Enroll. No._____

MARWADI UNIVERSITY

Faculty of Technology

Department of Information & Communication Technology

B.Tech **SEM: III** **WINTER:2019**

Subject: - Signals & Systems (01CT0302) **Date:- 12/10/2019**

Total Marks:-100 **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) A system whose output depends upon future input is called
(a) Static system (b) Causal system
(c) Dynamic system (d) Non causal system

(2) What is the rule x(t)*h1(t)+x(t)*h2(t) = x(t)*[h1(t)+h2(t)] is called?
(a) Commutative rule (b) Associative rule
(c) Distributive rule (d) Transitive rule

(4) Graphical representation of signal in frequency domain is called
(a) Frequency Spectrum (b) Frequency
(c) Wave form (d) None of the above

(5) Y (t) = x (t/3) is _____
(a) Compressed signal (b) Expanded signal
(c) Time shifted signal (d) Amplitude scaled signal by factor 1/3

(6) An example of a discrete set of information/system is
(a) The trajectory of the Sun (b) Data on a CD
(c) Universe time scale (d) Movement of water through a pipe

(7) $\delta(n)$= _____
(a) u(n)+u(n-1) (b) u(n)u(n-1)
(c) u(n)-u(n-1) (d) u(n-1)+u(n)

(8) Which of the following is an example of amplitude scaling?
(a) Electronic amplifier (b) Electronic attenuator
(c) Both amplifier and attenuator (d) Adder

(9) A signal is power signal if
(a) E=0, P=0 (b) E= infinite, P=Finite
(c) E= finite, P=0 (d) E = finite , P=infinite

(10) Which of the following method is not used for the inverse Z-transform.
(a) Partial Fraction Expansion (b) Power series Expansion
(c) Residue method (d) Slope over head method

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

(1) Examine whether the following signals are periodic or not?
(a) $e^{j4\pi t}$ (b) 3 Sin200πt+ 4 Cos100t

(2) Find even and odd component of following signal
x(t) = Sin2t + Sin2tCos 2t + Cos2t

(3) Find convolution of x1(n) = [1 1 2 1] and x2(n) = [1 4 2 3] using tabulation method.

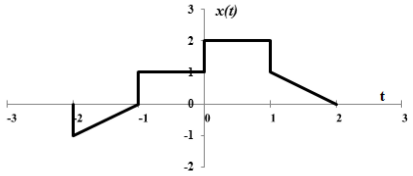
(4) State Commutative and Associative property for CT LTI system.

(5) Describe benefits of Z- transform.

Question: 2.

(a) Describe classification of systems in detail with example. [08]

(b) Sketch the following signals:



(i) x(t-3) & x(t/2) [02]

(i) -2r(t-2) [02]

(iii) Check whether the signals are energy signal or power signal [04]

(i) $(1/2)^n u(n)$ (ii) $x(t) = \{ t-2 , -2 \le t \le 0$

$\{ 2-t , 0 \le t \le 2$

$0 , \text{otherwise}$

OR

(b) For each of the following systems [08]

(i) $y(n) = x(n) + nx(n-2)$

(ii) $y(t) = tx(t)$

Determine which of properties "Static/dynamic", "time invariant/Variant", "linear/Nonlinear", "casual/Non causal" 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) Proove that $x(n) * \delta(n-n_0) = x(n-n_0)$ [04]

$x(n) . \delta(n-n_0) = x(n_0)$

(c) Find a linear convolution for [04]

$x(t) = e^{-at} u(t)$, $h(t) = u(t)$

OR

(a) State and prove sampling theorem also draw frequency spectrum for $fs \ge 2$ fm, $fs = 2fm$ and $fs \le 2$ fm. [08]

(b) Compute convolution for the following $x(n) = \{1,-2,1\}$, and $h(n) = \{1,1\}$. [04]

(c) Find linear convolution using graphical method for [04]

$x(n) = \{1,2\}$, $h(n) = \{1,1,2\}$

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]

$x(n) = 2^n u(n) + 3^n u(-n-1)$

(c) Find Z- transform of $x(n) = a^{|n|}$, $0 \le a \le 1$. Also comment on ROC. [04]

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]

$x(n) = \text{Cos } \omega_0 n \, u(n)$

(c) Define Z-transform. State the relationship in between Z-transform and DTFT. [04]

Question: 5.

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

$$X(Z) = \frac{1-(1/2)Z^{-1}}{1+(3/4)Z^{-1}+(1/8)Z^{-2}}$$ Find all possible x(n)

(b) Obtain Trigonometric Fourier series of the periodic rectangular waveform. [04]

$f(t) = A, -T/4 \leq t \; T/4$

$= 0$, otherwise

(c) State and Prove Frequency Shifting Property of Fourier Transforms. [04]

OR

(a) Find homogeneous solution of given differential equation [08]

$y(n) - 3y(n-1) - 4y(n-2) = x(n)$

(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) Obtain Fourier transform of signal $x(t) = e^{-at} u(t) + e^{at} u(-t)$ for all t. [04]

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(b) A system is described by linear difference equation [04]
$y(n) = 0.2\,x(n) - 0.5\,x(n-2) + 0.4\,x(n-3)$ given that the digital input sequence {-1,1,0,-1} is applied to the system. Determine the corresponding output sequence.

(c) Define Laplace transform. Explain mapping of S-Plane and Z- Plane. [04]

OR

(a) Compute convolution for the CT-LTI system [08]

$x(t) = 1$, $-1 \leq t \leq 1$

$h(t) = 2$ $0 \leq t \leq 2$

(b) State application of signals and systems explain any one in detail. [04]

(c) Define: The continuous time Fourier transforms. State and prove convolution properties of continuous time Fourier Transform [04]

---Best of Luck---