4E 2089

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4E 2089

B.Tech. IV Semester (Back/Old Back) Examination 2012

Electronics & Comm.

4EC5 Random Variables & Stochstic Processes

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **Five questions** selecting **one question** from **each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.) Units of quantities used/ calculated must be stated clearly.*

Unit - I

1. a) Two fair dice are thrown independelly three events A,B & C are defined as follows.

   A : Odd face with first dice

   B : Odd face with second dice

   C : Sum of points on two dice is odd

   Are the events A,B,C mutually independent. **(8)**

   b) In an examination with multiple choice answers each question has four choice answers, out of which, one is correct. A candidate ticks his answer either by his skill or by guess or by copying from his neighbours. The probability of guess is 1/3 and that by copying is 1/6. The probability of correct answer by copying is 1/8 if a candidate answers a question correctly then find the probability that he knew the answer. **(8)**

OR

2. a) A binary communication channel carries data in the form of two types of signal, denoted by 0 and 1. due to noise, a transmitted '0' is sometimes received as a '1' and as transmitted '1' as a '0'. For the channel the probability of correct transmission of 0 is 0.94 and that of correct transmission of 1 be 0.91. Compute the following if 45% transmitted signal are in the form of 0.

i) Probability that a '1' is received.

ii) Probability that a '0' is received.

iii) Probability that a 1 was transmitted given that a '1' was received. **(8)**

b) Two defective tubes get mixed up with 2 good ones. The tubes are tested, one by one until both defective are found. What is the probability that the last defective tube is obtained on

i) The second test   ii) The third test

iii) The fourth test **(8)**

Unit - II

3. a) A random variable X has following probability distribution : **(8)**

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

i) Find K

ii) Find $P(X<6)$, $P(X\geq6)$ & $P(0<X<5)$

iii) Find distribution function of X.

b) Let a random variable X has following P.D.F. **(8)**

$$f(x) = \begin{cases} \alpha x & ; \quad 0 \leq x \leq 1 \\ \alpha & ; \quad 1 \leq x \leq 2 \\ -\alpha x + 3\alpha & ; \quad 2 \leq x \leq 3 \\ 0 & ; \quad Otherwise \end{cases}$$

find (i) α (ii) $P(X\leq1.5)$ (iii) C.D.F. & $P(X\leq2.5)$

OR

4. a) Letters are received in an office on each one of 100 day. Assuming the following data to form a random sample from a poisson distribution. Find the expected frequencies correct to nearest units (Given $e^{-4} = 0.183$) **(8)**

No.of letters (X)	0	1	2	3	4	5	6	7	8	9	10
No.Frequency(F)	1	4	15	22	21	20	08	06	2	0	1

b) Prove that poisson distribution is the limiting case of binomial distribution. (8)

Unit - III

5\. a) The joint p.d.f. of a bivariate Random variable (x,y) is given by

$$f_{xy}(x, y) = \begin{cases} K\, x^2\, y^2, & 0<x<2, \quad 0<y<2 \\ 0 & otherwise \end{cases}$$

where K is contest.

i) Determine the value of K

ii) Are X and Y independent (8)

b) If the joint p.d.f. of (X,Y) is given by

$f_{xy}(x,y) = x+y;\ 0 \leq x;\ y \leq 1$

find the pdf of U = XY (8)

OR

6\. a) If X and Y each follow an exponential distribution with parameter 1 and are independent. Find the pdf of

i) $U = X - Y$

ii) $U = \dfrac{X}{X+Y}$ & $V = X + Y$ *are* U & V independent? (8)

b) Given the following Joint density function

$$f(x, y) = \begin{cases} \frac{1}{2}\, xy & 0 \leq x \leq y \leq 2 \\ 0 & otherwise \end{cases}$$

i) Find the marginal densities

ii) Find the conditional density function

iii) Are X and Y Independent? (8)

Unit - IV

7. a) Find the mean and variance of normal distribution. (8)

b) Find the moment generating function for

i) Uniform distribution ii) Exponential distribution

Hence find their mean and variance. (8)

OR

8. a) Find the coefficient of correlation for the following data. (8)

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

b) For binomial distribution, prove the following formulae

$$\mu_{r+1} = Pq\left(nr\mu_{r-1} + \frac{d\mu r}{dp}\right)$$

where μ_r is the r^{th} order central moment. (8)

Unit -V

9. a) Show that the auto-correlation function $R_x(\tau)$ of a stationary process is ergodic. (8)

b) Differentiate in between the following by giving example for each

i) Discrete Random Sequence.

ii) Discrete random process

iii) Continuous Random sequence

iv) Continuous Random process (8)

Or

10. a) Explain Gaussian Random Process and cross spectral density. (8)

b) Prove that the auto-correlation function $R_{XY}(\tau)$ is maximum at $\tau = 0$ (8)