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328455(28)

B. E. (Fourth Semester) Examination, ~~2020~~
APR-MAY 2022

(New Scheme)

(ET & T Engg. Branch)

SIGNALS and SYSTEMS

Time Allowed : Three hours

Maximum Marks : 80

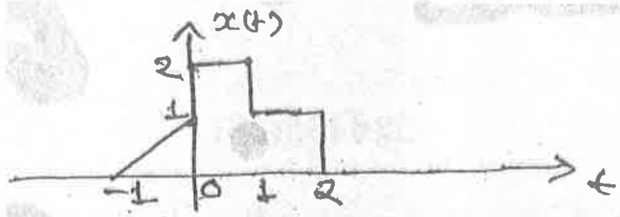
Minimum Pass Marks : 28

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 invertiable system.

(b) For the signal $x(t)$ shown in figure, sketch the following signals :



(i) $x(t-2)$

(ii) $x(2t+3)$

(iii) $x(-t+1)$

(c) Given a trapezoidal pulse :

$$x(t)=\begin{cases} t+5, & -5\le t\le -4 \\ 1 & -4\le t\le 4 \\ 5-t & 4\le t\le 5 \end{cases}$$

Determine the total energy and power of $x(t)$. Also find the total energy and power of the differentiated signal :

$$y(t)=\frac{d}{dt}x(t)$$

(d) Check whether the following system are :

(i) Static or dynamic

(ii) Linear or non-linear

(iii) Causal or non causal

(iv) Time invariantor time variant

$$y(n)=\sum_{k=0}^{n+1}x(k+1)$$

Unit-II

2. (a) Define Hilbert transform.

(b) State and prove following properties of a continuous time fourier transform.

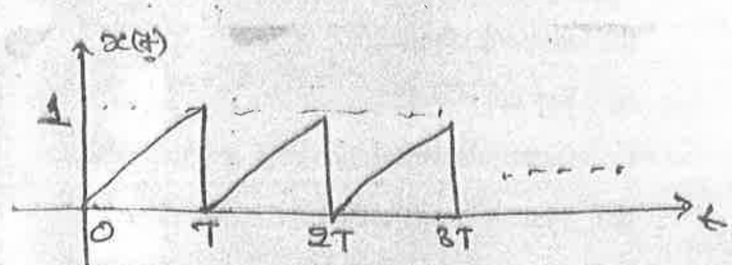
(i) Scaling

(ii) Time shifting

(iii) Linearity

(c) Find the fourier transform and energy spectral density of $x(t)=Ae^{at}u(-t)$. Also plot the amplitude and phase spectra.

(d) Determine the exponential fourier series for the periodic sawtoth waveform as shown in fig. :



Unit-III

3. (a) Write the condition for stability and causality of any discrete sequence $h(n)$.

(b) State and prove following properties of Z-transform :

(i) Time shifting

(ii) Differentiation

(c) Find $X(z)$ and sketch the ROC of $x(n) = a^{|n|}$ for $a < 1$ and $a > 1$.

(d) A linear time invariant is characteristized by the system function :

$$H(z) = \frac{1}{1 - 2{\cdot}5z^{-1} + z^{-2}}$$

Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions :

(i) System is stable

(ii) System is causal

(iii) System is anti-causal

Unit-IV

4. (a) Define transfer function.

(b) Explain the following properties of continuous time LTI system in term of impulse response :

(i) Memory less LTI system

(ii) Causal LTI system

(iii) Stable LTI system

(c) Obtain the graphical convolution of

$x(t) = u(t) - u(t-3)$ and $h(t) = u(t) - u(t-2)$.

(d) Consider on LTI system with differential equation

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

find the frequency response and impulse response.

Unit-V

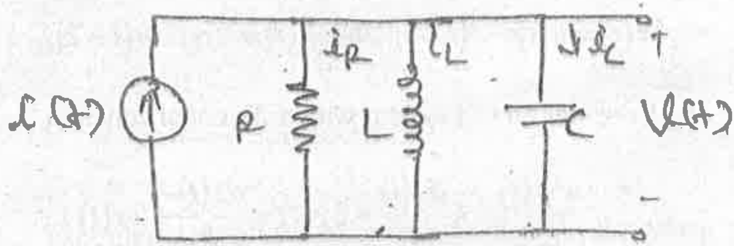
5. (a) What are the advantages of representing system in state space representation?

(b) Find the state space representation of the following system whose differential equation representation is :

$$\frac{d^3y(t)}{dt^3}+3\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)$$

$$=\frac{d^2x(t)}{dt^2}+\frac{6\,dx(t)}{dt}+5x(t)$$

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



(d) Find state equation of a discrete time system described by

$$y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)$$