A–1008

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MAT-503

Mathematics (MSCMT-23)

Advanced Statistics

Examination February, 2026

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *Two* (02) questions only.

1. From a vessel containing 3 white and 5 black balls, 4 balls are transferred into an empty vessel. From this vessel a ball is drawn and is found to be white. What is the probability that out of four balls transferred 3 are white and 1 is black?

2. State and prove Baye's Theorem.

3. A random variable X has the following probability function :

Values of X, x	$p(x)$
0	0
1	k
2	$2k$
3	$2k$
4	$3k$
5	k^2
6	$2k^2$
7	$7k^2 + k$

(i) Find k.

(ii) Evaluate $P(X < 6)$ $P(X \geq 6)$, and $P(0 < X < 5)$

(iii) If $P(X \leq a) > \frac{1}{2}$, find the minimum value of a, and

(iv) Determine the distribution function of X.

4. A sample of 100 dry battery cell tested to find the length of life produced the following results: $\bar{x} = 12$ 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

5. Define the following term :

   (i) Coefficient of Correlation,

   (ii) Rank Correlation,

   (iii) Regression Coefficients

   (iv) Angle between two lines of Regression

   (v) Relation between Correlation coefficient and Regression coefficients.

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *Four* (04) questions only.

1. A card is drawn from a pack of 52 cards. Find the probability of getting a king or a red card

2. Data on readership of a certain magazine show that the proportion of 'male' readers under 35 is 0.40 and over 35 is 0.20. If the proportion of readers under 35 is 0.70, find the proportion of subscribers that are "females over 35 years. Also calculate the probability that a randomly selected male subscriber is under 35 years of age.

3. The diameter of an electric cable, say X, is assume to be a continuous random variable with probability density function $f(x) = 6x(1 - x)$, $0 \leq x \leq 1$.

   (i) Check that $f(x)$ is probability density function and,

   (ii) Determine a number b, such that for $0 \leq x \leq 1$. $f(x) \geq 0$.

4. Define the following term :

   (i) Conditional Probability

   (ii) Independent Events

   (iii) Pairwise Independent Events

   (iv) Mutually Independent Events

5. Let X be a discrete random variable having probability mass function

$$p_x(x) = \begin{cases} \frac{1}{2} & \text{if} \quad x = 1 \\ \frac{1}{3} & \text{if} \quad x = 2 \\ \frac{1}{6} & \text{if} \quad x = 3 \\ 0 & \text{otherwise} \end{cases}$$

   Find the third moment of X.

6. An insurance company finds that 0.005% of the population dies from a certain kind of accident each year. What is the probability that the company must pay off no more than 3 of 10,000 insured risks against such incident in a given year?

7. Comment on the following statement :

   (i) For a Binomial distribution, mean is 6 and variance is 9.

   (ii) A die is tossed thrice. A success is getting 1 or 6 on a toss. Find the mean and variance of the number of success.

8. Show that the area under the normal curve is unity.

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