MARWADI UNIVERSITY
MU-FOT
ICT-FOT1 (MU)
Semester 3 - Summer

Subject : SIGNALS AND SYSTEMS (01CT0302)
Date : 04-May-2022   **Time : 3 Hours**   **Total Marks : 100**
Instructions :

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Que.1   **Answer the following objectives**   [10]
(A)

(1)   X(z) is the z-transform of the signal x(n), then what is the z-transform of the signal nx(n)?

A. -Z(dX(Z))/dZ
B. Z(dX(Z))/dZ
C. Z^-1(dX(Z))/dZ
D. -Z^-1(dX(Z))/dZ

(2)   Frequency shifting property in DTFT is
A. $e^{j2\pi fct}$x(t)<----> X(f-fc)
B. $e^{j2\pi ft}$x(t)<----> X(f-fc)
C. $e^{j2\pi fct}$x(t)<----> X(fc-f)
D. x(t)<----> $e^{j2\pi fct}$X(f-fc)

(3)   If X(Z)= Z-a/Z-b then comment on poles and Zeros.

A. Zeros at Z=a ,Poles at Z=b
B. Zeros at Z=b, Poles at Z=a
C. Zeros at Z=a, Poles at Z=a
D. Zeros at Z=b, Poles at Z=b

(4)   In Z- transform ROC will decide whether system is_____.

A. Stable or Unstable
B. Causal or non causal
C. Finite duration or infinite duration
D. All of the mentioned

(5)   To convolve two signals in time domain is equal to their _____ in Z- domain.
A. Summation
B. Inversion
C. Multiplication

D. Differentiation

(6)   What can be a particular solution of x(n)= u(n) ?
        A. K u(n)
        B. K
        C. K* C^n
        D. K1+K2

(7)   What is the set of all values of z for which X(z) attains a finite value?

        A. Region of convergence
        B. Region of divergence
        C. Feasible solution
        D. None of the mentioned

(8)   If x(n)= $(0.5)^n$ u(n) is energy signal or power signal.
        A. Energy Signal
        B. Power Signal
        C. Non predictable
        D. Energy and Power

(9)   For a given x(n) signal, x(2n) is its

        A. Compressed form
        B. Expand form
        C. Shifted form
        D. None

(10)   What is the ROC of z-transform of finite duration anti-causal sequence?
        A. Entire Z-plane, except at Z=0
        B. Z=∞
        C. Z=0
        D. Entire Z-plane, except at Z=∞

Que.1 **Answer the following questions.**   **[10]**
**(B)**

(1)   State the Associative properties of convolution.

(2)   For a causal LTI system to be stable, all the poles of $H(z)$ must lie _____ in the z-plane.

(3)   Define Region of Convergence for Z- transform.

(4)   The Z-transform of a discrete time signal $\sum_{k=0}^{\infty} \delta[n-k]$ is

(5)   Which is the sequence whose ROC is entire z-plane?

(6)   What is Z-transform for unit ramp sequence?

(7)   State Parseval's relation.

(8)   Enlist advantages of Z-transform.

(9)   Differntiate between Continuous Time Signal and Discrete Time Signal.

(10)   Prove that $\delta[n] = u[n] - u[n-1]$.

Que.2

(A)   Find the energy of the following signals   [8]
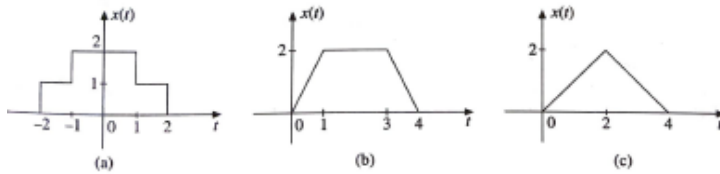
(B)   Determine whether the following signals are periodic or not: [8]
       i. $cos(0.04\pi n)$

       ii. $e^{j(\pi/3)n}$

       iii. $sin[n/2]sin[n\pi/2]$

       iv. $cos[2n/3]$

OR

(B)   Discuss properties of LTI systems.   [8]

Que.3

(A)   Using properties of Z-tranform, find the Z-transforn of following sequences.   [8]
       1. $x_1[n] = nu[n-1]$

       2. $x_2[n] = n^2 u[n]$

       3. $x_3[n] = n(1/2)^n u[n]$

       4. $x_4[n] = (1/3)^n u[-n]$

(B)   Determine the discrete-time Fourier Transform for the given signal   [4]

$$x[n] = \left(\frac{1}{2}\right)^{-n} u[-n-1]$$

(C)   Find convolution of x(t)=e^{-2t} u(t) and h(t)=e^{-t} u(t).   [4]

OR

(A)   Calculate Fourier Series coefficietns for any two non-sinusoidal periodic signals.   [8]

(B)   Evaluate whether the following systems are time invariant or not: [4]
       i. $y[n] = nx[n]$

       ii. $y(t) = 2x^3(t)$

(C)   Determine if the recursive system defined by the difference equation $y(n) = ay(n{-}1) + x(n)$ is linear. [4]

Que.4

(A)   Consider a stable LTI system that is characterised by the differential equation   [8]
       $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$.

