

22/05/2025 TE ELECTRICAL SEM-VI C-SCHEME SS QP CODE:10086606

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)

- Determine the Fourier series representation of $x(t) = 2\sin(2\pi t - 3) + \sin(6\pi t)$
- State the conditions for an LTI system to stable and casual.
- Determine whether the continuous time signal $x(t) = 3\cos(4t + \frac{\pi}{3})$ is periodic, determine its fundamental period.
- State four important properties of DTFT.
- Determine the z-transform and ROC of the signal $x(n) = 3^n u(-n - 1)$
- 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)

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

- Determine whether the system $y(n) = nx(n)$ is (10)
 - Time invariant
 - Linear
 - Causal
 - 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)

$$x(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 2-t, & 1 \leq t \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

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

$$H_d(e^{j\omega}) = \begin{cases} 1, & \frac{\pi}{4} \leq |\omega| \leq \frac{3\pi}{4} \\ 0, & \text{otherwise} \end{cases}$$

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)