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Total No. of Pages : 03

Total No. of Questions : 09

**B.Tech.(Electronics Engg.) (2012 Onwards)**  
**B.Tech.(ECE/ETE/Electronics & Computer Engg.) (2011 Onwards)**  
**(Sem.-4)**

**SIGNAL AND SYSTEMS**

Subject Code : BTEC-402

M.Code : 57594

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. **SECTION-A** is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

**SECTION-A**

**Q1. Answer briefly :**

- a) Differentiate between continuous time and discrete time systems.
- b) Determine whether the system is linear or non-linear  $y(n) = x(n^2)$ .
- c) State Parseval's relation for discrete-time aperiodic signals.
- d) Give the significance of ROC in Z-transform.
- e) Determine the Nyquist sampling rate and Nyquist sampling interval for the signal  $x(t) = \sin c^2(200\pi t)$ .
- f) What is the necessary and sufficient condition on impulse response for stability of a causal LTI system?
- g) What do you mean by statistical independence?
- h) What are the Dirichlet's conditions of Fourier series?
- i) How can you classify Random processes?
- j) List two properties of DTFT.

## SECTION-B

Q2. Find the trigonometric Fourier series for the periodic signal shown

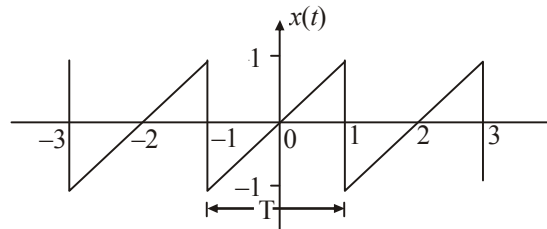


Fig.1

Q3. Consider the probability density  $f(x) = ae^{-b|x|}$  where  $x$  is a random variable whose allowable value range from  $x = -\infty$  to  $x = +\infty$ . Find :

- The cumulative distribution function  $F(x)$
- The relationship between  $a$  and  $b$  and
- The probability that the outcome  $x$  lies between 1 and 2.

Q4. Determine the Z-transform and sketch the ROC of :

$$x(n) = \begin{cases} \left(\frac{1}{3}\right)^n, & n \geq 0 \\ \left(\frac{1}{2}\right)^{-n}, & n < 0 \end{cases}$$

Q5. What is Fourier transform? Write down its properties.

Q6. A discrete random variable has  $k$  equally likely possible values 0,  $a$ ,  $2a$ ,  $3a$

$(k-1)a$ . Find mean, second moment and standard deviation.

**SECTION-C**

Q7. The input and output of a causal LTI system are related by the differential equation,

$$d^2y(t)/dt^2 + 6dy(t)/dt + 8y(t) = 2x(t)$$

- a) Find the impulse response of the system.
- b) What is the response of this system if  $x(t) = t e^{-2t} u(t)$

Q8. a) Find whether the following signals are periodic or not?

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

- ii)  $x(t) = 3\cos 4t + 2\sin t$

b) Determine whether the following signals are energy signals or power signals and why?

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

- ii)  $x(t) = \sin \omega_1 t + \cos \omega_2 t$

Q9. a) A box contains 3 red, 4 white and 5 black balls. One ball is drawn at random. Find the probability that it is :

- i) red ball
- ii) not black ball
- iii) black or white ball.

b) In a random experiment a trial consists of five successive tosses of a coin. If we define a random variable  $X$  as the number of tails appearing in a trial, determine and plot CDF for the random variable.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**