

R18

Code No: 153BT

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 $x(t) = \begin{cases} 1, & \text{for } 0 < t < \pi \\ -1, & \text{for } \pi < t < 2\pi \end{cases}$ [6+9]

- b) Discover the analogy of vectors and signals in terms of orthogonality.

- 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.

- 5.a) Find the convolution of the rectangular pulse given below figure 2 with itself.

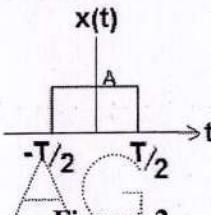


Figure: 2

- b) Explain causality and physical reliability 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 $S(w)$. Find the PSD of i) integral of $f(t)$ and ii) time derivative of $f(t)$. [7+8]