

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, September/October - 2023

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

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)

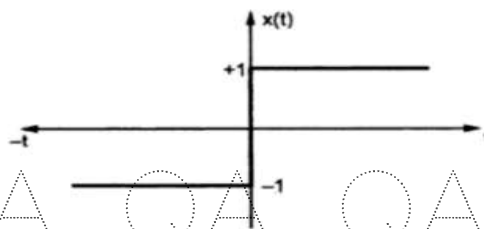
- 1.a) For the square signal, find the approximate $g(t)$ in terms of $\sin t$ so that the energy of the error signal is minimum. [2]
- b) What is orthogonality and discuss the conditions for Orthogonality? [3]
- c) What are the important classes of Fourier series methods available? [2]
- d) Define Fourier transform and Inverse Fourier transform of discrete time signal. [3]
- e) Compare system Bandwidth and signal bandwidth. [2]
- d) The input and impulse response of continuous time systems are given below. Find the output of continuous time systems. $x(t) = e^{-3t} u(t)$, $h(t) = u(t-1)$. [3]
- f) What is the Laplace Transform of Parabolic Function? [2]
- g) Find the Z-transform and ROC for the signal $x(n) = a^n u(n)$. [3]
- h) State sampling theorem for Band passes Signals. [2]
- i) Differentiate ESD and PSD. [3]

PART B

(50 Marks)

- 2.a) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$.
 - b) Draw the following signals
 - i) $u(t-3)-u(t-14)$
 - ii) $(1/3)^n u(n-3)$
- OR**
- 3.a) Find the odd and even components of the $x(n) = \{1, 2, 2, 3, 4\}$.
 - b) A function $f(t)$ is defined rectangular pulse given by:

$$f(t) = \begin{cases} 1 & 0 < t < \pi \\ -1 & \pi \leq t < 2\pi \end{cases}$$
 Approximate above function by a finite series of Sinusoidal functions. [5+5]
 - 4.a) State the conditions for the existence of fourier series.
 - b) Find the Fourier Transform of the Signum function shown in figure. [4+6]



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OR

- 5.a) Find the Fourier coefficients of $x(t)=1+\sin 2\omega t+2\cos 2\omega t+\cos(3\omega t+\pi/3)$.
b) State and prove Time Shifting property in relation to Fourier series. [5+5]

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- 6.a) Draw the ideal characteristics of LPF, HPF and BPF.
b) Let the system function of an LTI system be $1/(j\omega+2)$. What is the output of the system for an input $(0.8)^t u(t)$? [5+5]

OR

- 7.a) A system produces an output of $y(t)=e^{-3t} u(t)$ for an input of $x(t)=e^{-5t} u(t)$. Determine the impulse response and frequency response of the system.

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- b) Check whether the following system is linear, casual and time invariant or not.
 $d^3 y(t)/dt^3 + 4d^2 y(t)/dt^2 + 5dy(t)/dt + 2y^2(t) = x(t)$ [5+5]

- 8.a) Find the Laplace transform of the following signals using properties of Laplace transform
i) $x(t)=t e^{-t} u(t)$
ii) $x(t)=t e^{-2t} \sin 2t u(t)$

- b) Find the inverse Z-transform of $X(z)=z^{-1}/(3-4z^{-1}+z^{-2})$, ROC: $|z|>1$. [5+5]

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OR

- 9.a) Find the inverse Laplace transform of the following $X(s)=1/[s(s+1)(s+2)(s+3)]$.
b) Using scaling property determine the Z-transform of $a^n \cos(\omega n)$ and find its ROC. [5+5]

- 10.a) Explain the detection of periodic signals in the presence of noise by auto correlation.
b) Verify Parseval's theorem for the energy signal $x(t)=e^{-4t} u(t)$. [5+5]

OR

- 11.a) With the help of graphical example explain sampling theorem for Band limited Signals.
b) Determine the autocorrelation function and energy spectral density of $x(t)=e^{-at} u(t)$. [5+5]

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