Hall Ticket No | | | | | | | | | | | Question Paper Code: AEC003

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Regular) - November, 2018

Regulation: IARE – R16

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Time: 3 Hours **(ECE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) How do you explain statistically independent events using Baye's rule? **[7M]**

   (b) In a certain college, 4% of the men and 1% of the women are taller than 6 feet. Furthermore, 60% of the students are women. Now if a student is selected at random and is taller than 6 feet, what is the probability that the student is women? **[7M]**

2. (a) Find P(A|B) if (a) $A \cap B = 0$ (b) A^c B (c) B^c A. **[7M]**

   (b) Suppose that a laboratory test to detect a certain disease has the following statistics. Let A= event that the tested person has the disease B= event that the test result is positive it is known that P(B/A)= 0.99 and P(B/$\bar{A}$)= 0.005 and 0.1 percent of the population actually has the disease. What is the probability that a person has the disease given that the test result is positive? **[7M]**

UNIT – II

3. (a) A continuous random variable X that can assume any value between x=2 and x=3 has a density function given $f(x) = k(1+x)$. Find $P(X < 4)$. **[7M]**

   (b) For the triangular distribution $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ Find the mean and variance. **[7M]**

4. (a) Show that the Poisson distribution can be used as a convenient approximation to the binomial distribution for large n and small p. **[7M]**

   (b) A fair die is tossed. Let X denotes twice the number appearing, and let Y denotes 1 or 3 according as an odd or an even number appears. Find the distribution, expectation, variance and standard deviation of (i) X (ii) Y (iii) X+ Y. **[7M]**

UNIT – III

5. (a) Define the joint Distribution function and explain the properties of joint Distribution function? **[7M]**

   (b) Consider the bivariate r.v. (X, Y) $f_{XY}\,(x,y) = \begin{cases} k(x+y), & 0<x<2, 0<y<2 \\ 0, & otherwise \end{cases}$

   (i) Find the conditional pdf's fY/X (y / x) and fX/Y,(x/y). **[7M]**
   (ii) Find P(0 < Y < 1/2, X = 1).

6. (a) Explain and derive central limit theorem. **[7M]**

   (b) The joint pdf of a bivariate r.v. (X, Y) is given by $f_{XY}\,(x,y) = \begin{cases} k(x+y), & 0<x<2, 0<y<2 \\ 0, & otherwise \end{cases}$

   where k is a constant.
   (i) Find the value of k.
   (ii) Find the marginal pdf's of X and Y. **[7M]**

UNIT – IV

7. (a) A random process is defined as X(t)=A.sin(ωt+θ) where A is a constant and 'θ' is a random variable, uniformly distributed over(-π,π). Check X(t) for stationary. **[7M]**

   (b) Define Ergodic process. State and explain various properties of autocorrelation function **[7M]**

8. (a) Define random process and classify the random process with example. **[7M]**

   (b) Consider a random variable process X(t)=a cosωt , where 'ω' is a constant and a is a random variable uniformly distribution over (0,1). Find the auto correlation and covariance of X(t)? **[7M]**

UNIT – V

9. (a) State and explain various properties power spectral density function. **[7M]**

   (b) An ergodic random process is known to have an auto correlation function of the from

   $$R_{XY}(\tau) = 1 - |\tau|, |\tau| \leq 1$$
   $$= 0, |\tau|, > 1$$

   Show the spectral density is given by $S_{XY}(\omega) = \left[\frac{\sin \omega/2}{\omega/2}\right]^2$. **[7M]**

10. (a) Briefly explain the concept of cross power density spectrum. **[7M]**

    (b) Find the auto correlation function of the process X(t) for which the power density spectrum is given by $S_{XX}\,(w) = \begin{cases} 1+w^2, & |w| \leq 1 \\ 0, & |w| > 1 \end{cases}$ **[7M]**