

**GUJARAT TECHNOLOGICAL UNIVERSITY****BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026**

Subject Code: BE03000251

Date: 02/07/2026

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.

**Q.1 (a)** The time between breakdown of a particular machine follows an exponential distribution with a mean of 17 days. Calculate the probability that a machine breaks down in a 15 days. **03**

**(b)** A discrete random variable X has the following probability distributions: **04**

|        |   |   |     |    |     |    |
|--------|---|---|-----|----|-----|----|
| X      | 0 | 1 | 2   | 3  | 4   | 5  |
| F(X=x) | 0 | k | 0.2 | 2k | 0.3 | 2k |

Find (a) k (b) P(X&lt;3) (c) P(2&lt;X&lt;5).

**(c)** Using method of least square, find the best fitting second degree curve to the following data: **07**

|   |   |    |    |    |
|---|---|----|----|----|
| x | 1 | 2  | 3  | 4  |
| y | 6 | 11 | 18 | 27 |

**Q.2 (a)** Three coins are tossed together and let random variable X be the number of heads in each outcome. Then find (a) probability distribution (b) mean. **03**

**(b)** Find coefficient of correlation of price and demand of the commodity: **04**

|               |    |    |    |    |    |    |    |    |     |
|---------------|----|----|----|----|----|----|----|----|-----|
| Price (Rs)    | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| Demand (qty.) | 35 | 30 | 25 | 25 | 23 | 21 | 20 | 20 | 18  |

**(c)** Three boxes contain 10%, 20% and 30% of defective finger joints. A finger joint is selected at random which is defective. Determine the probability that it comes from (a) first box (b) second box (c) third box. **07**

OR

**Q.2 (c)** The life in hours of a certain kind of radio tube has the probability density **07**

$$f(x) = \begin{cases} \frac{100}{x^2} & ; \text{for } x \geq 100 \\ 0 & ; \text{elsewhere} \end{cases}$$

Find the distribution function and use it to determine the probability that the life of tube is more than 150 hrs.

**Q.3 (a)** Find the rank coefficient of correlation: **03**

|   |     |     |     |     |     |     |    |
|---|-----|-----|-----|-----|-----|-----|----|
| x | 12  | 10  | 17  | 14  | 13  | 18  | 20 |
| y | 110 | 210 | 108 | 135 | 160 | 104 | 70 |

**(b)** Determine the equation of a straight line which best fits the following data: **04**

|   |      |      |      |      |      |
|---|------|------|------|------|------|
| x | 2003 | 2004 | 2005 | 2006 | 2007 |
| y | 35   | 56   | 79   | 80   | 40   |

- (c) Find the Karl Pearson's coefficient of skewness for the following frequency distribution: 07

|           |       |       |       |       |       |
|-----------|-------|-------|-------|-------|-------|
| Class     | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 |
| Frequency | 8     | 10    | 15    | 17    | 8     |

OR

- Q.3** (a) Find standard deviation for the following distribution: 03

|       |   |    |    |    |    |
|-------|---|----|----|----|----|
| $x_i$ | 5 | 10 | 15 | 20 | 25 |
| $f_i$ | 7 | 4  | 6  | 3  | 5  |

- (b) Fit the curve  $y = ax^b$  to the following data: 04

|   |     |     |     |     |
|---|-----|-----|-----|-----|
| x | 61  | 26  | 7   | 2.6 |
| y | 350 | 400 | 500 | 600 |

- (c) Find the coefficient of skewness for the following: 07

|                |    |    |    |    |    |     |
|----------------|----|----|----|----|----|-----|
| Years under    | 10 | 20 | 30 | 40 | 50 | 60  |
| No. of persons | 15 | 32 | 51 | 78 | 97 | 109 |

- Q.4** (a) There are 5 black balls and 4 red balls. Find the number of ways in which 6 balls can be selected so that there are at least 2 red balls in that selection. 03

- (b) Assume that on the average one telephone number out of fifteen called between 1 pm and 2 pm on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called (a) not more than 3 (b) at least three of them would be busy? 04

- (c) The lifeline 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 (a) at least 490 hours, (b) between 385 and 490 hours. Also find the minimum life of the best 5% of batteries. 07  
(Use  $P(0 < z < 2) = 0.4772$ ,  $P(0 < z < 0.33) = 0.1293$  and  $P(0 < z < 1.65) = 0.45$ )

OR

- Q.4** (a) Let A and B be two events with  $P(A) = 3/8$ ,  $P(B) = 7/8$  and  $P(A \text{ or } B) = 3/4$ . Find  $P(A|B)$  and  $P(B|A)$  03

- (b) Suppose that the time it takes to get service in a restaurant follows a gamma distribution with mean 8 minutes and variance 32 minutes. Suppose that you went to this restaurant at 6:30 pm. What is the probability that you will receive service before 6:36 pm? 04

- (c) On an average one in 400 times items is defective follows poisson distribution. 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 defective. 07

- Q.5** (a) A coin was tossed 960 times and returned heads 183 times. Test the hypothesis that the coin is unbiased. Use 5% level of significant. (Use  $Z_{0.05} = 1.96$ ) 03

- (b) Manager of a diet plan advertise that the mean weight loss for people on their plan is at least 45 pounds in 6 months. A sample of 28 people on this plan lose an average of 35 pounds with a standard deviation of 20 pounds. Test at 1% of significance level, if the claim is to high. (Use  $t_{0.01} = -2.473$ ) 04

- (c) If 57 out of 150 patients suffering from certain disease are cured by allopathy and 33 out of 100 patients with the same disease are cured by homeopathy, is there reason to believe that allopathy is better than homeopathy at 0.05 level of significance? (Use  $Z_{0.05} = 1.645$ ) **07**

OR

- Q.5** (a) A random sample size of 20 from a normal population has mean 40 and standard deviation of 4. Test the hypothesis that the population mean is 45. (Use  $t_{0.05,19} = 2.09$ ) **03**

- (b) In a coal mining it is observed that at least 90% of detonators will ignite the explosive when charged. From a random sample of 200 detonators it is found that 174 are upto standards. Test the level of significance at 5%. **04**  
(Use  $Z_{0.05} = -1.645$ )

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

|          |    |    |    |    |    |      |
|----------|----|----|----|----|----|------|
| Sample-1 | 21 | 24 | 25 | 26 | 27 | ---- |
| Sample-2 | 22 | 27 | 28 | 30 | 31 | 36   |

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

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