Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III EXAMINATION – WINTER 2025

Subject Code:3130006 Date:31-12-2025

Subject Name: Probability and Statistics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

MARKS

Q.1 **(a)** A can hit a target 4 times in 5 shots, B, 3 times in 4 shots; and C, 2 times in 3 shots. They fire a volley (it means one shot each). Find the probability that target will be hit. **03**

(b) Three companies A, B and C supply 30%, 50% and 20% of the notebooks to a school. Past experience shows that 8%, 5% and 10% of the notebooks produced by these companies are defective. If a notebook was found to be defective, what is the probability that the notebook was supplied by A? **04**

(c) A random variable X has the following probability function **07**

$X=x$	-2	-1	0	1	2	3
$P(X=x)$	0.1	K	0.2	2K	0.3	3K

(i) Find K (ii) Find P(X<2)

(iii) Determine the distribution function $F(x)$ of X.

Q.2 **(a)** Four balls are drawn simultaneously from a bag containing 6 white, 5 black and 7 red balls. Find E(X), where X denotes number of white drawn. **03**

(b) It is known that the mean diameters of rivets produced by two firms A and B are practically the same, but the standard deviation may differ. For 22 rivets produced by firm A , the standard deviation is 2.9mm, while for 16 rivets manufactured by firm B, the standard deviation is 3.8mm. Compute the statistic you would use to test whether the products of firm A have the same variability as those of firm B. Using the value $F_{0.05}(15,21) = 2.20$ **04**

(c) Fit a curve of the form $y = ab^x$ to the following data **07**

x :	1	2	3	4	5	6	7
y :	87	97	113	129	202	195	193

OR

(c) Fit the second degree parabola using the least square method to the following data **07**

x :	1	2	3	4
y :	1.7	1.8	2.3	3.2

Q.3 **(a)** Find the mean and median for the given data **03**

C.I.	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
f	4	6	5	10	20	22	24	6	2	1

(b) The first four moments of a distribution about the value 5 of the variate are 2, 20, 40, and 50. Find mean and variance. **04**

(c) Calculate the correlation coefficient between x and y using the following data **07**

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

OR

Q.3 **(a)** State Chebyshev's inequality. A fair dice is tossed 120 times. Use Chebyshev's inequality to find a lower bound for the probability of getting 80 to 120 sixes. **03**

(b) Calculate the rank correlation coefficient for given data **04**

X	85	74	85	50	65	78	74	60	74	90
Y	78	91	78	58	60	72	80	55	68	70

(c) The equation of two regression lines obtains in a correlation analysis of 60 observations are $5x = 6y + 24$ *and* $1000y = 786x - 3608$. **07**

What is the correlation coefficient? Show that the ratio of coefficient of variability of x to that of y is 5/24. What is the ratio of variance of x *and* y.

Q.4 **(a)** A speaks truth in 75% cases and B in 80% cases. Find the probability that they are likely to contradict each other in stating the same fact. **03**

(b) The incidence of occupational disease in an industry is such that the workmen have a 20% chance of suffering from it. What is the probability that out of 6 workmen 4 or more will suffer from disease? **04**

(c) The following mistakes per page were observed in a book. **07**

No. of Mistake per page	0	1	2	3	4	Total
No of Pages	211	90	14	5	0	320

Fit a Poisson distribution for the given data.

OR

Q.4 **(a)** Suppose on an average 1 house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during the year? **03**

(b) In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the parameters of the distribution. **04**

(c) In a sample of 10 pens. If 10% of pens produced by a company are defective. Find out the probability that **07**

(i) No pen must be defective.
(ii) One must be defective.
(iii) At least two must be defective.

Q.5 **(a)** A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160 cm. Can it be reasonably regard that, in the population, the mean height is 165 cm and the SD is 10 cm? (use 5% level of significance) **03**

(b) Below are given the gain in weights (in lbs) of pigs fed on two diets A and B. **04**

Gain in weight

Diet A : 25, 32, 30, 34, 24, 14, 32, 24, 30, 31, 35, 25

Diet B : 44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21, 35, 29, 22

Test if the two diets differ significantly as regards their effect on increase in weight. (using $t_{0.05}$ at 25 d. f. = 2.07)

(c) From the following table, test the hypothesis that the flower colour is independent of flatness of leaf **07**

	Flat leaves	Curled leaves	Total
White flowers	99	36	135
Red flowers	20	5	25
Total	119	41	160

If the value of χ^2 for 1 d. f at 5% level of significance is 3.841.

OR

Q.5 **(a)** Two large population, there are 30 % and 25 % respectively of blue eyed people. Is this difference likely to be hidden in the sample of 1200 and 900 respectively from the two populations? (Test at 5% level of significance). **03**

(b) A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure: **04**

5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4 and 6

Can it be concluded that the stimulus will, in general be accompanied by an increase in blood pressure? (Given that for 5% level of significance t for 11 d. f is 1.796)

(c) 12 dice were thrown 4096 times and a throw of 6 was considered as a success; the observed frequencies were given below : **07**

No. of successes :	0	1	2	3	4	5	6	7 & above
Frequencies	447	1145	1181	796	380	115	24	8

Find the value of chi-square on the basis of the hypothesis that the dice were unbiased and hence show that the data are consistent with the hypothesis so far as the χ^2 – test is concerned. The value of χ^2 for 7 degrees of freedom at 5% level of significance is 14.067.

****