

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER– III EXAMINATION – SUMMER 2026****Subject Code:3130006****Date:03-07-2026****Subject Name:Probability and Statistics****Time:02:30 PM TO 05:00 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 committee of 4 people is to be appointed from 3 teachers, 4 health officers, 2 security personnel and 1 chartered accountant. Find the probability of forming the committee so that the chartered accountant is mandatorily present in the committee.	03										
	(b) A student doing his online homework on a regular basis has a chance of 83 percent to get a good grade; but the chance drops to 58 percent if he doesn't do the homework regularly. The student figures out that he has only 69 percent chance of doing the homework regularly. What is his chance of not getting a good grade in the course?	04										
	(c) From a vessel containing 3 white and 5 black balls, 4 balls are transferred into an empty vessel. From this new vessel, a ball is drawn and is found to be white. What is the probability that out of the 4 balls transferred, 3 are white and 1 is black?	07										
Q.2	(a) Two variates have the regression lines as $x + 4y + 3 = 0$ and $4x + 9y + 5 = 0$. Find the correlation coefficient.	03										
	(b) If $p(x) = x/15; x = 1, 2, 3, 4, 5$ $= 0$, otherwise (i) Find $P(X = 1 \text{ or } 2)$ (ii) Find $P(1/2 < X < 5/2 X > 1)$	04										
	(c) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days on which (i) neither car is used (ii) some demand is refused.	07										
OR												
	(c) The joint probability function of X and Y is given as $f(x, y) = e^{-(x+y)}, 0 \leq x < \infty, 0 \leq y < \infty$. Evaluate $P(1 < X + Y < 2)$.	07										
Q.3	(a) A random variable X with unknown probability distribution has a mean 8 and standard deviation 3. Evaluate the bounds on $P(-4 < X < 20)$.	03										
	(b) Fit the curve $y = ax^b$ to the given data:	04										
<table><tr><td>x</td><td>61</td><td>26</td><td>7</td><td>2.6</td></tr><tr><td>y</td><td>350</td><td>400</td><td>500</td><td>600</td></tr></table>			x	61	26	7	2.6	y	350	400	500	600
x	61	26	7	2.6								
y	350	400	500	600								
	(c) Find the coefficient of variation of the marks obtained by the students of a college:	07										
Marks : 20-30 30-40 40-50 50-60 60-70												
No. of Students : 2 35 46 12 5												

OR

- Q.3 (a)** A sample of 12 fathers and their eldest sons gave the following data about their height in inches. Calculate coefficient of rank correlation. **03**

Father: 65 63 67 64 68 62 70 66 68 67 69 71
Son : 68 66 68 65 69 66 68 65 71 67 68 70

- (b)** An incomplete frequency distribution is given with $N = 229$ and median = 46. Determine the missing frequencies. **04**

Obs.	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Freq.	12	30	?	65	?	25	18

- (c)** Obtain the line of regression of monthly sales (Y) on advertisement expenditure (X) and estimate the monthly sales when the company will spend Rs. 50,000 on advertisement, if the data on X and Y are as follows: **07**

Y (in lac) : 74 76 60 68 79 70 71 94
X (in thousand) : 43 44 36 38 47 40 41 54

- Q.4 (a)** The arrival rate of cars at a gas station is 40 customers per hour. What is the probability of having no arrival of cars in a 5 minute interval? **03**

- (b)** The standard deviations calculated from two random samples of sizes 9 and 13 are 2.1 and 1.8 respectively. May the samples be regarded as drawn from normal populations with the same standard deviation? (Test at 5% significance level) **04**

- (c)** In a flu epidemic, 500 persons contracted the disease. 200 receives no serum treatment and of these 75 died. Of those who did receive serum treatment, 65 died. Was the serum treatment effective? Use χ^2 test at 1% significance level. **07**

OR

- Q.4 (a)** In a distribution exactly normal, 10.03% of the items are under 25 kg weight and 89.97% of the items are under 70 kg weight. What are the mean and standard deviation of the distribution? **03**

- (b)** A machine produced 20 defective articles in a batch of 400. After overhauling, it produced 10 defectives in a batch of 300. Has the machine improved? (Test at 5% level of significance) **04**

- (c)** Fit a second degree parabola to the data: **07**

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

- Q.5 (a)** The mean weekly sales of soap bars was 146.3 bars per store. After an advertising campaign, the mean weekly sales in 22 stores for a typical week increased to 153.7 with standard deviation of 17.2. Was the advertising campaign successful? (Test at 5% level) **03**

- (b)** A test is carried out to check the efficiency of both the factories ascertaining the variability of the life of the bulbs produced by each factory. The results are as follows: **04**

	Factory A	Factory B
--	-----------	-----------

Standard deviation of lifetime (hours)	240	220
No. of bulbs in sample	100	200

Determine whether the difference between the variability of life of light bulbs from the two factories is significant (Test at 1% level).

- (c) In his experiments on pea-breeding, Mendel obtained the following frequencies of seeds: 07

Class	Observed Frequency
Round and yellow	315
Wrinkled and yellow	101
Round and green	108
Wrinkled and green	32
Total	556

Theory predicts that the frequencies should be in the proportions 9 : 3 : 3 : 1. Use χ^2 test to examine the correspondence between theory and observations at 5% significance level.

OR

- Q.5** (a) The correlation coefficient between income and food expenditure for sample of 7 household from a low income group is 0.9. Using 1% level of significance, test whether the correlation coefficient between incomes and food expenditure is positive. Assume that the population of both variables are normally distributed. 03

- (b) A machine part was designed to withstand an average pressure of 120 units. A random sample of size 100 from a large batch was tested and it was found that the average pressure which these parts can withstand is 105 units with a standard deviation of 20 units. Test at 1% significance level whether the batch meets the specification. 04

- (c) The following table gives the joint distribution of X and Y: 07

Y \ X	0	1	2
1	0.3	0.2	0.1
2	0.1	0	0.3

Are X and Y independent?

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III EXAMINATION – SUMMER 2025****Subject Code:3130006****Date:13-06-2025****Subject Name:Probability and Statistics****Time:02:30 PM TO 05:00 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.

- Q.1** (a) Define independent events and provide an example **03**
 (b) A coin is tossed three times. What is the probability of getting exactly two heads? **04**
 (c) Find the best fitting parabola: **07**

x	1	2	3	4	5
y	2	5	10	17	26

- Q.2** (a) Does there exists a binomial distribution for which variance is greater than mean? **03**
 (b) A biased coin returns head 10% of times. Find the probability of getting exactly 2 heads in 10 trials using binomial distribution. **04**
 (c) A factory has three machines A, B, and C producing 20%, 30%, and 50% of the total items, respectively. The probabilities of producing a defective item are 1%, 2%, and 3% for A, B, and C, respectively. If an item is defective, what is the probability that it was produced by machine B? **07**

OR

- (c) A factory produces light-bulbs. The probability of a bulb being defective is 0.02. If 200 bulbs are tested, use the Poisson approximation to find the probability that at least three bulbs are defective. **07**

- Q.3** (a) Find the mean and median of 2, 3, 5, 7 **03**
 (b) Calculate the rank correlation: **04**

x	1	2	3	4	5
y	2	1	5	4	3

- (c) Find the correlation coefficient. **07**

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

OR

- Q.3** (a) Find mode **03**

x	0-10	10-20	20-30	30-40
y	10	20	40	30

- (b) Calculate first four central moments of observations 3,5,7,13 **04**

- (c) Find regression line of Y on X **07**

x	2	4	6	8	10
y	5	12	19	26	33

- Q.4** (a) Explain the terms one-tailed and two-tailed test **03**
 (b) In a sample of 500 bulbs 20 are found defective. The company claims that only 2% bulbs are defective. Test the reality of claim at 5% level of significance. **04**

- (c) Test whether the following samples could have been drawn from population with same SD. **07**

	Sample A	Sample B
Size	100	200
SD	10	11

OR

- Q.4** (a) Explain the terms null and alternate hypothesis **03**
 (b) A coin returned 531 heads in 1000 tosses. Is it biased? [Use $\alpha = 0.05$] **04**
 (c) Use chi-square test to determine whether smoking and hypertension are independent at 5% level of significance [$\chi^2(\alpha = 0.05, df = 1) = 3.84$] **07**

	Smoking	No Smoking
Hypertension	30	20
No Hypertension	10	40

- Q.5** (a) State Chebyshev's inequality. **03**
 (b) Two cards are chosen randomly from deck. What is probability that (a) both are ace? (b) both are black? (c) none is ace (d) none is black **04**
 (c) Weight of 1000 experimental animals is normally distributed with mean 235 grams and standard deviation 35. How many animals weigh (a) below 172 grams (b) above 312 grams (c) between 172 to 312 grams. **07**
 [$P(Z=1.8)=0.4641, P(Z=2.2)=0.4841$]

OR

- Q.5** (a) If A and B are independent events with $P(A)=0.5$, $P(B)=0.4$ then find $P(A \cup B)$ **03**
 (b) Find the best fitting line to the points (1,1), (2,4), (3,9), (4,16) **04**
 (c) Fit the curve $y = ab^x$ **07**

x	1	2	3	4
y	35	70	140	280

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024****Subject Code:3130006****Date:16-07-2024****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) Define and give the example of Random variable. **03**
- (b) What is the probability that a leap year selected at random will have 53 Sundays? **04**
- (c) In a bolt factory, three machines A, B and C produce 25%, 35% and 40% of total output respectively. It was found that 5%, 4% and 2% are defective bolts in the production by machines A, B, C respectively. A bolt is chosen at random from the total output and is found to be defective. Find the probability that it is manufactured from (i) Machine A (ii) Machine B (iii) Machine C. **07**

- Q.2**
- (a) A bag contains 3 red and 4 white balls. Two draws are made without replacement. What is the probability that both balls are red. **03**
- (b) The probability that a student A solves a mathematics problem is $\frac{2}{5}$ and the probability that a student B solves it is $\frac{2}{3}$. What is the probability that (i) the problem is not solved (ii) both A and B can solve the problem, working independently of each other? **04**
- (c) Verify that the following function $F(x)$ is a distribution function. **07**

$$F(x) = \begin{cases} 0; & x < 0 \\ 1 - e^{-\frac{x}{4}}; & x \geq 0 \end{cases}$$

Also, find the probabilities $P(X \leq 4)$, $P(X \geq 8)$, $P(4 \leq X \leq 8)$.**OR**

- (c) The probability mass function of a random variable X is zero except at the points $X = 0, 1, 2$. At these points, it has the values $P(X = 0) = 3c^3$, $P(X = 1) = 4c - 10c^2$, $P(X = 2) = 5c - 1$. Find (i) c (ii) $P(X < 1)$ (iii) $P(1 < X \leq 2)$ (iv) $P(0 < X \leq 2)$. **07**

- Q.3** (a) Find the constant k such that the function **03**

$$f(x) = \begin{cases} kx^2; & 0 < x < 3 \\ 0; & \text{otherwise} \end{cases}$$

is a probability density function,

- (b) A random variable X has the following distribution: **04**

X	1	2	3	4	5	6
$P(X = x)$	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{5}{36}$	$\frac{7}{36}$	$\frac{9}{36}$	$\frac{11}{36}$

Find (i) mean (ii) variance.

- (c) Compute Karl Pearson's coefficient of correlation between X and Y for the following data: **07**

x	10	14	18	22	26	30
y	18	12	24	6	30	36

OR

- Q.3 (a)** Find coefficient of correlation between x and y if the regression lines are: $x + 6y = 6$ and $3x + 2y = 10$. **03**

- (b)** Calculate the first four moments from the following data: **04**

x	0	1	2	3	4	5	6	7	8
y	5	10	15	20	25	20	15	10	5

- (c)** The following data give the experience of machine operators and their performance rating as given by the number of good parts turned out per 100 piece. **07**

Operator	1	2	3	4	5	6
Performance rating (x)	23	43	53	63	73	83
Experience (y)	5	6	7	8	9	10

Calculate the regression line of performance rating on experience and also estimate the probable performance if an operator has 11 years of experience.

- Q.4 (a)** Explain the term related to testing of hypothesis: (i) Null hypothesis (ii) Alternate hypothesis and (iii) Level of Significance **03**

- (b)** A dice is tossed 960 times and it falls with 5 upwards 184 times. Is the dice unbiased at a level of significance of 0.01? ($|Z_{0.01}| = 2.58$) **04**

- (c)** A set of five similar coins is tossed 320 times and result is obtained as follows **07**

No of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

Test the hypothesis that the data follow a binomial distribution. (Critical value $\chi^2_{0.05} = 11.07$)

OR

- Q.4 (a)** The heights of 10 males of a given locality are found to be 175, 168, 155, 170, 152, 170, 175, 160, 160 and 165 cm. Based on this sample, find the 95% confidence limits for the heights of males in that locality. [$t_{0.05}(v = 9) = 2.262$] **03**

- (b)** Random samples drawn from two countries gave the following data relating to the heights of adult males: **04**

	Country A	Country B
Standard deviation (in inches)	2.58	2.50
Number in samples	1000	1200

Is the difference between the standard deviation significant? ($|Z_{0.05}| = 1.96$)

- (c)** If a random variable has a Poisson distribution such that $P(X = 1) = P(X = 2)$, find (i) the mean of the distribution (ii) $P(X = 4)$ (iii) $P(X \geq 1)$ (iv) $P(1 < X < 4)$. **07**

- Q.5 (a)** Fit a straight line $y = ax + b$ to the following data: **03**

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

- (b)** Fit a curve $y = ab^x$ to the following data: **04**

x	1	2	3	4	5	6	7	8
y	1	1.2	1.8	2.5	3.6	4.7	6.6	9.1

- (c)** The lifetime of a certain kind of batteries has a mean life of 400 hours and the standard deviation as 45 hours. Assuming the distribution of lifetime to be normal, find (i) the percentage of batteries with a lifetime of at least 470 hours (ii) the proportion of batteries with a lifetime between 385 and 415 hours, and (iii) the minimum life of the best 5% of batteries. ($P(0 < z < 0.33) = 0.1293$) **07**

OR

- Q.5 (a)** The mean and variance of a binomial variate are 8 and 6. Find $P(X \geq 2)$. **03**

(b) Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys? (ii) 5 girls? **04**

(c) Fit a second-degree parabolic curve to the following data: **07**

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3130006****Date:24-07-2023****Subject Name:Probability and Statistics****Time:02:30 PM TO 05:00 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 study showed that 65% of managers had some business education and 50% had some engineering education. Furthermore 20% of managers had some business education but no engineering education. What is probability that a manager has some business education, given that he has some engineering education?	03
	(b) Two computer A and B are to be marketed. A salesman who is assigned the job of finding customers for them has 60% and 40% chances respectively of succeeding in case of Computer A and B. The Computers can be sold independently. Given he was able to sell at least one computer, what is the probability that computer A has been sold?	04
	(c) In a post office, three clerks are assigned to process incoming mails. The first clerk B_1 processes 40%, the second clerk B_2 processes 35% and the third clerk B_3 processes 25% of the total mails. The first clerk has an error rate of 0.04, the second has an error rate of 0.06 and the third has an error rate of 0.03. A mail selected at random from a day's output is found to have an error. The Post Master wishes to know the probability that the mail was processed by the first, second or third clerk respectively.	07
Q.2	(a) The incidence of occupational disease in an industry is such that the workers 20% chance of suffering from it. What is the probability that out of six workers 4 or more will contract disease?	03
	(b) On an average one in 400 times items is defective. If the items are packed in boxes of 100, what is the probability, that any given box of items will contain a) No defective b) Less than two defectives c) One or more defectives d) More than three defectives.	04
	(c) The average daily sales of 500 branch offices was Rs. 150 thousand and the standard deviation Rs. 15 thousand. Assuming the distribution to be normal, indicate how many branches have sales between: 1. Rs. 120 thousand and Rs. 145 thousand. 2. Rs. 140 thousand and Rs. 165 thousand. $\left[P(0 < z < 3.3) = 0.4772, P(0 < z < 2) = 0.1293, \right.$ $\left. P(0 < z < 0.67) = 0.2486, P(0 < z < 1) = 0.3413 \right]$ OR	07
	(c) In a Normal distribution 31% of the items are under 45 and 8% are above the 64. Find mean and standard deviation of the distribution.	07

- Q.3** (a) The mean monthly salary paid to all employees in a company is Rs. 1600. The mean monthly salaries paid to technical and non-technical employees are Rs. 1800 and Rs. 1200 respectively. Determine the percentage of technical and non-technical employees of the company. **03**
- (b) Calculate average deviation from mean from the following data: **04**
- | | | | | | |
|-------------|-------|-------|-------|-------|-------|
| Sales | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 |
| No. of days | 3 | 6 | 11 | 3 | 2 |
- (c) The median and mode of the following wage distribution are Rs. 33.5 and Rs. 34 respectively. However, three frequencies are missing. Determine their values. **07**
- | | | | | | | | | |
|-------|------|-------|-------|-------|-------|-------|-------|-------|
| Wages | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | Total |
| f | 4 | 16 | f_0 | f_1 | f_2 | 6 | 4 | 230 |
- OR**
- Q.3** (a) The following data relate to the sales of 100 companies: **03**
- | | | | | | | | |
|------------------|----------|-------|-------|-------|-------|-------|-------|
| Sales | Below 60 | 60-62 | 62-64 | 64-66 | 66-68 | 68-70 | 70-72 |
| No. of Companies | 12 | 18 | 25 | 30 | 10 | 3 | 2 |
- Calculate the value of modal sales.
- (b) The following data relate to the profits of 1000 companies. **04**
- | | | | | | | | |
|------------------|---------|---------|---------|---------|---------|---------|---------|
| Profits | 100-120 | 120-140 | 140-160 | 160-180 | 180-200 | 200-220 | 220-240 |
| No. of Companies | 17 | 53 | 199 | 194 | 327 | 208 | 2 |
- Calculate the coefficient of skewness and comment on its value.
- (c) The profits earned by 100 companies during 1998-99 are given below. Calculate Q_1 , median, D_4 and P_{80} . **07**
- | | | | | | | | | |
|------------------|-------|-------|-------|-------|-------|-------|-------|--------|
| Profits | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 |
| No. of Companies | 4 | 8 | 18 | 30 | 15 | 10 | 8 | 7 |
- Q.4** (a) Find correlation of coefficient between the sales and expenses from the data given below: **03**
- | | | | | | | | | | | |
|---------|----|----|----|----|----|----|----|----|----|----|
| Firm | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Sales | 50 | 50 | 55 | 60 | 65 | 65 | 65 | 60 | 60 | 50 |
| Expense | 11 | 13 | 14 | 16 | 16 | 15 | 15 | 14 | 13 | 13 |
- (b) Two housewives, Geeta and Rita, asked to express their preferences for different kinds of detergents, gave the following replies. **04**
- | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|----|
| Detergent | A | B | C | D | E | F | G | H | I | J |
| Geeta | 4 | 2 | 1 | 3 | 7 | 8 | 6 | 5 | 9 | 10 |
| Rita | 4 | 1 | 2 | 3 | 8 | 7 | 5 | 6 | 9 | 10 |
- To what extent the preferences of these two ladies go together?
- (c) Obtain both the regression equations from the data given below. **07**
- | | | | | | | | | | |
|---|---|---|----|----|----|----|----|----|----|
| X | 1 | | 2 | 3 | 45 | 6 | 7 | 8 | 9 |
| Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | 16 | 15 |
- Also calculate the coefficient of correlation.
- OR**
- Q.4** (a) Find the coefficient of correlation by Karl Pearson's method between X and Y and interpret the values. **03**
- | | | | | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|----|----|----|----|
| X | 57 | 42 | 40 | 33 | 42 | 45 | 42 | 44 | 40 | 56 | 44 | 43 |
| Y | 10 | 60 | 30 | 41 | 29 | 27 | 27 | 19 | 18 | 19 | 31 | 29 |

