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)

(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.

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

3. (a) Evaluate the convolution of a unit step function u(n) with itself. (7)

(b) Check the stability of LT1 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?

Given $x(n) = n\left(\frac{1}{2}\right)^{|n|}$ (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

$x(n) = x(1-n) + x(-1-n)$ (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 equations assuming initial condition $X_0 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. (15)
