



MARWADI UNIVERSITY

Faculty of Technology

Department of Information & Communication Technology

B.Tech

SEM: III

Enroll. No. \_\_\_\_\_

WINTER:2018

Subject: - Signals & Systems (01CT0302)

Total Marks:-100

Date:- 26/10/2018

Time: - 03:00 hours

**Instructions:**

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

**Question: 1. (a)** Answer the following: [10]

- (1) Discrete time signal is derived from continuous time signal by \_\_\_\_\_ process.  
a) Addition b) Multiplying  
c) Sampling d) Addition and multiplication
- (2) Even signals are symmetric about the vertical axis.  
a) True b) False
- (3) Noise generated by an amplifier of radio is an example for?  
a) Discrete signal b) Deterministic signal  
c) Random signal d) Periodic signal
- (4) Which of the following is an example of amplitude scaling?  
a) Electronic amplifier b) Electronic attenuator  
c) Both amplifier and attenuator d) Adder
- (5)  $Y(t) = x(3t)$  is \_\_\_\_\_  
a) Compressed signal b) Expanded signal  
c) Shifted signal d) Amplitude scaled signal by a factor of 3
- (6) What is the value of  $\delta[0]$ , such that  $\delta[n]$  is the unit impulse function?  
a) 0 b) 0.5  
c) 1.5 d) 1
- (7) How is discrete time convolution represented?  
a)  $x[n] + h[n]$  b)  $x[n] - h[n]$   
c)  $x[n] * h[n]$  d)  $x[n] + h[n]$
- (8) What is the commutative property?  
a)  $x(n)*h(n)=h(n)*x(n)$  b)  $x(n)+h(n)=h(n)+x(n)$   
c)  $x(n)**h(n)=h(n)**x(n)$  d)  $x(n)h(n)=h(n)x(n)$
- (9) Graphical representation of signal in frequency domain is called  
a) Frequency Spectrum b) Fequency  
c) Wave form d) None of the above
- (10) Which theorem states that the total average power of a periodic signal is equal to the sum of average powers of the individual Fourier coefficients?  
a) Parseval's Theorem b) Rayleigh's Theorem  
c) Both a & b d) None of the above

(b) Attempt the following: (Two marks each) [10]

- (1) Examine whether the following signals are periodic or not?  
a)  $\sin 13\pi t$  b)  $2 + \cos 2\pi t$
- (2) Find even and odd component of following signal  
 $x(n) = \{-2, 5, 1, 3\}$

- (3) Define : (i) Impulse response (ii) Convolution.
- (4) Describe Commutative and Distributive property for Discrete time LTI system.
- (5) Check the following signal is energy signal or power signal.
  - (i)  $x(t) = e^{-at} u(t)$ ,  $a < 0$
  - (ii)  $x(n) = -(0.5)^n u(n)$

**Question: 2.**

- (a) Describe classification of systems in detail with example. [08]
- (b) Sketch the following signals:
  - (i)  $2u(t+2) - 2u(t-3)$  [02]
  - (ii)  $r(t) - r(t-1) - r(t-3) + r(t-4)$  [02]
  - (iii)  $x[n] = \{2, -5, 1, 2, 1, -3, 3\}$  [04]
    - (a)  $x[2n-1]$
    - (b)  $x[-n+3]$

**OR**

- (b) For each of the following systems [08]
  - i)  $y(t) = x(t-2) + x(2-t)$
  - ii)  $y(n) = nx(n)$
 determine which of properties “memoryless”, “time invariant”, “linear”, “casual” holds and justify your answer.