- (b) An examination of eight applicants for a clerical post was taken by a firm. From the marks obtained by the applicants in the accountancy and statistics papers, compute the rank coefficient of correlation. 04

Applicant	A	B	C	D	E	F	G	H
Marks in accountancy	15	20	28	12	40	60	20	80
Marks in Statistics	40	30	50	30	20	10	30	60

- (c) In a partially destroyed laboratory record of an analysis of correlation data the following results are eligible. 07
 $Variance\ of\ X = 9, 8x - 10y + 66 = 0, 40x - 18y = 214.$
 Find on the basis of the above information:
- The mean values of X and Y.
 - Coefficient of correlation between X and Y
 - Standard deviation of Y.

- Q.5** (a) The mean lifetime of a sample of 100 light tubes produced by a company is found to be 1580 hours with standard deviation of 90 hours. Test the hypothesis that mean lifetime of the tube produced by the company is 1600 hours. (The critical value of z at 5% level of significance is ± 1.96). 03

- (b) Two salesman A and B are working in a certain district. From a sample survey conducted by the Head office, the following results were obtained. State whether there is any significant difference in the average sales between the two salesmen? 04

	A	B
No. of sales	20	18
Average sales	170	205
Standard deviation	20	25

The table value of t at 5% level of significance and 36 df is 1.9

- (c) Fit a curve $y = ab^x$ to the following data. 07

x	2	3	4	5	6	8
y	8.3	15.4	33.1	65.2	126.4	146

OR

- Q.5** (a) The Prices of shares of a company on the different days in a month were found to be : 03

66, 65, 69, 70, 69, 71, 70, 63, 64, and 68.

Test whether the mean price of the shares in the month is 65. (The table value of t for 9 degrees of freedom at 5% level of significance is 1.833.)

- (b) In random sample of 100 persons taken from village A, 60 are found to be consuming tea. In another sample of 200 persons taken from village B, 100 persons are found to be consuming tea. Do the data reveal significant difference between the two villages as far as the habit of consuming tea is concerned? (The critical value of z at 5% level of significance is ± 1.96). 04

- (c) Fit a second degree parabola to the following data: 07

x	1	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022****Subject Code:3130006****Date:11-07-2022****Subject Name:Probability and Statistics****Time:02:30 PM TO 05:00 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.

- Q.1** (a) Define and give the example of: (i) Random variable, (ii) Independent Events. **03**
- (b) Two fair six-sided dice are tossed independently. Let M be the maximum of the two tosses. What is the probability mass function (pmf) of M ? **04**
- (c) Seventy percent of the light aircraft that disappear while in flight in a certain country are subsequently discovered. Of the aircraft that are discovered, 60% have an emergency locator, whereas 90% of the aircraft not discovered do not have such a locator. Suppose a light aircraft has disappeared.
- (i) If it has an emergency locator, what is the probability that it will not be discovered?
- (ii) If it does not have an emergency locator, what is the probability that it will be discovered?

- Q.2** (a) State the probability function of Exponential and Gamma distribution. **03**
- (b) A dice is thrown 264 times with the following results. Show that the dice is biased. **04**
[Use $\chi^2_{0.05} = 11.07$ for 5 degree of freedom].

No. appeared on dice	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

- (c) Fit a straight line to the following data. Also, estimate the value of y at $x=72$. **07**

x :	65	66	67	67	68	69	71	73
y :	67	68	64	68	72	70	69	70

OR

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

x :	1	2	3	4	5
y :	5	12	26	60	97

Also, estimate y at $x=6$.

