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**May 2026**

**B. Sc. (Mathematics, Mathematics & Computing) – 2nd Semester**

**Probability & Statistics II (BMH23-205)**

**Time: 3 Hours** **Max. Marks:75**

***Instructions:***
1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Students can use calculator. Specific tabular values are mentioned in the question paper, no more tables are required.*

## PART –A

Q1 (a) Define a discrete random variable. (1.5)

(b) For a continuous random variable $X \geq 0$, show that $E(X) \geq 0$. (1.5)

(c) Find $\text{Var}(k)$, where $k$ is a constant. (1.5)

(d) Does a function given by $f(x) = \frac{1}{2}(x+1),\ -1 < x < 1$ represent a density function? (1.5)

(e) In a normal probability curve, area to the right of the point $x_1$ is 0.5 and to the left of the point $x_2$ is 0.6. Is $x_1 > x_2$ or $x_1 < x_2$ or $x_1 = x_2$? Explain. (1.5)

(f) Let $A$ and $B$ be any two independent events. Does $P\left(\frac{A}{B}\right)$ depend on $P(B)$? (1.5)

(g) In hypothesis testing, write the test statistic for the test of significance for difference of means. (1.5)

(h) In left-tailed test, what is the critical value at 5% level of significance? (1.5)

(i) State the null and alternative hypotheses regarding population mean that lead to (i) left-tailed test, (ii) two-tailed test. (1.5)

(j) Differentiate between parameter and statistic. (1.5)

## PART –B

Q2 (a) The probability that a pen manufactured by a company will be defective is $\frac{1}{10}$. (7)

If 12 such pens are manufactured, find the probability that (i) exactly two will be defective, (ii) at least two will be defective.

(b) If a random variable has a Poisson distribution such that $P(1) = P(2)$, find (8)
(i) mean of the distribution, (ii) $P(4)$.

Q3 (a) A sample of 100 dry battery cells tested to find the length of life produced the following result: $\mu = 12$ hours, $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of battery cells are expected to have life: (i) more than 15 hours, (ii) less than 6 hours, (iii) between 10 and 14 hours? [Given $P(0 \le Z \le 1) = 0.3413, P(0 \le Z \le 2) = 0.4772, P(0 \le Z \le 0.67) = 0.2486$], (7)

(b) Let $(X, Y)$ be a bivariate variable having the joint probability function as (8)

| X / Y | -1 | 0 | 1 |
|---|---|---|---|
| 0 | b | 2b | b |
| 1 | 3b | 2b | b |
| 2 | 2b | b | 2b |

Find marginal distributions of $X$ and $Y$. Also find the conditional distribution of $X$ given $Y = 1$.

Q4 (a) Find $k$ such that $f(x, y) = k(x + y), 0 < x < 1, 0 < y < 1$ is a joint probability density function for $x$ and $y$. Also find marginal densities for $x$ and $y$. (7)

(b) Two marbles are drawn at random from a box containing 10 red, 30 white, 30 blue, and 15 orange marbles. Assuming that replacement being made after each drawing, find the probability that (i) both are white, (ii) first is red and second is white. (8)

Q5 (a) Fit a second-degree parabola in the following data: (7)

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $y$ | 1 | 4 | 10 | 17 | 30 |

(b) Fit a straight line to the following data considering $x$ as independent variable: (8)

| $x$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $y$ | 1200 | 900 | 600 | 200 | 110 | 50 |

Q6 (a) In a sample of 1000 people, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat eaters are equally popular at 1% level of significance? (7)

(b) A random sample of 200 villages was taken from a certain district and the average population per village was found to be 485 with standard deviation of 50. Another random sample of 200 villages from the same district gave an average population of 510 per village with standard deviation of 40. Is the difference between averages of two samples significant at 5% level? (8)

Q7 (a) A pair of dice is rolled. Find the conditional probability $P(A/B)$ where $A$ is "2 appears on at least one dice", and $B$ is "sum of numbers appearing on die is 6". (7)

(b) A certain stimulus when injected to 12 patients resulted in the following increase in the blood pressure:
5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4 and 6.
Can it be concluded that the stimulus, in general, caused an increase in blood pressure? [Given tabulated $t_{0.05} = 2.2$ for 11 degrees of freedom]. (8)

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