Total No of Questions: [XII] **SEAT NO. :**

[Total No. of Pages : 3]

S.E. 2008 (E&TC/Electronics)Examination

Signals and Systems (204181)

Semester - I

Time: 3 Hours **Max. Marks : 100**

Instructions to the candidates:

1) *Answers to the two sections should be written in separate answer books.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data if necessary*

SECTION I

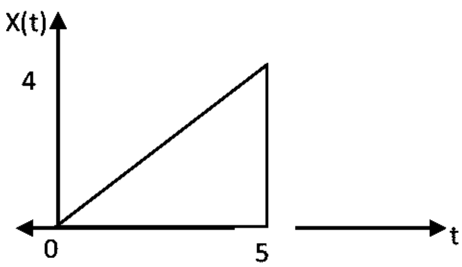
Q1) a) Find whether following signals are periodic. If yes find the period [8]

i) $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$

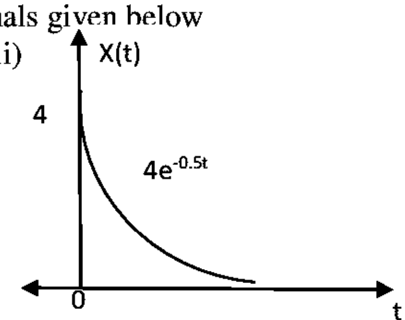
ii) $x[n] = \cos[5\pi n]$

b) Sketch an even and odd components of the signals given below [8]

i)



ii)



OR

Q2) a) A discrete time signal x[n] is given as y[n]={-2, -3, <u>**2**</u>, 2, 0, -2} [8]

Sketch the following

i) $x[n-4]$

ii) $x[2n]$

iii) $x[-n+3]$

iv) $x[\frac{n}{2}]$

b) For each of the following systems determine whether they are causal, memory less, linear and time invariant [8]

i) $y[n] = \log_{10}|x[n]|$

ii) $x(t) = \frac{dy(t)}{dt} + 5y(t)$

Q3) a) Determine the convolution integral of [10]

$x(t) = \ e^{-at}u(t)$

$h(t) = \ u(t)$

b) Explain the following properties of liner convolution [8]

i) Commutative

ii) Distributive

iii) Associative

iv) Shifting

OR

Q4) a) Test the stability of the LTI system where impulse responses are given below [8]

i) $h(t) = e^{-t}u(t-1)$

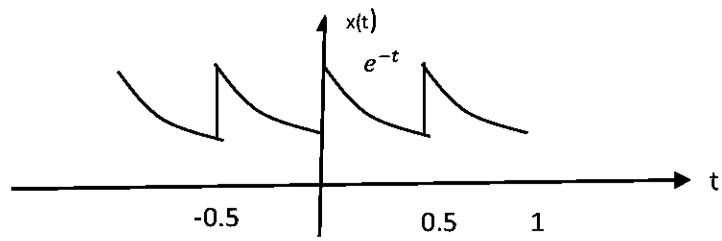
ii) $h(t) = \frac{1}{RC}e^{-\frac{t}{RC}}u(t)$

b) Find convolution of following signals using graphical method [10]

$$x[n] = \{1, 0, -1, 2, 1\}$$
$$y[n] = \{1, 2, -1, 2\}$$

Q5) a) Write the equation for three types of Fourier series representation [6]

b) Find exponential Fourier series for given signal [10]



OR

Q6) a) State and prove following properties of Fourier transform [8]

i) Convolution in Time domain

ii) Integration in Time domain

b) Find the Fourier Transform of [4]

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

c) Find inverse Fourier Transform of [4]

$$X(jw) = \frac{4jw + 1}{(4jw + 1)^2}$$

SECTION II

Q7) a) Find the Laplace Transform of the following signals [10]

i) $x(t) = t\, e^{-2t}u(t)$

ii) $x(t) = e^{-at}\sin(wt)u(t)$

b) Find Initial and Final values of the x(t) if the Laplace transform of the signal is [8]

$$X(S) = \frac{8s^2 + s}{S^2 + 2s - 2}e^{-4s}$$

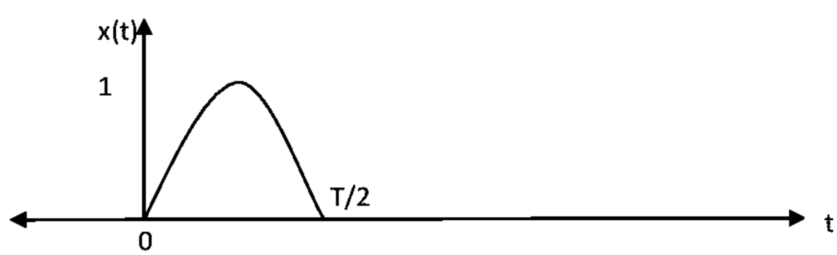
OR

Q8) a) State and prove convolution following properties of Laplace transform [8]

i) Time Scaling

iii) Differentiation in Time domain

b) Find Laplace Transform of the half sine pulse as shown below [10]



Q9) a) Prove that for any energy signal x(t) the autocorrelation function and energy spectral density forms a Fourier Transform pair [8]

b) Find the energy spectral density and total energy of content of the sinc pulse given below [8]

$x(t) = Asinc(2wt) \leftrightarrow \frac{A}{2w} rect(\frac{f}{2w})$

OR

Q 10) a) Determine cross correction between two sequences [8]
x1(n) = {1, 3, 4, 5} and x2(n) = {2, 1, 3, 4}

b) Define autocorrelation function energy of energy signal and state and prove all its properties [8]

Q 11) a) A three digit message is transmitted over a noisy channel having probability of error as p(e)= 1/5 per digit. Find out the corresponding CDF [8]

b) Define following for the random variable [8]
i) Moment
ii) Expectation
iii) Variance
iv) Standard deviation

OR

Q 12) a) Explain Gaussian probability model with respect to its density and distribution function. [8]

b) The probability density function of a random variable is given by [8]

$$f_x(x) = xe^{-\frac{x^2}{2}} \; for\; x \geq 0$$

$$= 0 \qquad for\; x < 0$$

Find i) CDF ii) 0.5 < p(x) ≤ 2