22/5/2025

. Elect: TE Sem VI Reg. C'scheme Summer 2025 .

Time (3 Hours) **80 Marks**

Note: (1) Question no. 1 compulsory
(2) Attempt any 3 question out of remaining five questions.
(3) Draw neat diagram wherever necessary.

Q 1. Attempt **any Four** out of Six questions **(5 marks each)** **(20)**

a. Determine the Fourier series representation of $x(t) = 2Sin(2\pi t - 3) + Sin(6\pi t)$
b. State the conditions for an LTI system to stable and casual.
c. Determine whether the continuous time signal $x(t) = 3\cos(4t + \frac{\pi}{3})$ is periodic, determine its fundamental period.
d. State four important properties of DTFT.
e. Determine the z-transform and ROC of the signal $x(n) = 3^n u(-n-1)$
f. Describe the following signals with their graphical and mathematical representations.
(i)Step (ii) Ramp (iii) Impulse.

Q 2. a. Determine the transfer function and the impulse response for the casual LTI system described by the difference equation **(10)**

$$y(n) = \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1)$$

b. Determine whether the system $y(n) = nx(n)$ is **(10)**
(i) Time invariant
(ii)) Linear
(iii) Causal
(iv) Stable

Q3. a. Categorize the following signal as a energy signal or a power signal, find the energy or time averaged power of the signal. **(10)**

$$x(t) = \begin{pmatrix} t, & 0 \le t \le 1 \\ 2-t, & 1 \le t \le 2 \\ 0, & otherwise \end{pmatrix}$$

b. Design a Bandpass FIR filter using rectangular window for N=11 samples **(10)**

$$H_d(e^{j\omega}) = \{1\ , \quad \frac{\Pi}{4} \le |\omega| \le \frac{3\Pi}{4}\}$$
$$\{0\ , \quad \text{otherwise}\}$$

Q4. a. Determine inverse Z-transform of $X(z) = \frac{z^2 - 3z}{z^2 + \frac{3z}{2} - 1}$ **(10)**

When ROC is $\frac{1}{2} < |z| < 2$

b. Discuss the method of Bilinear transformation for design of IIR filter **(10)**

Q5. a. Explain any five properties of DFT **(10)**

b. Given x(n) = {1,2,4,8,16,32,64,128) Find X(k) using DIT-FFT algorithm. **(10)**

Q6. a) An LTI system is described by the equation: **(10)**

$Y(n) = x(n) + 0.8\ x(n-1) + 0.8\ x(n-2) - 0.49\ y(n-2)$

Determine the transfer function of the system, sketch poles and zeroes on the z-plane.

b) Find y(n) by using convolution if x(n) = [1,3,5,3] and h(n) = [2,3,1,1]. **(10)**