



INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.TECH II Semester End Examinations (Regular) AUGUST- 2021

Regulation:UG20

PROBABILITY AND STATISTICS

Time: 3 Hours (CSE|IT|CSE(AIML)|CSE(CS)|CSE(DS)|CSIT) **Max Marks: 70**

Answer all questions in Modules I and II

Answer ONE out of two questions from Modules III, IV and V

(NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V)

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain the concepts:
 - i) Random variables and its types
 - ii) Probability mass and density functions [7M]
- (b) Given that $f(x)=k/2^x$ is a probability distribution for a random variable that can take on the values $x=0, 1, 2, 3$ and 4 .
 - i) Find k ii) Find the Cumulative probability distribution $F(x)$ [7M]

MODULE – II

2. (a) State Binomial distribution. Determine the mean and variance of a binomial distribution. [7M]
- (b) On an average a certain intersection results in 3 traffic accidents per month. obtain the probability that for any given month at this intersection.
 - i) Exactly 5 accidents will occur
 - ii) Less than 3 accidents will occur
 - iii) Atleast 2 accidents will occur [7M]

MODULE – III

3. (a) A researcher wished to determine if a person’s age is related to the number of hours, he or she exercises per week. The data obtained from a sample is given in Table 1. State your opinion based on Karl Pearsons’s coefficient of correlation for the data. [7M]

Table 1

Age x	18	26	32	38	52	59
Hours y	10	5	2	3	1.5	1

- (b) Show that the coefficient of correlation lies between -1 and 1. [7M]

4. (a) Raw material used in the production of a synthetic fiber is stored in a place which has no humidity control. Measurements of the relative humidity in the storage place and the moisture content of a sample of the raw material (both in percentages) on five days yielded the following results shown in Table 2:

Table 2

Humidity x	42	35	50	43	48
Moisture content y	12	8	14	9	11

- i) Make a scatter plot to verify that it is reasonable to assume that the regression of y on x is linear.
 ii) Fit a straight line by the method of least squares. [7M]
- (b) The value of Karl Pearson's correlation (r) for the data given in Table 3 is 0.636.

Table 3

x	0.05	0.14	0.24	0.30	0.47	0.52	0.57	0.61	0.67	0.72
y	1.08	1.15	1.27	1.33	1.41	1.46	1.54	2.72	4.01	9.63

- (i) Calculate the Spearman's rank correlation for this data.
 (ii) Obtain the advantage of ρ brought out in this problem? [7M]

MODULE – IV

5. (a) Explain the terms:
 i) Null hypothesis ii) Alternative hypothesis iii) Critical region [7M]
- (b) If a 1-gallon can of paint covers on an average 513 square feet with a standard deviation of 31.5 square feet, Calculate the probability that the mean area covered by a sample of 40 of these 1-gallon cans will be anywhere from 510 to 520 square feet? [7M]
6. (a) In a sample of 1,000 people in Maharashtra, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 1% level of significance? [7M]
- (b) The mean breaking strength of cables supplied by a manufacturer is 1800 with a standard deviation of 100. By a new technique in the manufacturing process, it is claimed that the breaking strength of cables has increased. In order to test this, claim a random sample of 50 cables is tested. It is found that the mean breaking strength is 1850. Can we support the claim at 0.01 level of significance? [7M]

MODULE – V

7. (a) In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 ozs. With a standard deviation of 12 ozs. While the corresponding figures in a sample of 400 items from the other process are 124 and 14. Obtain the standard error of difference between the two-sample means. Is this difference significant? [7M]

- (b) A course can be taken for credit either by attending lecture sessions at fixed times and days, or by doing online sessions that can be done at the student's own pace and at those times the student chooses. The course coordinator wants to determine if these two ways of taking the course resulted in a significant difference in achievement as measured by the final exam for the course. The data given in Table 4 gives the scores on an examination with 45 possible points for one group $n_1 = 9$ students who took the course online, and a second group of $n_2 = 9$ students who took the course with conventional lectures. Do these data present sufficient evidence to indicate that the grades for students who took the course online are significantly higher than those who attended a conventional class?

Test scores for online and classroom presentations:

[7M]

Table 4

Online	32	37	35	28	41	44	35	31	34
Class Rom	35	31	29	25	34	40	27	32	31

8. (a) A machinist is making engine parts with axle diameters of 0.700 inch. A random sample of 10 parts shows a mean diameter of 0.742 inch with a standard deviation of 0.040 inch. Compute the test statistic you would use to test whether the work is meeting the specifications. Also state how you would proceed further. [7M]
- (b) Five hundred television sets are inspected as they come off the production line and the number of defects per set is recorded as given in Table 5:

Table 5

Number of defects	0	1	2	3	4
Number of sets	368	72	52	7	1

Estimate the average number of defects per set and expected frequencies of 0,1,2,3, and 4 defects assuming Poisson distribution and Test for the assessment of goodness of fit at 0.05 level. [7M]

— o o ○ o o —