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328455(28)

B. E. (Fourth Semester) Examination, April-May 2020

(New Scheme)

(ET & T Engg. Branch)

SIGNALS and SYSTEMS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory & carries 2 marks. Solve any two from (b), (c) and (d) and carries 7 marks.*

Unit-I

1. (a) Define causal and non-causal signal. 2

(b) Sketch the signal $x(t) = e^{-a|t|}$ and $a > 0$. Also determine whether the signal is a power signal or an energy signal or nither. 7

(c) Assume $x_1(t)$ and $x_2(t)$ are periodic signals with periods T_1 and T_2 respectively under what conditions is the sum $x(t) = x_1(t) + x_2(t)$ periodic and what will be the period of $x(t)$ if it's periodic. 7

(d) Check whether the following system are static or dynamic, linear or non linear, causal or non causal and time invariant or time variant. 7

(i) $y(n) = x(n)\, x(n-1)$

(ii) $y(n) = \cos[x(n)]$

Unit-II

2. (a) State Dirichelets conditions for the existence of continuous time Fouriers series. 2

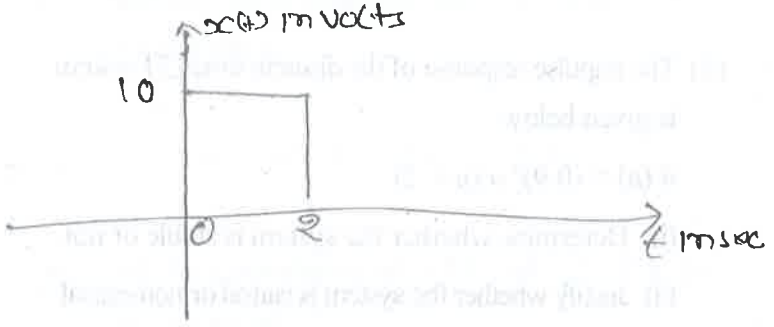
(b) State and prove following properties of Fourier transform. 7

(i) Linearity

(ii) Time shifting

(iii) Time scaling

(c) Obtain the Fourier transform and plot spectrum of a rectangular pulse of duration 2 second and having a magnitude of 10 volts as shown in below figure. 7



(d) Exlplain with example Fourier series wave symmetry conditions. 7

Unit-III

3. (a) State initial value theorem and final value theorem. 2

(b) Define the ROC of z transform and state the properties of the ROC. 7

(c) Find z-transform and ROC of the following sequence : 7

(i) $x(n)=\left(\frac{2}{3}\right)^n u(n)+\left(\frac{1}{2}\right)^n u(n)$

(ii) $x(n)=n^2u(n)$

(d) The impulse response of the discrete time LTI system is given below

$h(n) = (0{\cdot}9)^n\, u(n+2)$ 7

(i) Determine whether the system is stable or not.

(ii) Justify whether the system is causal or non causal.

Unit-IV

4. (a) Define Invertible LTI system. 2

(b) An LTI system with input $x(t)$ and output $y(t)$ is described by following differential equation.

$$\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=x(t);\quad t\geq 0$$

Initial conditions $y(0) = 3$, $\left.\frac{dy(t)}{dt}\right|_{t=0} = 4$

Find the natural response $y_N(t)$, forced response $y_F(t)$ and total response $y(t)$ of the system for $r(t) = u(t)$. 7

(c) Determine the frequency response, magnitude response, phase response and time delay of the system given by 7

$$y(n)+\frac{1}{2}y(n-1)=x(n)-x(n-1)$$

(d) Find the convolution of $x_1(t)$ and $x_2(t)$ for the following signal : 7

(i) $x_1(t) = e^{-at}\, u(A)$ and $x_2(t) = e^{-bt}\, u(t)$

(ii) $x_1(t) = \sin t\, u(t)$ and $x_2(t) = u(t)$

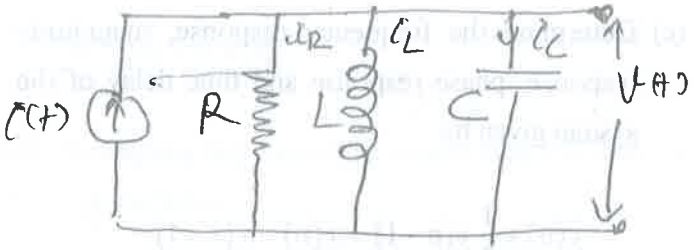
Unit-V

5. (a) Define the state of system. 2

(b) Find state equation of a continuous-time LTI system with differential equation. 7

$$\frac{d^3y(t)}{dt^3}+2\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+4y(t)=5x(t)$$

(c) Obtain the state model of the parallel RLC network as shown in below figure. 7



(d) Find state equation of a discrete-time LTI system with system function. 7

$$H(z)=\frac{b_0+b_1z^{-1}+b_2z^{-2}}{1+a_1z^{-1}+a_2z^{-2}}$$