Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[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]

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

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

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

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

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

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

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

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

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]

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

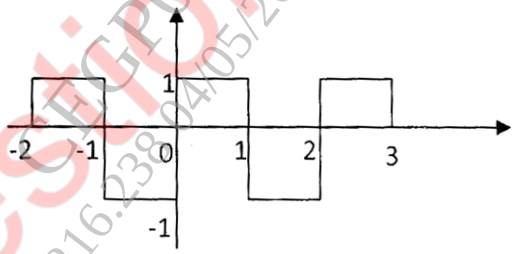
c) Compute the convolution integral for the following signal [2]

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

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. $-4 \leq Re(s) < 1$
b. $Re(s) > 1$
c. $Re(s) < -4$

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]

$$f_X(X) = 5X^2 \quad ; 0 \leq x \leq 1$$

$$= 0 \quad ; elsewhere$$

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]