R18

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, December - 2019

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full 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 an impulse function. [2]

b) State the Dirichlets conditions for convergence of Fourier series [2]

c) State the Paley-Wiener criterion for physical realizability of the system. [2]

d) Find the Laplace Transform of the signal $x(t)=\sin(t)+\cos(t)$ [2]

e) What is meant by Aliasing? [2]

f) What is complete set of orthogonal functions? [3]

g) Find and Sketch the Fourier Spectrum of the signal $x(t)=\frac{1}{t}$ [3]

h) Find and Sketch the conditions for distortion less transmission System. [3]

i) Find the Z-Transform of the sequence $x(n)=a^n u(n)-(b)^n u(-n-1)$ [3]

j) Determine the Autocorrelation Function of a signal $x(t)=e^{-at}u(t)$ [3]

PART – B

(50 Marks)

2.a) Define signal space. Give an example of a signal space, and also define the term 'basis set' for a signal space.

b) Find the even and odd components of an unit step signal, and also show that these components are orthogonal functions. [5+5]

OR

3.a) If $x(t)=\begin{cases}1-|t|; & -1\le t\le 1\\ 0 & oterwise\end{cases}$; then sketch the signal $x\left(\frac{-t+1}{2}\right)+x\left(\frac{-t-1}{2}\right)$

b) How to approximate a function by set of mutually orthogonal functions. Derive the necessary equations. [5+5]

4.a) Find the TFS of an even symmetric square wave periodic signal with period T_0.

b) Find the TFS of a Quarter wave odd symmetric periodic signal. [5+5]

OR

5.a) If $x(t)$ and $X(\omega)$ forms the Fourier Transform pair, then find the Inverse Fourier Transform of: i) $X(\omega)=\frac{1}{1+\omega^2}$ ii) $X(\omega)=\operatorname{sgn}(\omega)$

b) $x(t)$ and $X(\omega)$ forms the Fourier Transform pair, prove that, if $x(t)$ is real and even, then $X(\omega)$ is also real and even. [5+5]

6. 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]

OR

7.a) Find the necessary and sufficient condition on the impulse response $h(t)$ such that system is BIBO Stable.

b) Find and sketch the impulse response of an Ideal BPF. [5+5]

8.a) Determine the Laplace Transform ,also sketch the pole, zero locations, and associated ROC of the signal $x(t)=-e^{-at}u(-t), \quad a<0$.

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. [5+5]

OR

9.a) State and prove Final value Theorem of Z-Transform.

b) If $h(n)$ and $H(Z)$ forms Z-Transform pair, then find the Inverse Z-Transform of $Z^{-N}H\left(-Z^{-1}\right)$. [5+5]

10.a) Derive Relation between correlation and convolution.

b) Find the convolution of the following signal by graphical method

$x(t)=e^{-3t}u(t), h(t)=u(t+3)$ [5+5]

OR

11.a) Determine the output of the system for the input $x(t)$ and the impulse response of the system is $h(t)$, where $x(t)=\begin{cases}1; & -0.5\le t\le 0.5\\ 0; & otherwise\end{cases}$ and $h(t)=\begin{cases}1; 0\le t\le 1\\ 0; \ otherwise\end{cases}$

b) Derive the relationship between Autocorrelation Function and Power Spectral density. [5+5]

---ooOoo---