



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Regular/Supply) - May, 2018

Regulation: IARE – R16

PROBABILITY AND STATISTICS

Time: 3 Hours

(Common to CSE | IT)

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) For the continuous variable x whose probability density function is given by

$$f(x) = \begin{cases} cx(2-x), & 0 \leq x \leq 2 \\ 0, & \text{Otherwise} \end{cases} \quad \text{where } c \text{ is a constant. Find } c, \text{ mean and variance of } x.$$

[7M]

- (b) In the inspection of tin plate produced by a continuous electrolytic process, 0.2 imperfections is spotted on the average per minute. Find the probabilities of spotting (i) 1 imperfection in 3 minutes (ii) At least 2 imperfections in 5 minutes (iii) At most one imperfection in 15 minutes.

[7M]

2. (a) The probability density function of a variate X is shown in Table 1.

Determine (i) K (ii) Mean (iii) Variance

[7M]

Table 1

X	0	1	2	3	4	5	6	7	8
p(x)	K/45	K/15	K/9	K/5	2K/45	6K/45	7K/45	8K/45	4K/45

- (b) During one stage in the manufacture of integrated circuit chips, a coating must be applied. If 70% of the chips receive a thick enough coating, find the probability that among 15 chips.

- i. At least 12 will have thick enough coatings
- ii. At most 6 will have thick enough coatings
- iii. Exactly 10 will have thick enough coatings

[7M]

UNIT – II

3. (a) If the joint probability density function of two random variables is given by

$$f(x_1, x_2) = \begin{cases} 6e^{-2x_1-3x_2} & \text{for } x_1 > 0, x_2 > 0 \\ 0 & \text{elsewhere} \end{cases}$$

Find the probabilities that

- i. The first random variable will take on a value between 1 and 2 and the second random variable will take on a value between 2 and 3
- ii. The first random variable will take on a value less than 2 and the second random variable will take on a value greater than 2.

[7M]

- (b) The numbers of minutes to take 10 mechanics to assemble a piece of machinery in the morning (x) and in the late afternoon (y) is shown in Table 2. Calculate r. [7M]

Table 2

x	11.1	10.3	12.0	15.1	13.7	18.5	17.3	14.2	14.8	15.3
y	10.9	14.2	13.8	21.5	13.2	21.1	16.4	19.3	17.4	19.0

4. (a) A chemical company wishing to study the effect of extraction time on the efficiency of an extraction operation obtained the data shown in the Table 3.

Table 3

Extraction time minutes (x)	27	45	41	19	35	39	19	49	15	31
Extraction efficiency (%) (y)	57	64	80	46	62	72	52	77	57	68

- i. Draw a scatter diagram to verify that a straight line will provide a good fit to the data [7M]
- ii. Fit a straight line to the given data by the method of least squares and use it to predict extraction efficiency one can expect when the extraction time is 35 minutes.

- (b) i. Determine the correlation coefficient by regression coefficients. [7M]
 ii. Find the angle between two regression lines.

UNIT – III

5. (a) Construct sampling distribution of means for the population 3, 7, 11, 15 by drawing sample of size two with replacement. Determine
- i. Population mean
 - ii. Population variance
 - iii. The mean of sampling distribution of means
 - iv. Standard error.

[7M]

- (b) If 1-gallon can of paint cover on an average 513.3 square feet with standard deviation of 31.5 square feet, what is the probability that the sample area covered by a sample of 40 of these 1-gallon cans will be anywhere from 510.0 to 520.0 square feet? [7M]

6. (a) If the population size is 4, 7, 10, 16, 26. (i) List all possible samples of size 3 that can be taken without replacement from the finite population. (ii) Calculate the mean of each of the sampling distribution of means (iii) Find the sampling distribution of means. [7M]

- (b) If the distribution of the weights of all men travelling by air between Dallas and El Paso has a mean of 163 pounds and a standard deviation of 18 pounds, what is the probability that the combined gross weight of 36 men travelling a place between these two cities is

- i. more than 160 pounds
- ii. lies in between 159 and 165. [7M]

UNIT – IV

7. (a) In a sample of 600 students of a certain college 400 are found to be use ball pens. In another college, from a sample of 900 students 450 were found to use ball pens. Test whether the two colleges are significantly different with respect to the habit of using ball pens. [7M]
- (b) A trucking firm is suspicious of the claim that the average life time of certain tires is at least 28,000 miles. To check the claim, the firm puts 40 of these tires on trucks and gets mean life time of 27,463 miles with a standard deviation of 1,348 miles. What can you conclude if the probability of type-I error is to be at most 0.01? [7M]
8. (a) A manufacturer claimed that at least 98% of the steel pipes which he supplied to a factory conformed to specifications. An examination of a sample of 500 pieces pips revealed that 30 were defective. Test his claim at a significance level 5%. [7M]
- (b) A random sample of size $n = 100$ is taken from a population with S.D is 5.1. Given that a sample mean is 21.6, construct a 95% and 99% confidence interval for the population mean μ . [7M]

UNIT – V

9. (a) An average commission charged by a service brokerage firm on a sales of stock is Rs.154 and S.D is Rs.52. We take a random sample of 121 traders by his clients and determine that they paid average commission of Rs.161. Can you conclude that clients average commission are higher than industry average? Use 5% level of significance. [7M]
- (b) Three varieties of coal were analyzed by four chemists and ash content in the varieties was found to be as shown in Table 4. Analyze the data by two-way classification. [7M]

Table 4

Varieties	Chemist-1	Chemist-2	Chemist-3	Chemist-4
A	18	15	15	17
B	17	16	14	14
C	13	16	15	19

10. (a) Prices of shares of a company on the different days in a month were found to be 66, 65, 69, 70, 69, 71, 70, 63, , 63, 64 and 68. Discuss whether the mean price of the shares in the month is Rs. 65. [7M]
- (b) The number of mistakes made in 5 successive days for 4 technicians working for a photographic laboratory are shown in Table 5. Test at the level of significance of 0.05 whether the differences among the 4 sample means can be attributed to chance. [7M]

Table 5

Technician - I	Technician - II	Technician - III	Technician - IV
6	14	10	9
14	9	12	12
10	12	7	8
8	10	15	10
11	14	11	11

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