of fice copy

Roll Number:_____

Thapar University, Patiala

Department of Electronics and Communication Engineering

END SEMESTER EXAMINATION

B. E. (Second Year): Semester-III (2017/18) (ECE/ENC)	Course Code: UEC404 Course Name: Signals and Systems
11th December, 2017	Monday, 9.00 – 12.00 Hrs.
Time: 3 Hours, M. Marks: 100	Name of Faculty: US, SP, MK, NS,SK

Note: ***Attempt all questions***
Assume missing data, if any, suitably

Q.1 (a) Determine and plot the even and odd components of a signal (10)

$$x(t) = \begin{cases} 2e^{-2t}, & t > 0 \\ 0, & t < 0 \end{cases}$$

Q.1 (b) Consider the system with input x(t)and output y(t) given by (4+6=10)

$$y(t) = \sum_{n=0}^{3} x(t)\delta(t - nT)$$

(i) Is this system linear?

(ii) Suppose that input to the system is $x(t) = cos(2\pi t)$. Sketch and label the output y(t) for each of the following values of T: 1 and 0.5

Q.2 (a) The input and the output of a causal LTI system are related by differential equation: $\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$ (10)

i) Find the impulse response of the system.

ii) What is the response of this system if $x(t) = te^{-2t}u(t)$?

Q.2 (b) Find the inverse Laplace transform of (10)

$$X(s) = \frac{-5s - 7}{(s+1)(s-1)(s+2)}$$

if the ROC is

i) $\mathcal{R}\{s\} > 1$

ii) $\mathcal{R}\{s\} < -2$

iii) $-1 < \mathcal{R}\{s\} < 1$

iv) $-2 < \mathcal{R}\{s\} < -1$

Q.3 (a) Determine the z-transform of (8)

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

and depict the ROC and the locations of poles and zeros in the z-plane.

Q.3 (b) Given the following five facts about a discrete-time signal x(n) with z-transform X(z) (12)

i) x(n) is real and right-sided

ii) X(z) has exactly two poles.

iii) X(z) has two zeros at the origin

iv) X(z) has a pole at z= $(1/2)^{e^{j\pi/3}}$

v) X(1) =8/3

Determine X(z) and specify its ROC

Q.4 (a) With the help of discrete Fourier transform (DFT) and inverse DFT, determine the sequence corresponding to the circular convolution of $x_1(n)$ and $x_2(n)$. The sequences $x_1(n)$ and $x_2(n)$ are defined as follows: (10)

$$x_1(n)=\{2,1,2,1\} \text{ and } x_2(n)=\{1,2,3,4\}$$

Q. 4(b) Consider x(n) = $\{\alpha_0, \alpha_1, \alpha_2, \alpha_3\}$ where α_i; *i=0,1,2,3* are real numbers. If DFT[x(2n)] = {4, -2} and DFT [x(2n + 1)] = {6 , -2}, then determine the sequence x(n). (10)

Q.5 (a) Two manufacturing plants produce similar parts. Plant 1 produces 1000 parts, 100 of which are defective. Plant 2 produces 2000 parts, 150 of which are defective. A part is selected at random and found to be defective. What is the probability that it came from plant 1? (05)

Q.5 (b) Consider a random process $X(t)$ defined by $X(t) = Acos(\omega t + \theta)$, $-\infty < t < \infty$, where A and ω are constant and θ is a uniform random variable over $(-\pi, \pi)$. Show that $X(t)$ is wide sense stationary process. (05)

Q. 5 (c) Let X be a continuous random variable with pdf (10)

$$f_X(x) = \begin{cases} kx & 0 < x < 1 \\ 0 & otherwise \end{cases}$$

where k is a constant.

(i) Determine the value of k and sketch $f_X(x)$

(ii) Find and sketch the corresponding CDF $F_X(x)$

(iii) Find $P\left(\frac{1}{4} < X \leq 2\right)$.

**********END**********

The answer sheets will be shown on 20-12-17 in room no E101 at 10 a.m.