b) Derive the z-transforms of standard sequences of unit impulse, delayed unit impulse, advanced unit impulse and unit step signals. Also, plot their ROCs.

[08]

Question: 5.

(a) Explain commutative, associative and distributive properties of convolution sum with suitable mathematical expressions and graphical representation.

[06]

(b) Determine the fourier transform of decaying exponential pulse $x(t) = e^{-\alpha t}$

[06]

(c) Show the representation of DT signals by fourier transform and discuss the condition for existence.

[04]

OR

(a) Explain the impulse response of interconnected system. Show cascade and parallel connection of LTI systems along with their mathematical and graphical representations.

[06]

(b) Determine the fourier transform of $x(t) = e^{\alpha t} u(-t) + e^{-\alpha t} u(t)$

[06]

(c) Obtain DTFT for unit impulse and single sided exponential pulse.

[04]

Question: 6.

(a) What is continuous time fourier transform? Discuss the necessity of fourier transform. Also explain the conditions for the existence of fourier transform.

[08]

(b) Compare time domain and frequency domain representations of signals with suitable assumption. Show their graphical representations as well.

[04]

(c) List and write mathematical expressions of any four properties of fourier series.

[04]

OR

(a) Discuss the need of CT fourier series. Derive the expressions for polar and quadrature fourier series. [08]

(b) Show single sided frequency representations of :
1. $x(t) = 3\cos(40\pi t + \pi/4) + 2\cos(20\pi t)$
2. $x(t) = 3\sin(100\pi t) + \cos(50\pi t)$

[04]

(c)List and write the mathematical expressions for any four properties of fourier transform.

[04]

---Best of Luck---

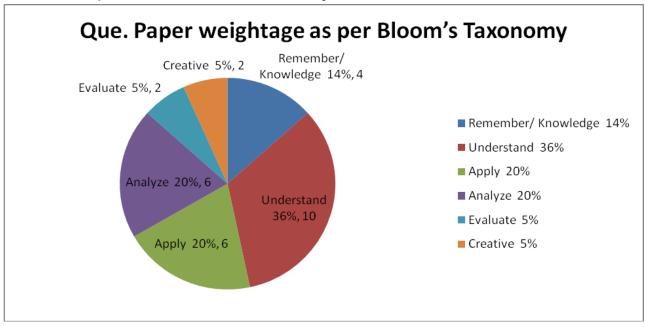– Bloom'S Taxonomy Report –

Sub: Signals and Systems(01CT0302)

Sem. 3

Branch: Information and Communication Technology

Que. Paper weightage as per Bloom's Taxonomy

LEVEL	% of weightage	Question No.	Marks of Que.
Remember/Knowledge	24%	1(A), 1(B),6(C)	24
Understand	30%	2(A), 3(A), 3(B), 3(C), 5(A)	30
Apply	16%	4(A), 4(B)	16
Analyze	16%	5(C), 6(A), 6(B)	16
Evaluate	14%	2(B), 5(B)	14
Higher order Thinking/ Creative			

Chart/Graph of Bloom's Taxonomy