

Code No: 156CV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, February - 2023

SIGNALS AND SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

- Note:** i) Question paper consists of Part A, Part B.  
 ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.  
 iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

## PART – A

(25 Marks)

- 1.a) List out the properties of impulse function. [2]
- b) Find the Energy of the signal  $x(t) = e^{-at}u(t)$  [3]
- c) State the Parseval's Theorem of Fourier Series. [2]
- d) Find the Fourier Transform of the unit step signal. [3]
- e) Find the convolution between two impulse functions. [2]
- f) Define Paley wiener criterion. [3]
- g) List out the Properties of ROC. [2]
- h) Find the Z-Transform of the unit step sequence. [3]
- i) Determine the Energy Spectral density function of a signal  $x(t) = e^{-at}u(t)$ . [2]
- j) Find the Nyquist rate of the signal  $x(t) = \sin c(200t) + \sin c(700t)$ . [3]

## PART – B

(50 Marks)

- 2.a) Define signal space. Give an example of a signal space, and define the term 'Basis set' for a signal space.
  - b) Find the relationship between unit step signal and signum function. [5+5]
- OR**
- 3.a) If  $x(t) = \begin{cases} 1-|t|; & -1 \leq t \leq 1 \\ 0 & \text{otherwise} \end{cases}$ ; then sketch the signal  $x\left(\frac{-t+1}{2}\right) + x\left(\frac{-t-1}{2}\right)$ .
  - b) Determine the fundamental frequency of the signal  $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$ . [5+5]
- 4.a) Find the TFS of a quarter wave odd symmetric periodic signal.
  - b) Consider a rectified sine wave signal  $x(t)$  defined by  $x(t) = A \sin(\pi t)$ . Find the complex exponential Fourier series of  $x(t)$ . [5+5]
- OR**
- 5.a) Find the Fourier Transform of a signal  $x(t) = e^{-a|t|}$ .
  - b) Find and sketch the Fourier Spectrum of the signal  $x(t) = \frac{1}{t}$ . [5+5]

- 6.a) Find and sketch the impulse response of an Ideal LPF.  
 b) Find the necessary and sufficient condition on the impulse response  $h(t)$  such that system is BIBO Stable. [5+5]

**OR**

7. The continuous-time LTI system is described by the following differential equation  
 $y'(t) + 2y(t) = x(t)$   
 a) Verify that the impulse response of this system is  $h(t) = e^{-2t}u(t)$   
 b) Is this system i) Memoryless? ii) Causal? iii) Stable? Justify your answer. [5+5]

- 8.a) State and prove final value Theorem of Laplace transform  
 b) The input and output relationship of the continuous time system is  
 $y''(t) - y'(t) - 2y(t) = x(t)$   
 Determine the step response of the system when the system is causal. [4+6]

**OR**

- 9.a) State and prove Convolution Theorem of Z-transform.  
 b) Find the Z-Transform of the signal  $x(n) = \left(\frac{1}{2}\right)^n u(n) + \left(\frac{3}{4}\right)^n u(-n-1)$ . [5+5]

10. State and prove Uniform Sampling Theorem for band limited signals with the necessary mathematical equations. Also sketch the neat graphs (in time domain, frequency domain). [10]

**OR**

- 11.a) State and prove the relationship between Auto correlation function and Energy Spectral density function.  
 b) Find the Power spectral density of the signal  $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$ . [5+5]

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