- Q.3** (a) State the properties of the Normal Distribution **03**
- (b) If a random variable has a Poisson distribution such that $P(X=1)=P(X=2)$, find **04**
(i) the mean of the distribution, (ii) $P(X=5)$, (iii) $P(X>1)$, and (iv) $P(1<X<4)$.
- (c) Define Binomial Distribution. **07**
A particular telephone number is used to receive both voice calls and fax messages. Suppose that 25% of the incoming calls involve fax messages, and consider a sample of 10 incoming calls. What is the probability that (i) At most 3 (ii) Exactly 3 (iii) At least 3 (iv) More than 3, of the calls involve a fax message?

OR

- Q.3** (a) The mean and variance of a binomial distribution are 4 and 2. Find $P(X \geq 2)$. **03**

- (b) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean of 1.5. Calculate the proportion of days on which (i) neither car is used, (ii) some demand is refused, (iii) only one car is used. **04**

- (c) Define Standard normal variate. **07**

The lifetime of a certain kind of batteries has a mean life of 400 hours and the standard deviation as 45 hours. Assuming the distribution of lifetime to be normal.

Find The percentage of batteries with lifetime (i) at least 490 hours, (ii) between 385 and 490 hours. Also, find the minimum life of the best 5% of batteries.

[Use: $P(0 < z < 2) = 0.4772$, $P(0 < z < 0.33) = 0.1293$ and $P(0 < z < 1.65) = 0.45$]

- Q.4** (a) Explain the term related to testing of hypothesis: (i) Type I Error, (ii) Type II Error, (iii) Level of Significance. **03**

- (b) A coin was tossed 960 times and returned heads 183 times. Test the hypothesis that the coin is unbiased. Use 5% level of significance. [use $Z_{0.05} = 1.96$]. **04**

- (c) Two types of batteries are tested for their length of life and the following data are obtained: **07**

	No. of samples	Mean Life in hours	Variance
Type A	9	600	121
Type B	8	640	144

Is there a significant difference in the two means? [Use $t_{0.05,15} = 2.132$]

OR

- Q.4** (a) Ten objects are chosen at random from a large population and their weights are found to be in grams: 61, 63, 64, 65, 68, 69, 69, 70, 71, 71. Discuss the suggestion that the mean is 65 g. [Use $t_{0.05} = 2.262$ at $v = 9$]. **03**

- (b) The means of simple samples of sizes 1000 and 2000 are 67.5 cm and 68 cm respectively. Can the samples be regarded as drawn from the same population of standard deviation 2 cm. [use $Z_{0.05} = 1.96$] **04**

- (c) Two random samples are drawn from two populations and the following results were obtained: **07**

Sample I	21	24	25	26	27	
Sample II	22	27	28	30	31	36

Find the variances of the two samples and test whether the two populations have the same variances. [Use $F_{0.05}(5,4) = 6.26$.]

- Q.5** (a) The probability distribution of a random variable X is given below. Find (i) $E(X)$, (ii) $V(X)$ **03**

X:	-2	-1	0	1	2
P(x=X)	0.2	0.1	0.3	0.3	0.1

- (b) The following are the lines of regression $9y = x + 288$ and $4y = x + 38$. Estimate y when $x = 99$ and x when $y = 30$. Also, find the means of x and y. **04**

- (c) Ten competitors in a test are ranked by three judges in the following order: **07**

Rank by First Judge:	6	10	2	9	8	1	5	3	4	7
Rank by Second Judge:	5	4	10	1	9	3	8	7	2	6
Rank by Third Judge:	4	8	2	10	7	5	9	1	3	6

Use the method of rank correlation to gauge which pairs of judges has nearest common approach.

OR

- Q.5** (a) For a group of 10 items, $\Sigma x = 452$, $\Sigma x^2 = 24270$, and $mode = 43.7$. Find Karl Pearson's coefficient of Skewness. **03**

- (b) Find the correlation coefficient for the following data:

04

X:	-3	-2	-1	0	1	2	3
Y:	9	4	1	0.5	1	4	9

- (c) Calculate the regression coefficients and find the two lines of regression for the following data:

07

x:	57	58	59	59	60	61	62	64
y:	67	68	65	68	72	72	69	71

Find the value of y when x=65.