**Question: 3.**

- (a) State properties of LTI System. Prove a condition for a discrete time LTI system to be Causal and Stable. [08]
- (b) Determine impulse response for the system given by the following differential equation. [04]
 
$$y(n) + 3y(n-1) + 2y(n-2) = 2x(n) - x(n-1)$$
- (c) Find a linear convolution for [04]
 
$$x(n) = \{1, 2, 4\}, h(n) = \{1, 2\}$$

**OR**

- (a) Obtain the convolution of the following functions: [08]
 
$$x(t) = 1, \text{ for } -3 \leq t \leq 3 \quad h(t) = 2, \text{ for } 0 \leq t \leq 3$$

$$= 0, \text{ Otherwise} \quad = 0, \text{ otherwise}$$
- (b) State and prove sampling theorem also mention Nyquist criteria. [04]
- (c) Find linear convolution using graphical method for [04]
 
$$x(n) = \{1, 1, 1\}, h(n) = \{1, 2, 1\}$$

**Question: 4.**

- (a) Define ROC of Z- Transform. State and explain Properties of ROC. [08]
- (b) Find Z- Transform for the following also comment on ROC. [04]
  - (ii)  $x(n) = u(n+2)$
  - (iii)  $x(n) = 2^n u(n)$
- (c) Prove that  $x(n) * \delta(n-n_0) = x(n-n_0)$  [04]
 
$$x(n) \cdot \delta(n-n_0) = x(n_0)$$

**OR**

- (a) State and Prove following properties of Z- Transform. [08]
  - (i) Linearity
  - (ii) Time Shifting
  - (iii) Convolution
  - (iv) Differentiation.

- (b) Find the z transform of signal [04]  
 $x(n) = \cos \omega_0 n u(n)$
- (c) Find convolution of  $x_1(n)$  and  $x_2(n)$  using Z- Transform. [04]  
 $x_1(n) = \{1, 2, 1, 2\}$   $x_2(n) = \{1, 1, 2, 2\}$

**Question: 5.**

- (a) Using the partial fraction expansion technique find the inverse z transform of [08]  

$$X(z) = \frac{z}{2z^2 - 3z + 1}, |z| < \frac{1}{2}$$
- (b) Obtain Trigonometric Fourier series of the periodic rectangular waveform. [04]  
 $f(t) = A, -T/4 \leq t \leq T/4$   
 $= 0, \text{ otherwise}$
- (c) State and Prove time shifting property of Fourier transforms. [04]

**OR**

- (a) Find inverse Z- Transform by Partial Fraction Expansion for all possible  $x(n)$  [08]  
 $X(z) = Z + 1/2Z^2 - 7Z + 3$
- (b) Find Fourier transform of a rectangular pulse 2 seconds long with a magnitude of 10 volts. [04]
- (c) State Dirichlet condition for Fourier series representation. [04]

**Question: 6.**

- (a) Define Laplace transform. Prove linearity property of Laplace transform. [08]  
 State how ROC of Laplace transform is useful for in defining stability of system.
- (b) Describe importance of convolution in analysis of Linear time invariant system. [04]
- (c) Define discrete Fourier transform and describe difference between DTFT and DFT. [04]

**OR**

- (a) Derive DFT of the sample data sequence  $x(n) = \{1, 1, 2, 2, 3, 3\}$ . [08]
- (b) State application of signals and systems explain any one in detail. [04]
- (c) Define: The continuous time Fourier transforms. State and prove Duality properties of continuous time Fourier Transform [04]

**---Best of Luck---**

### Que. Paper weight-age as per Bloom's Taxonomy

No.	Que. Level	% of weight-age	
		% of weight -age	Que. No.
1	Remember/Knowledge	20	Q:2(a)Q:6(b)Q:6(c)(OR)Q:4(a)Q:6(a) Q:3(a)
2	Understand	25	Q:1(a)Q:2(b)Q:2(b)(OR)Q:3(b)Q:4(c) Q:4(b)
3	Apply	25	Q:1(b)Q:3(c)(OR)Q:4(b)Q:4(C)(OR) Q:5(b)(OR)
4	Analyze	25	Q:3(a)(OR),Q:3(b)(OR)Q:4(a)(OR) Q:5(c)Q:3(c)
5	Evaluate	05	Q:6(b)Q:5(C)(OR)
6	Higher order Thinking	--	

### GRAPH:

