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[5559]-131

S.E. (E & TC/Electronics) (I Sem.) EXAMINATION, 2019

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

Instructions to the candidates:

- 1) Attempt four question as Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary

Q1) a) Perform the following operations on the given signal $x(t)$ which is defined as [2]

$$x(t) = 2 * \text{rect}\left(\frac{t}{4}\right)$$

Sketch $z(t) = x(-t - 1)$

- b) Write the expression for energy and power of the signal. Also Determine [4]
whether the following signal is Energy or Power. and find energy or time
averaged power of the signal.

$$x(t) = 5\cos(10\pi t) + 5\sin(20\pi t) \quad ; -\infty \leq t \leq \infty$$

- c) Determine whether the following system is Static/Dynamic. Causal/Non Causal [3]
and stable/Un Stable and justify.

$$h(t) = 2 * \text{rect}\left(\frac{t}{10}\right)$$

- d) Determine the step response of the following systems whose impulse responses [4]
is

$$h(t) = e^{-5t}u(t)$$

P.T.O.

OR

- Q2) a) Compute the convolution integral by graphical method and sketch the output for the following signals. [4]

$$x(t) = u(t)$$
$$h(t) = e^{-2t} u(t)$$

- b) Check whether the following signal is even or odd and determine the even and odd part of the signal. [4]

$$x(t) = u(t)$$

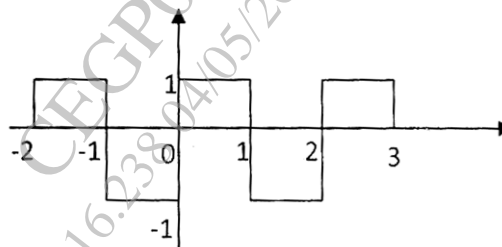
- c) Compute the convolution integral for the following signal [2]

$$x(t) = u(t), \quad h(t) = \delta(t+1) + \delta(t) + \delta(t-1)$$

- d) Determine whether the following signals are periodic or not. if periodic find the fundamental period of the signal

$$x(t) = \cos(t) + \sin(2t)$$

- Q3) a) Find the Trigonometric/Exponential Fourier series for the periodic signal $x(t)$ shown in following figure. [6]



- b) Find Fourier transform of the following signal [6]

$$\frac{d}{dt} \{ (e^{-3t} u(t) * e^{-3t} u(t-2)) \}$$

OR

- Q.4 a) Find the Fourier transform of the following signals [4]

1. $x(t) = \sin(t)$

2. $x(t) = \cos(\omega_0 t) u(t)$

- b) State the dirichlet conditions for existence of Fourier series. Define amplitude and Phase spectrum. [5]

- c) Write expression for Trigonometric Fourier series and Exponential Fourier series. [3]

Q.5 a) Find the inverse Laplace transform of [6]

$$X(s) = \frac{2}{(s+4)(s-1)}$$

If the Region of convergence is

- a. $-4 \leq \operatorname{Re}(s) < 1$
- b. $\operatorname{Re}(s) > 1$
- c. $\operatorname{Re}(s) < -4$

b A signal $x(t)$ has Laplace transform [6]

$$X(s) = \frac{s+2}{s^2+4s+5}$$

Find the Laplace transform of the following signals

- a. $y_1(t) = \frac{d}{dt}(x(t))$
- b. $y_2(t) = x(2t)$

OR

Q6) a Find the Laplace transform of the following signal and sketch ROC [6]

$$x(t) = e^{-3t}u(t) + e^{-5t}u(t)$$

b Find the initial and final value of the following signal [4]

$$X(s) = \frac{2s+3}{s^2+5s-7}$$

c State the relationship between Fourier transform and Laplace transform. [2]

Q7) a) Define the following terms [2]

- 1. Autocorrelation
- 2. Cross correlation

b State the properties of Probability Density Function (PDF) [3]

c A random variable X has PDF [4]

$$f_X(X) = 5X^2 ; 0 \leq x \leq 1$$
$$= 0 ; \text{elsewhere}$$

Find $E[X]$, $E[3X-2]$, $E[X^2]$ and standard deviation

d Explain Uniform distribution model with respect to its density and distribution function. [4]

OR

- Q.8 a Consider the experiment as rolling of two dice. Find the CDF for the random variable X if it assigns the sum of numbers appearing on the dice to each outcome. [6]
- b A box contains 4 white, 10 Red and 15 black balls. A ball is drawn at random find the probability that it is 1) Red 2) Not black 3) Black or white [3]
- c Explain Gaussian distribution model with respect to its density and distribution function. [4]