

Roll No.

Total Pages : 3

007402

May 2023

B.Tech. (EL) - IV SEMESTER

Signal and Systems (ELPC 404)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume the relevant data wherever required.*

PART-A

1. (a) What is the difference between recursive and non-recursive system (1.5)
- (b) Define the term state and state variable. (1.5)
- (c) State Parseval's Theorem for continuous time periodic signals. (1.5)
- (d) Write short notes on Dirichlets conditions for Fourier series. (1.5)
- (e) Why CT signals are represented by samples (1.5)
- (f) Determine whether the signal $x(n) = \left(\frac{1}{2}\right)^n u(n)$ is power signal or energy signal (1.5)

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- (g) What is the condition for causality if $H(z)$ is given. (1.5)
- (h) Define Fourier Transform pair. (1.5)
- (i) Consider the signal $x(t) = 10 \cos(2000\pi t) \cos(8000\pi t)$. What is the minimum sampling rate based on low pass uniform sampling theorem. (1.5)
- (j) What is an anti-aliasing filter? (1.5)

PART-B

2. The following system have input $x(n)$ and output $y(n)$. For the given system determine whether it is memoryless, stable, causal linear or time invariant.

$$y(n) = |x(n)| \quad (15)$$

3. (a) Evaluate the convolution of a unit step function $u(n)$ with itself. (7)
- (b) Check the stability of LTI system with unit sample (impulse) response $h(n) = A^n u(n)$ where A is a constant. (8)
4. (a) Find the Z transform of the following signal. Sketch the pole zero plot and indicate the ROC. Indicate whether or not the DTFT of the signal exists?

$$\text{Given } x(n) = n \left(\frac{1}{2} \right)^{n-1} \quad (10)$$

- (b) What is the relationship between Z transform and Fourier Transform. (5)

5. (a) Find Inverse Z Transform of the following :

$$X(Z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

- If (a) ROC $|z| > 1$.
 (b) ROC $|z| < 0.5$.
 (c) ROC $0.5 < |z| < 1$ (10)

- (b) Find Fourier Transform of the following signal

$$x(n) = x(1-n) + x(-1-n) \quad (5)$$

6. (a) Explain reconstruction of the signal from its samples. (10)
- (b) What are the effects aliasing. How it can be avoided? (5)

7. A linear time invariant system is characterized by the state equation

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where u is unit step input. Compute the solution of these

$$\text{equations assuming initial condition } X_0 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}. \quad (15)$$