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B. Tech EE (Semester – 4th)
MATHEMATICS - III (Probability & Statistics)
Subject Code: BMATH3-301
Paper ID: [18111519]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) The probability density function of a random variable X is $(x) = \frac{k}{1+x^2}$; $-\infty < x < \infty$. Determine k and the distribution function.

b) The probabilities of hitting a target by three soldiers are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$, respectively. Find the probability that one and only one of them will hit the target when they fire simultaneously.

c) If X and Y are two random variables having joint density function:

$$f(x) = \{\frac{1}{8}(6 - x - y),\ 0 \leq x < 2,\ 2 \leq x < 4\ 0,\ otherwise$$

Find $P(X + Y < 3)$.

d) The sum of mean and variance of a binomial distribution is 4.8 for five trials. Find the distribution.

e) Distinguish between "Skewness" and "Kurtosis" and bring out their importance in describing frequency distribution.

f) For a random variable X with the following probability distribution:

x	-3	-2	-1	0	1	2	3
P(x)	0.05	0.10	0.30	0	0.30	0.15	0.10

Compute E(X).

g) A sample of 400 male students is found to have a mean height of 67.47 inches. Can it be reasonably regarded as a sample from a large population with mean height 67.39 inches and S.D. 1.30 inches?

h) Define a continuous random variable and give an example.

i) The number of students in a class is 100. The average marks scored by 64 boys is 66 with a S.D. of 10, while the average marks scored by 36 girls is 70 with a S.D. 8. Test at 5% level of significance whether the girls perform better than the boys.

j) If A and B are two independent events, show that A and $\overline{B}$ are also independent.

Section – B (5 marks each)

Q2. Find $\overline{X}$, $\overline{Y}$, and r from the following two regression equations:

$$3X + 2Y = 26,\ \ 6X + Y = 31$$

Q3. Two independent samples of sizes 7 and 6 had the following values:

Sample A	28	30	32	33	31	29	34
Sample B	29	30	30	24	27	28	

Examine whether the samples have been drawn from normal population having the same variance.

Q4. The joint distribution of two random variables X and Y is given by:

$f(x, y) = 4xy\, e^{-(x^2+y^2)}$; $x \geq 0$, $y \geq 0$.

Test whether X and Y are independent. For the above joint distribution, find the conditional density of X given $Y = y$.

Q5. Derive the Poisson distribution as a limiting case of the Binomial distribution.

Q6. In a normal distribution, 7% of the items are under 35, and 89% are under 63. What are the mean and standard deviation of the distribution?

Section – C (10 marks each)

Q7. a) Calculate the Rank correlation coefficient for the following distribution:

X	11	6	9	13	6	27	15	16	17	10	1
Y	21	30	37	40	29	34	39	24	20	40	38

b) Define the exponential distribution and find its mean.

Q8. Fit a Binomial distribution to the following data and test for goodness of fit at the 5% level of significance.

x	0	1	2	3	4	5
f	38	144	342	287	164	25

Q9. State and prove Chebyshev's inequality.