017303

December 2023
B.Tech. (EEIOT) III SEMESTER
Signal and Systems (ECC-01)

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.*

PART–A

1. (a) What is BIBO stability? (1.5)
   (b) How the aliasing process is eliminated. (1.5)
   (c) State the condition for causality in terms of impulse response h(t) of the system. (1.5)
   (d) What are the Dirichlet's conditions of Fourier series? (1.5)
   (e) State and prove the differentiation properties of DTFT. (1.5)
   (f) What do you mean by delta function and write its properties. (1.5)
   (g) What is an invertible system? (1.5)

(h) Differentiate energy and power signal. (1.5)

(i) What is the advantage of Laplace transform over Fourier transform? (1.5)

(j) Define unit step, ramp functions for continuous Time and Discrete Time. (1.5)

PART-B

2. (a) What do you mean by system and classify the system? Explain in detail. (10)

(b) Sketch the following signals.

(i) $x(t) = 2t$ for all t.

(ii) $x(n) = 2n - 3$, for all n. (5)

3. (a) Define LTI system. List the properties of LTI system. Explain. (7.5)

(b) Using graphical method, find the output sequence y[n] of the LTI system whose response h[n] is given and input x[n] is given as follows :

$x[n] = \{1, 2, 3\}$; $h[n] = \{1, 1, 1\}$. (7.5)

4. (a) Obtain DTFT of a Signal

$X(n) = a^n \cos(\omega_0 n)$ un, $a < 1$. (7.5)

(b) Find the complex Fourier series for half wave rectified sine wave. (7.5)

5. (a) Determine Z-transform and ROC of Signal :

$x(n) = [3(4^n) - 5(3^n)]u(n)$. (7.5)

(b) What do you mean by ROC? and write its properties. (7.5)

6. (a) Find the Nyquist rate for each of the following signal

(i) $x(t) = 15 . \text{rect}\left[\dfrac{t}{2}\right]$.

(ii) $x(t) = 4 \sin c^2 (100t)$

(iii) $x(t) = -10 \sin(40\pi t) \cos(300\pi t)$ (7.5)

(b) State and Prove the Sampling Theorem. (7.5)

7. (a) Find the function x(t) if its Laplace Transform is given by $X(s) = \dfrac{10s}{(s+1)(s+3)} . e^{-s}$. (7.5)

(b) Find the Laplace Transform of $x(t) = (t-3)^2$. (7.5)