Find its response for input $x(t) = e^{-t}u(t)$

(B)   Find the DTFT of the following sequences: i. $a^n u[n]$ and ii. $-a^n u[-n-1]$ [8]

OR

(A)   Explain Natural top and Flat top sampling.   [8]

(B)   Calculate Fourier Transform for Rectangular and Triangular Pulse.   [8]

Que.5

(A)   State and prove following properties of Z- transform.   [6]
       (i) Convolution (ii) Differentiation

(B)   Calculate and plot response of LTI system with impulse response $h(t) = u(t)$ for input   [6]
       $x(t) = e^{-at}u(t), a > 0$.

(C)   State following property of DTFT   [4]
          (1) Linearity
          (2) Time Shifting
          (3) Convolution
          (4) Differentiation

OR

(A)   Find the fourier transform of a rectangular pulse of duration T and amplitude A   [6]

(B)   Obtain Fourier transform of signal x (t)= $e^{-a|t|}$ for all t.   [6]

(C)   Using the power series expansion technique, find the inverse Z-transform of   [4]
       $X(z) = z/(2z^2 - 3z + 1); ROC|z| < 1/2$

Que.6

(A)   Find the inverse Z-transform using partial fraction expansion method for   [8]
       $X(z) = z(z-1)/(z+1)^3(z+2); ROC|z| > 2$

(B)   State and prove following properties of Z transform.   [4]
       (i) Time reversal (ii) Time Expansion

(C)   Evaluate whether the following systems are dynamic or not: [4]
       i. $y[n] = nx[n]$
       ii. $y(t) = 2x^3(t)$

OR

(A)   With regard to Fourier series representation, justify the following statements.   [8]
       i. Odd functions have only sine terms.
       ii. Even functions have no sine terms.

(B)   Find Z-transform and sketch ROC for x(n)= $(-1)^n(2)^{-n}$ u(n).   [4]

(C)   State and prove following properties of Z transform.   [4]
       (i) Linearity (ii) Time shifting

---Best of Luck---

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Difficulty Level	Weightage Recommended	Actual	No of Question	Total Marks	Question List
High	20	19.77	6	34	3(B), 4(A), 5(B), 5(C), 6(A), 6(C)
Low	20	19.77	10	34	1(B), 2(A), 2(B), 3(C), 4(A)
Medium	60	60.47	29	104	1(A), 1(B), 2(B), 3(A), 3(B), 3(C), 4(B), 5(A), 5(B), 5(C), 6(A), 6(B), 6(C)

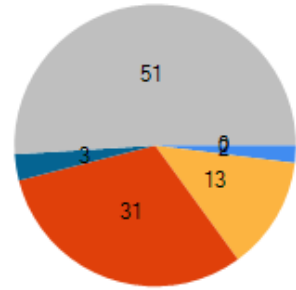| Module Name	Weightage Recommended	Actual	No of Question	Total Marks	Question List
Continuous time and discrete time signals and systems	20	15.70	6	27	1(A), 1(B), 2(A), 2(B), 4(A)
Analysis of Continuous Time Signals and Systems	20	17.44	5	30	2(B), 3(B), 3(C), 4(A), 5(B)
Analysis of discrete time signals and systems	30	36.05	25	62	1(A), 1(B), 3(A), 3(C), 5(A), 5(C), 6(A), 6(B), 6(C)
Frequency domain analysis	30	30.81	9	53	1(A), 3(A), 3(B), 4(B), 5(A), 5(B), 5(C), 6(A)

Blooms Taxonomy	Weightage Recommended	Actual	No of Question	Total Marks	Question List
Remember / Knowledge	20	1.74	3	3	1(B)
Understand	30	13.37	9	23	1(A), 1(B), 2(B), 4(A)
Apply	25	30.81	16	53	1(A), 1(B), 3(C), 5(A), 5(B), 5(C), 6(A), 6(B), 6(C)
Analyze	15	3.49	3	6	1(B), 3(C)
Evaluate	10	50.58	14	87	1(B), 2(A), 2(B), 3(A), 3(B), 4(A), 4(B), 5(B), 5(C), 6(A), 6(C)
Higher order Thinking	0	0.00	0	0	
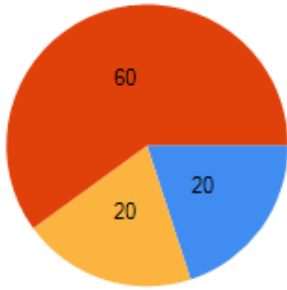
■ High	■ Low	■ Medium
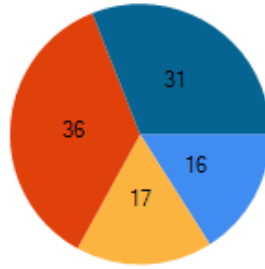
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