Branch: Electronics and Telecommunication Engineering   **Sem.:- IV**
Subject:- Signals and Systems (BTEXC404)   **Marks: 60**
Date:- 02/12/2019   **Time:- 3 Hr.**

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Instructions to the Students
1. Each question carries 20 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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	(Marks)

Q.1. a)   Prove the following: (06)
  1. Even signal × Even signal = Even signal
  2. Odd signal × Odd signal = Even signal
  3. Even signal × Odd signal = Odd signal

Q.1. b)   Determine whether the following system is linear or not: (06)
  1. $y(t) = n. \, x(t)$
  2. $y(n) = x^2(n)$
  3. $y(n) = 2 \, x(n) - 3$

Q.2. a)   (i) Determine and sketch convolution of the following two signals: (06)

   $x(t) \quad = 1, \quad -1 < t < 1$
   $\quad\quad = 0, \quad$ otherwise

   $h(t) \quad = \delta(t+1) + 2\delta(t+2)$

   (ii) compute convolution of the following signals: (06)
   $$y(n) = u(n) * u(n)$$

Q.2. b)   Write a note on   (06)
  1. causality for LTI system
  2. stability for LTI system

Q.3. a) For $x(t)$ an even signal i.e. $x(t) = x(-t)$, prove that the trigonometric **(06)** Fourier Series coefficients become,

$$a_0 = \frac{2}{T} \int_0^{T/2} x(t) \, dt$$

$$a_n = \frac{4}{T} \int_0^{T/2} x(t) \cos(nw_0 t) \, dt$$

$$b_n = 0$$

Q.3. b) State and prove any five properties of Continuous time Fourier **(06)** series.

Q.4. a) Find the Fourier transform of the unit step function $u(t)$. **(06)**

Q.4. b) Find DTFT of the following sequence, **(06)**
$x(n) = a^n \, u(n)$ where $|a| < 1$.
Also find magnitude and phase of the DTFT.

Q.5. a) Determine the inverse Z-transform of the following function using **(06)** power series expansion (long division) method.
$$X(z) = 1/(1-0.5z^{-1}) \quad |z| > 0.5$$

Q.5. b) A causal discrete LTI system is described by the following equation, **(06)**
$$y(n) - (3/4)y(n\text{-}1) + (1/8)y(n\text{-}2) = x(n)$$
where $x(n)$ and $y(n)$ are the input and the output of the system respectively. Determine the system transfer function $H(z)$ and impulse response $h(n)$ of the system.

Q.6. a) A card is drawn at random form an ordinary deck of 52 playing **(06)** cards. Find the probability of its being (a) an Ace (b) a six or a Heart (c) neither a Nine nor a Spade.

Q.6. b) In a factory, four machines A1, A2, A3 and A4 produce 10%, 20%, **(06)** 30% and 40% of the items, respectively. The percentage of defective items produced by them is 5%, 4%, 3% and 2%, respectively. An item selected at random is found to be defective. What is the probability that it was produced by the machine A2?

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