

4. Old Question Paper

Code No: 153BT

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, October - 2020

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 2 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Show that $f(t)$ is orthogonal to signals $\cos t, \cos 2t, \cos 3t, \dots, \cos nt$ for all integer values of $n, n \neq 0$, over the interval $(0, 2\pi)$ if $x(t) = \begin{cases} 1, & \text{for } 0 < t < \pi \\ -1, & \text{for } \pi < t < 2\pi \end{cases}$
- b) Discover the analogy of vectors and signals in terms of orthogonality. [6+9]
- 2.a) Estimate the mean square error value of a function $f(t)$.
- b) Sketch the following signals (i) $r(t) - r(t-1) - r(t-3) + r(t-4)$ (ii) $\pi \left(\frac{t-2}{2}\right) + \pi(2t - 3.5)$ [7+8]
- 3.a) Assume that $T=2$, determine the Fourier series expansion of the signal shown below figure 1 with amplitude of ± 1 .

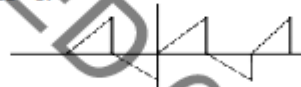


Figure: 1

- b) Prove the following properties of the Fourier transform: (i) duality (ii) modulation. [8+7]
- 4.a) Determine the exponential Fourier series from trigonometric Fourier series.
- b) Solve the Fourier transform of the rectangular pulse. [6+9]
- 5.a) Find the convolution of the rectangular pulse given below figure 2 with itself.

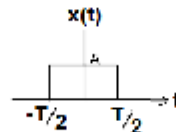


Figure: 2

- b) Explain causality and physical realizability of a system and give Paley Wiener criterion. [8+7]
- 6.a) A system produces an output of $y(t) = e^{-t} u(t)$ for an input of $x(t) = e^{-2t} u(t)$. Determine the impulse response and frequency response of the system.
- b) Compare the signals and system bandwidth. [9+6]
7. Evaluate the Laplace Transforms of the following functions:
a) Exponential function b) Unit step function c) Damped sine function. [15]
- 8.a) Prove that for a signal, auto correlation and PSD form a Fourier transform pair.
- b) A function $f(t)$ has a PSD of $S(\omega)$. Find the PSD of i) integral of $f(t)$ and ii) time derivative of $f(t)$. [7+8]

---ooOoo---

Code No: 153BT

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, March - 2021

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) State and prove the properties of Impulse Function.
- b) How to approximate the given signal using complete set of orthogonal functions? Explain with one example. [6+9]
- 2.a) Find the Exponential Fourier series of train of impulses.
- b) Find the Fourier Transform of the signal $x(t) = e^{-at}$. [7+8]
- 3.a) Find and sketch the impulse response of Ideal Band pass Filter.
- b) Find the convolution between the following signals:
 $x(t) = e^{-at}u(t); h(t) = e^{-bt}u(t)$ [7+8]
- 4.a) Find the impulse response of the system described by the differential equation.
 $y''(t) + 5y'(t) + 4y(t) = 6x(t)$
- b) State and prove initial final value Theorems of Z-transform. [7+8]
- 5.a) State and prove Sampling theorem for band limited signals.
- b) Derive the relationship between Autocorrelation function and Power spectral density function. [9+6]
- 6.a) Find the Hilbert Transform of the signal $x(t) = \cos(t) + \sin(t)$.
- b) Check the stability of the system $y(t) = tx(t)$. [7+8]
- 7.a) Derive the conditions for distortion less transmission through a system.
- b) State and prove the multiplication theorem of Fourier Transform. [7+8]
- 8.a) State and prove time shifting property of Laplace Transform.
- b) State and prove convolution theorem of z-transform. [7+8]

---ooOoo---

R18

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, March - 2022

SIGNALS AND SYSTEMS

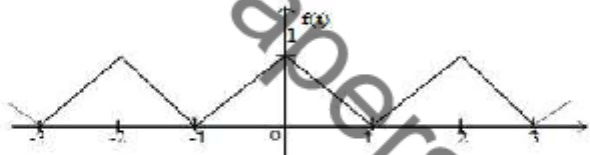
(Common to ECE, EIE)

Time: 3 Hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

1. a) Define Dirac Delta function, draw its waveform and Summarize its properties.
b) Obtain the condition under which two real signals $f_1(t)$ and $f_2(t)$ are said to be orthogonal to each other. Hence, prove that $\sin m\omega t$ and $\cos n\omega t$ are orthogonal to each other for all integer values of m, n . [6+9]
2. Classify the signals under different categories and then explain the same. [15]
3. a) State the existence conditions of fourier series.
b) Find the Trigonometric Fourier series coefficients and build Fourier series for the following signal.



