

Oct-22/TE/Insem-538

T.E. (Electrical)

DIGITAL SIGNAL PROCESSING

(2019 Pattern) (Semester - I) (303145B) (Elective - I)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Answer Q1 or Q2, Q3 or Q4.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of scientific calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) List the different types of discrete signals with their equations. [3]

b) State whether system $y(n) = x(n) + \frac{1}{x(n-1)}$ is (with reason) [5]

- i) Linear or non linear
- ii) Time invariant or variant

c) Let $x(t)$ be the sum of sinusoidal signals

$x(t) = 4 + 3 \sin(\pi t) - 2 \sin(5\pi t) - 5 \sin(12\pi t)$ where t is in milliseconds. Determine the minimum sampling rate that will not cause any aliasing effects, that is, the Nyquist rate. To observe such aliasing effects, suppose this signal is sampled at (1/3)rd of its Nyquist rate. Determine the analog signal $x_a(t)$ that would be aliased with $x(t)$. [7]

OR

Q2) a) Differentiate between even and odd discrete time signals (any three). [3]

b) Let signal $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{2, 4, 3, 1\}$ Perform following operation. [5]

- i) $x_1(n) + x_2(n)$
- ii) $x_1(n)x_2(n)$

P.T.O.

- c) Determine impulse response of the system with

$$x(n) = \left(\frac{2}{5}\right)^n u(n) \text{ and } h(n) = \left(\frac{1}{5}\right)^n u(n). \quad [7]$$

- Q3)** a) State and prove time reversal property of Z-transform. [3]

- b) Find the Z-transform and its ROC for following signal [5]

$$x(n) = \delta(n-2) - 5\delta(n-1) + 3\delta(n) + 4\delta(n+1)$$

- c) Find the unit impulse response of the system given below.

$$y(n) - y(n-1) + 0.5y(n-2) = x(n) + x(n-1)$$

Plot poles and zeros in Z-plane. Also determine stability of the system. [7]

OR

- Q4)** a) What is ROC? State ROC for : [5]

i) Right handed sequence

ii) Left handed sequence

iii) Two handed sequence

- b) Let $X(z) = \frac{1}{1 + 4.5z^{-1} + 3.5z^{-2}}$ Find the inverse Z-transform of following function for ROC. [10]

i) $|z| > 3.5$

ii) $|z| < 1$

iii) $1 < |z| < 3.5$
