

(3 Hours)

- N.B: (1) Question No. 1 is compulsory.
 (2) Attempt any three from the remaining questions.
 (3) Assume suitable data wherever required.

1. Attempt any four (20)
- Compute DFT of the given sequence $x(n) = [2, 4, 6, 8]$.
 - What is ROC?
 - Give the classification of signals and systems.
 - Determine the periodicity of the following continuous time signal:

$$X(t) = 5 \cos 8\pi t + 3 \sin 4\pi t$$
 - State sampling theorem and explain how aliasing error occurs?
2. (A) An 8-point sequence is given by $x(n) = [0, 1, 1, 1, 1, 1, 1, 1]$. Compute 8-point DFT of $x(n)$ by radix 2 DIT-FFT method. (10)
 (B) Prove any three DFT Properties. (10)
3. (A) Explain any three properties of Z-Transform. (10)
 (B) Obtain magnitude and phase response of the following system: (10)

$$H(n) = [1, -1/2]$$
4. (A) Determine the inverse Z-Transform of the function for all possible ROCs: (10)

$$X(z) = \frac{1}{1 - 0.8z^{-1} + 0.12z^{-2}}$$

 (B) Find $x(n)$ for the following: (10)

$$X(z) = \frac{10z}{(z-1)(z-2)}$$
5. (A) Classify the following systems as linear, non-linear, time-variant, time invariant, causal, non-causal, static, dynamic, stable and unstable. (10)
 (a) $y(n) = n x(n)$
 (b) $y(n) = x(n^2)$
 (B) Determine the response of the LTI system governed by the difference equation:

$$Y(n) - 0.5 y(n-1) = x(n)$$

 for input $x(n) = 5^n u(n)$ and initial condition $y(-1) = 2$. (10)
- Q 6 a. Explain any five properties of Z-transform. (10)
- b. Using Bilinear transformation, obtain Butterworth filter design which satisfies the following conditions (10)

$$0.8 \leq |H(e^{jw})| \leq 1 \quad 0 \leq w \leq 0.2 \pi$$

$$|H(e^{jw})| \leq 0.2 \quad 0.6 \pi \leq w \leq \pi$$
