

Code No: S3101

MEDIUM · MODEL PAPER

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech III Year I Semester Examinations — Practice Model Paper 2 (MEDIUM)****PROBABILITY AND STATISTICS**

(Common to CSE, IT) · Pattern: R18, as in the Apr/May-2026 paper

Time: 3 hours**Max. Marks: 75****Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) Define conditional probability. If $P(A) = 0.4$, $P(B) = 0.5$, $P(A \cup B) = 0.7$, find $P(A/B)$. [2]
- b) Three coins are tossed. Find the probability of at least two heads, given that at least one head appears. [3]
- c) Distinguish between discrete and continuous random variables with examples. [2]
- d) X is a Poisson variate with $P(X = 1) = P(X = 2)$. Find the mean and $P(X = 0)$. [3]
- e) Define critical region and level of significance. [2]
- f) Given $\sigma = 12$, how large a sample is needed to be 95% confident that the error of estimate of the mean is at most 2? [3]
- g) Write the applications of the t-distribution. [2]
- h) Two independent samples of sizes 9 and 13 have unbiased variances 16 and 9. Test the equality of population variances at 5% level. [3]
- i) Write the normal equations to fit $y = ax^b$. [2]
- j) If $b_{yx} = 0.8$, $b_{xy} = 0.45$, $\bar{x} = 10$, $\bar{y} = 12$, find r and the regression line of y on x. [3]

PART – B**(50 Marks)**

- 2.a) If $P(A) = \frac{1}{3}$, $P(B) = \frac{3}{4}$, $P(A \cup B) = \frac{11}{12}$, find $P(A/B)$, $P(B/A)$ and $P(\bar{A} \cap B)$.
- b) A problem is given to three students A, B, C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$. Find the probability that the problem is solved. [5+5]

OR

- 3.a) State and prove the theorem of total probability.
- b) Urn I has 2 white and 3 black balls, urn II has 3 white and 2 black, urn III has 4 white and 1 black. An urn is chosen at random and a ball drawn is white. Find the probability that it came from each urn. [4+6]
- 4.a) A continuous random variable has PDF $f(x) = kx^2(1 - x)$, $0 < x < 1$. Find k, the mean, the variance and $P(X < \frac{1}{2})$.
- b) The average number of defects per item is 3 (Poisson). Find the probability that an item has at least 2 defects. [6+4]

OR

5. Marks of 500 students are normally distributed with mean 65 and s.d. 8. Find (a) the number of students who scored more than 75 (b) the number who scored between 55 and 71 (c) the minimum mark of the top 10% of students. **[10]**

6.a) Explain Type I and Type II errors with an example.

- b) A sample of 50 bulbs of brand A gives mean life 1282 h with s.d. 80 h. A sample of 60 bulbs of brand B gives mean 1208 h with s.d. 94 h. Is brand A better than brand B at 5% level? **[4+6]**

OR

7.a) A coin is tossed 400 times and shows 216 heads. Test at 5% whether the coin is unbiased.

- b) Find the 95% confidence limits for the proportion of heads. **[5+5]**

8. Marks of 8 students before and after a training programme are: Before 23, 20, 19, 21, 18, 20, 18, 17; After 24, 19, 22, 18, 20, 22, 20, 20. Test at 5% whether the programme improved the marks. **[10]**

OR

9. In an experiment on immunisation of cattle: Inoculated — attacked 25, not attacked 220; Not inoculated — attacked 90, not attacked 160. Test whether inoculation is effective in preventing the disease (5% level). **[10]**

10. Fit a curve of the form $y = ae^{bx}$ to the data: x: 1, 2, 3, 4, 5; y: 1.6, 4.5, 13.8, 40.2, 125. **[10]**

OR

11. Find the correlation coefficient and both regression lines for x: 2, 4, 6, 8, 10; y: 5, 7, 6, 10, 12. Estimate y when x = 7. **[10]**

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Answer Key

Part A

1a	$P(A \cap B) = 0.4 + 0.5 - 0.7 = 0.2$; $P(A/B) = \frac{0.2}{0.5} = 0.4$.
1b	$P(\geq 2) = \frac{4}{8}$, $P(\geq 1) = \frac{7}{8}$; answer $\frac{4/8}{7/8} = \frac{4}{7}$.
1c	Use the table in Unit 2, §2.1.
1d	$e^{-\lambda}\lambda = \frac{e^{-\lambda}\lambda^2}{2} \Rightarrow \lambda = 2$; $P(0) = e^{-2} = 0.1353$.
1e	See Unit 3, §3.6.
1f	$n = \left(\frac{1.96 \times 12}{2}\right)^2 = 138.3 \Rightarrow n = 139$.
1g	Single mean, two means, paired t, CI for μ , test of r. [Unit 4, §4.2]
1h	$F = \frac{16}{9} = 1.78 < F_{0.05}(8, 12) = 2.85$: accept; the variances are equal.
1i	$nA + b\Sigma X = \Sigma Y$; $A\Sigma X + b\Sigma X^2 = \Sigma XY$ with $X = \log x$, $Y = \log y$, $A = \log a$.
1j	$r = \sqrt{0.36} = 0.6$; $y - 12 = 0.8(x - 10) \Rightarrow y = 0.8x + 4$.

Part B

Q2. Conditional / independent

(a) $P(A \cap B) = \frac{1}{3} + \frac{3}{4} - \frac{11}{12} = \frac{1}{6}$; $P(A/B) = \frac{2}{9}$; $P(B/A) = \frac{1}{2}$; $P(\bar{A} \cap B) = \frac{3}{4} - \frac{1}{6} = \frac{7}{12}$. (b) $1 - \frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3}{4} = \frac{3}{4}$.

Q3. Urns

$P(W) = \frac{1}{3} \left(\frac{2}{5} + \frac{3}{5} + \frac{4}{5} \right) = \frac{3}{5}$. $P(I/W) = \frac{2}{9}$, $P(II/W) = \frac{1}{3}$, $P(III/W) = \frac{4}{9}$.

Q4. PDF / Poisson

(a) $k \left(\frac{1}{3} - \frac{1}{4} \right) = 1 \Rightarrow k = 12$; mean $= 12 \left(\frac{1}{4} - \frac{1}{5} \right) = 0.6$; $E(X^2) = 12 \left(\frac{1}{5} - \frac{1}{6} \right) = 0.4$, var $= 0.04$; $P(X < \frac{1}{2}) = 12 \left(\frac{1}{24} - \frac{1}{64} \right) = 0.3125$. (b) $1 - e^{-3}(1 + 3) = 0.8009$.

Q5. Normal

(a) $z = 1.25$: $0.5 - 0.3944 = 0.1056 \rightarrow 53$ students. (b) $z = -1.25$, 0.75 : $0.3944 + 0.2734 = 0.6678 \rightarrow 334$. (c) $z = 1.28$: $65 + 1.28(8) = 75.24$.

Q6. Two means

$H_1: \mu_1 > \mu_2$. $Z = \frac{74}{\sqrt{128+147.27}} = 4.46 > 1.645$: reject H_0 . Brand A is better.

Q7. Single proportion

$p = 0.54$; $Z = \frac{0.04}{\sqrt{0.25/400}} = 1.6 < 1.96$: accept; unbiased. CI: $0.54 \pm 0.0488 = (0.491, 0.589)$.

Q8. Paired t

d = After – Before: 1, -1, 3, -3, 2, 2, 2, 3. $\bar{d} = 1.125$, $S_d = 2.10$, $t = 1.52 < t_{0.05}(7) = 1.895$: accept H_0 .
No significant improvement.

Q9. χ^2 2×2

E: 56.92, 188.08 / 58.08, 191.92. $\chi^2 = 46.17 > 3.841$ ($v = 1$): reject independence. Inoculation is effective.

Q10. ae^{bx}

$\log_{10} y$: 0.2041, 0.6532, 1.1399, 1.6042, 2.0969; $\Sigma Y = 5.6983$, $\Sigma xY = 21.8316$. $5A + 15B = 5.6983$,
 $15A + 55B = 21.8316 \rightarrow B = 0.4737$, $A = -0.2813$. $a = 0.523$, $b = \frac{0.4737}{0.4343} = 1.091$. **$y = 0.523e^{1.091x}$** .

Q11. Correlation / regression

$\bar{x} = 6$, $\bar{y} = 8$; $\Sigma X^2 = 40$, $\Sigma Y^2 = 34$, $\Sigma XY = 34$. $r = 0.922$; $b_{yx} = 0.85$, $b_{xy} = 1.0$. $y = 0.85x + 2.9$; $x = y - 2$. At $x = 7$: $y = 8.85$.