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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Supplementary) - January, 2019

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) Define following types of events. i) Simple events ii) Conditional events iii) Independent events iv)Joint events with examples **[7M]**

   (b) Five men in a company of 20 are graduates. Three men are picked out of 20 at random. **[7M]**

   (i) What is the probability that all are graduates?

   (ii) What is the probability of at least 1 is a graduate?

2. (a) A and B are independent events then prove that **[7M]**

   (i) A^c and B are also independent.

   (ii) A^c and B^c are also independent.

   (b) The chances of A, B and C becoming the G.M. of a company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A, B and C become G.M. are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as G.M.? **[7M]**

UNIT – II

3. (a) State and prove properties of distribution function. Discuss the method of defining a conditioning event. **[7M]**

   (b) A random variable X has the following probability function shown in Table 1: **[7M]**

Table 1

x	0	1	2	3	4
P(x)	1/25	3/25	1/5	7/25	9/25

Find (i) The distribution function of X. (ii) $P\,(X < 3)$ and $P\,(0 < X < 4)$

4. (a) Define exponential distribution and calculate mean of exponential random variable. **[7M]**

   (b) If X and Y are independent Poisson random variable show that the conditional distribution of X given X+Y is a binomial distribution. **[7M]**

UNIT – III

5. (a) Explain the joint moments of random variables. **[7M]**

   (b) Statistically independent random variables X and Y have moments m_{10}=2, m_{20}=14 and m_{11}=-6. Find second central moment μ_{22}. **[7M]**

6. (a) Show that the variance of a weighted sum of uncorrelated random variables equals the weighted sum of the variances of the random variables. **[7M]**

   (b) The life time of a certain brand of an electric bulb may be considered as a random variable with mean 1200 and standard deviation 250. Find the probability using Central Limit Theorem that the average lifetime of 60 bulbs exceeds 1250 hours. **[7M]**

UNIT – IV

7. (a) When does the time average converge to the ensemble average? Justify the answer. Briefly explain about Gaussian random process. **[7M]**

   (b) A random process is defined as X(t)=A cos(w_ct+ θ) where θ is a uniform random variable over(0,2π) .Verify the process is ergodic in the mean sense and auto correlation sense **[7M]**

8. (a) Define strict sense stationary random process, auto correlation and cross correlation function of a random process. **[7M]**

   (b) Consider two random processes X(t)=Acosωt + B sinωt and Y(t)= Bcosωt-A sinωt where A and B are uncorrelated, zero mean random variables with same variance and 'ω' is a constant. Show that X(t) and Y(t) are jointly stationary? **[7M]**

UNIT – V

9. (a) State and prove Winner-Khinchine theorem. **[7M]**

   (b) The auto correlation of a stationary random process is given by $R_{XX}\,(\tau) = ae^{-n|\tau|}$, $a > 0$. Find the spectral density function. **[7M]**

10. (a) Explain power spectrums for discrete-time random processes and sequences and state any two properties of cross-power density spectrum. **[7M]**

    (b) A WSS random process X(t) with autocorrelation function Rx(τ) =$e^{-a|\tau|}$ where a is a real positive constant, is applied to the input of an LTI system with impulse response h(t) = e^{-bt}u(t). Where b is a real positive constant. Find the autocorrelation function of the output Y(t) of the system. **[7M]**