- c) Explain about Complex fourier spectrum. [4+7+4]
4. a) Obtain the Fourier transform of the following signals
i) $4 \cos 2\omega t$ ii) $e^{-4t} u(t)$
b) State and prove the following properties of Fourier transform.
i) Convolution in time domain ii) Differentiation in time domain. [8+7]
5. a) With the help of plots, determine the convolution of the following two signals in time domain. $x_1(t) = e^{-4t} u(t)$ and $x_2(t) = u(t+4)$.
b) Explain about stability and causality of an LTI system. [10+5]
6. a) Perform the graphical convolution of the following signals:
 $x_1(t) = e^{-\alpha t} u(t)$; $x_2(t) = u(t) - u(t-3)$.
b) List and explain the properties of convolution and prove any one. [10+5]
7. a) Determine the Laplace transform of the following two signals.
i) $e^{-\alpha t} \sin(bt) u(t)$ ii) $x(t) = t e^{-\alpha t} u(t)$
b) State and prove the following properties of z-transform
i) Time shifting ii) Convolution [8+7]
8. a) State and explain the sampling theorem for band limited signals with graphs analysis.
b) Define cross correlation function? State and prove the properties of cross correlation function. [7+8]

---ooOoo---

R18

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, August/September - 2022

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 3 Hours

Max.Marks:75

Answer any five questions
All questions carry equal marks

- 1.a) Compare continuous-time and discrete-time signals.
b) Draw and explain the unit step signal and unit ramp signal.
c) Explain the term complete orthogonal set using relevant expressions. [4+5+6]
- 2.a) Discuss about Orthogonal Signal Space and obtain the expression for mean signal error.
b) What is signum function and explain its importance.
c) Describe the functionality of Complex exponential signals and Sinusoidal signals. [7+4+4]
- 3.a) Discuss the Dirchlet's conditions and its significance to obtain Fourier series representation of any signal.
b) State and prove the following properties of Fourier transform.
(i) Multiplication in time domain (ii) Frequency shifting. [8+7]
- 4.a) Derive the expression for Fourier Transform from Fourier Series.
b) State and prove the properties of Fourier series. [8+7]
- 5.a) When is a system said to be a Causal system?
b) State Distributive properties of convolution.
c) Explain the filter characteristics of ideal LPF, HPF and BPF using their magnitude and phase responses. [4+4+7]
- 6.a) List and explain the properties of Autocorrelation function.
b) Determine whether the following systems are Linear or Nonlinear, Shift variant or Invariant, Causal or Non-causal, Stable or unstable.
(i) $y(t) = x(t + 10) + x^2(t)$ (ii) $\frac{dy(t)}{dt} + 10y(t) = x(t)$ [7+8]
- 7.a) State and prove the time shifting, differentiation and integration properties of Z transform.
b) Determine the inverse Laplace Transform of the following functions.
(i) $1/s(s + 1)$ (ii) $3s^2 + 8s + 6 / ((s + 2)(s^2 + 2s + 1))$ [8+7]
- 8.a) Explain the detection of periodic signals in the presence of noise by correlation.
b) With the help of graphical example, explain sampling theorem for Band limited signals and also give the mathematical analysis. [7+8]

---oo0oo---

R18

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, April/May - 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) Differentiate between Vector and signal. [2]
- b) Justify why Mean Square Error criterion is preferred over Average error criterion is chosen for minimizing the error over an interval? [3]
- c) Write down the trigonometric form of the Fourier series representation of a periodic signal. [2]
- d) What is the Fourier transform of DC signal with amplitude 1? [3]
- e) Explain with suitable example what is meant by an LTI system. [2]
- f) Explain the LPF characteristics. [3]
- g) State convolution property of Z transform. [2]
- h) Find the L.T. of $x(t) = e^{-3t} \cos(2\pi 100 t) u(t)$. [3]
- i) Write the expression for cross correlation of power (periodic) signals. [2]
- j) State sampling theorem for Band passes Signals. [3]

PART B

(50 Marks)

- 2.a) Explain orthogonality property between two complex functions $f_1(t)$ and $f_2(t)$ for a real variable t .
- b) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$. [5+5]

OR

- 3.a) 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.

- b) Give the relationship between continuous time unit impulse function $f(t)$, step function $u(t)$ and ramp function $r(t)$. [5+5]