Code No: 156CV **R18**

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 $x(t)=\begin{cases}1-|t|; & -1\le t\le 1\\ 0 \quad otherwise\end{cases}$; 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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