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

(New Scheme)

(Electronics and Telecommunication Engineering Branch)

SIGNALS & SYSTEMS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each units is compulsory.Attempt any **two** parts from (b), (c) and (d).*

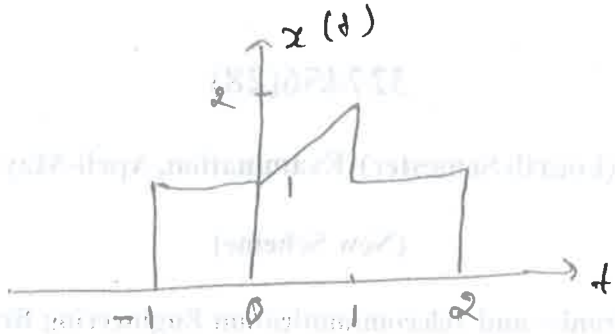
Unit - I

1. (a) Define even and odd signal. 2

(b) Sketch the following signal : 7

(i) $x(t-3)$ & $x(t+3)$

(ii) $x(5/3t)$ & $x(3/5t)$



(c) Find whether the signal : 7

$$x(t)=\begin{cases}(t-2), & -2\le t\le 0\\ (2-t), & 0\le t\le 2\\ 0, & \text{otherwise}\end{cases}$$

is energy signal or power signal. Also find the energy and power of the signal.

(d) Check whether the following system are : 7

(i) Static or Dynamic

(ii) Linear or non-linear

(iii) Causal or Non-causal

(iv) Time-invariant or time-variant

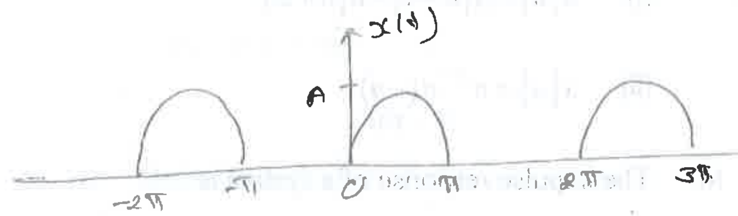
(a) $\frac{\partial^3 y}{\partial t^3}+2\frac{\partial^2 y}{\partial t^2}+4\frac{\partial y(t)}{\partial t}+3y^2(t)=x(t+1)$

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

Unit - II

2. (a) State Dirichlet's condition for the existence of fourier series. 2

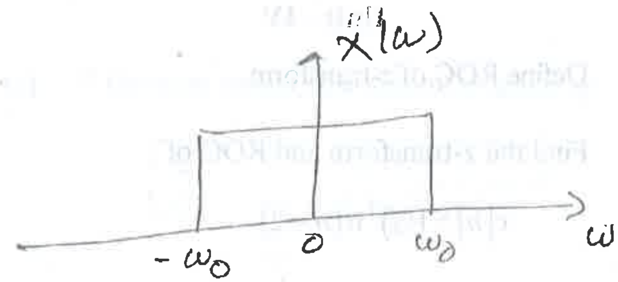
(b) Find the fourier series expausion of the half wave rectified sine wave shown in fig. 7



(c) Find the fourier transform of the signal :

$$x(t)=\cos w_0 t\ u(t)$$ 7

(d) Find the time domain signal corresponding to the spectrum shown in fig. 7



Unit - III

3. (a) State sampling theorem. 2

(b) Find the convolution of the following signals :

$$x_1(t) = e^{-2t}u(t),\ x_2(t) = e^{-ut}u(t)$$ 7

(c) Using properties of DTFT, find the : 7

(i) $x[n] = u[n+1] - u[n+2]$

(ii) $x[n] = n^{3^{-n}}u(-n)$

(d) The impulse response of a system is :

$$h(n) = \begin{cases} 1 & \text{for } 0 \le n \le n-1 \\ 0 & \text{otherwise} \end{cases}$$

Find the transfer function, frequency response, magnitude response and phase response. 7

Unit - IV

4. (a) Define ROC of *z*-transform. 2

(b) Find the z-transform and ROC of :

$$x[n] = (½)^n u(n-2)$$ 7

(c) Using long division, determine the inverse *z*-transform of

$$x(z) = \frac{z^2 + z + 2}{z^3 - 2z^2 + 3z + 4},\ \text{ROC}|z| < 1$$ 7

(d) Determine the impulse response of the system described by the difference equation.

$$y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$$

using z-transform. 7

Unit - V

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

(b) Find the direct form I and direct form II realization of the discrete time system represented by the transfer function *H* (*z*) as :

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z - 1/4)(z^2 - z + ½)}$$ 7

(c) If the state model of a system is given by :

$$\begin{bmatrix} x_1'' \\ x_2'' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}\begin{bmatrix} x_1' \\ x_2' \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = [-2 \ -1]\begin{bmatrix} x_1' \\ x_2' \end{bmatrix} + [1]U(k)$$

find the transfer function of the system. 7

(d) Determine the state model of the system governed by the equation :

$$y(n) = -2y(n-1) + 3y(n-2) + 0\cdot 5y(n-3) + 2x(n)$$
$$+1\cdot 5y(n-1) + 2\cdot 5x(n-2) + 4x(n-3)$$ 7