6. (a) What do you mean by Nyquist rate and Nyquist time interval ? **7.5**

And also Find the Nyquist rate and Nyquist time interval of the following signal :

(i) $x(t) = 4\ \text{sinc}^2\ (100t)$

(ii) $x(t) = 20\ \sin\ (40\pi t)\ \cos\ (300\pi t)$ **7.5**

(b) Explain the sampling theorem in detail, also prove it. How can you reconstruct the signal from its sample ? **7.5**

7. (a) Obtain inverse laplace transform of : **7.5**

$$X(s) = \frac{S-\frac{1}{2}}{S^2+\frac{3}{4}S+\frac{1}{8}}, \text{ Roc } \sigma - 1/4$$

(b) Find the laplace Transform of : **7.5**

$x(t) = (t-3)^2$

Roll No. 2300101705S

Total Pages : 04

017303

December 2024

B. Tech. (EEIOT) (Third Semester)

Signals and Systems (ECC-01)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Obtain the DTFT of $x(n) = A$ for $0 \leq n \leq N-1$ **1.5**

(b) What do you mean by ROC ? **1.5**

(c) State the condition for causality in terms of impulse response $h(t)$ of the system. **1.5**

(d) What do you mean by time scaling, time shifting and time inversion signal ? **1.5**

(e) What are the Dirichlet's conditions of Fourier series ? **1.5**

(f) What do you mean by delta function ? Write its properties ? **1.5**

(g) What do you mean by unilateral and Bilateral Laplace transform ? **1.5**

(h) What do you mean by aliasing ? How the aliasing process is eliminated. **1.5**

(i) Differentiate Fourier series and Fourier Transform. **1.5**

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

Part B

2. (a) Find the energy and power of the signal $x(n) = u(n)$ **7.5**

(b) State and explain the following system : **7.5**

(i) Static system and Dynamic system

(ii) Stable and Unstable system

(iii) Linear and Non-linear system

(iv) Time variant and Time invariant System

(v) Causal and Non-causal System

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 : **7.5**

$$x[n] = \{1, 2, 3\}; h[n] = \{1, 1, 1\}$$

4. (a) State and prove the following properties of DTFT : **7.5**

(i) Correlation in time domain

(ii) Differentiation

(iii) Multiplication in time domain

(b) Compute circular convolution of two sequence : **7.5**

$x_1(n) = \{1, 1, 0, 0\}$. and. $x_2(n) = \{1, 0, 1, 0\}$ using DFT and IDFT.

5. (a) Determine Z-transform and ROC of Signal : **7.5**

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

(b) Find the input of the time invariant system with impulse response, $h(n) = \{1, 2, 3\}$ to an output signal, $y(n) = \{3, 8, 14, 8, 3\}$. **7.5**