

SEMESTER EXAMINATION-2021
CLASS – B.Sc.V SEMESTER, SUBJECT: MATHEMATICS
PAPER CODE: BMA-S501

PAPER TITLE: PROBABILITY AND STATISTICS

Time: 3 hour

Max. Marks: 70

Min. Pass: 40%

Note: Question Paper is divided into two sections: **A and B**. Attempt both the sections as per given instructions.

SECTION-A (SHORT ANSWER TYPE QUESTIONS)

Instructions: Answer any five questions in about 150 words (5 X 6 = 30 Marks) each. Each question carries six marks.

Question-1: Define mathematical probability with an example.

Question-2: What is the chance that a leap year selected at random will contain 53 Sundays?

Question-3: A bag contains 3 red, 6 white and 7 blue balls, What is the probability that two balls drawn are white and blue?

Question-4: Prove that the probability of the union of any two events A and B is

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Question-5: A problem in Statistics is given to the three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently?

Question-6: The diameter of an electric cable; say X, is assumed to be a continuous random variable with p.d.f. $f(x) = 6x(1-x)$, $0 \leq x \leq 1$

(i). Check that above is p.d.f.

(ii) Determine number b such that $P(X < b) = P(X > b)$

Question-7: Define joint density function and marginal density functions.

Question-8: Two unbiased dice are thrown. Find the expected values of the sum of numbers of points on them.

Question-9: Ten coins are thrown simultaneously. Find the probability of getting at least seven heads.

Question-10: Define exponential distribution and find its mean and variance.

SECTION-B (LONG ANSWER TYPE QUESTIONS)

Instructions: Answer any FOUR questions in detail. Each question carries 10 marks. (4 X 10 = 40 Marks)

Question-11: A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, two officers of the sales department and 1 chartered accountant, Find the probability of forming the committee in the following manner:

(i). There must be one from each category.

(ii) It should have at least one from the purchase department.

(iii) The chartered accountant must be in the committee.

Question-12: A bag contains 10 gold and 8 silver coins. Two successive drawings of 4 coins are made such that:

- (i) coins are replaced before the second trial,
- (ii) the coins are not replaced before the second trial.

Find the probability that the first drawing will give 4 gold and the second 4 silver coins.

Question-13: Define probability mass function. Also if A random variable X has the following probability Distribution:

| | | | | | | | | |
|-------------|---|---|----|----|----|----------------|-----------------|---------------------|
| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| P(x) | 0 | k | 2k | 2k | 3k | k ² | 2k ² | 7k ² + k |

- (i) Find k
- (ii) Evaluate P(X < 6), P(X ≥ 6)

Question-14: Prove that Poisson Distribution is a limiting case of Binomial Distribution.

Question-15: The joint probability distribution of two random variables X and Y is given by :

$$p(x, y) = \frac{2}{n(n+1)}, \quad x = 1, 2, \dots, n \quad y = 1, 2, \dots, x$$

Examine whether X and Y are independent.

Question-16: 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 Poisson variate with mean 1.5. Calculate the proportion of days on which

- (i) neither car is used, and
- (ii) some demand is refused.

Question-17: Define uniform distribution. Subway train on a certain line runs every half between mid night and six in the morning. What is the probability that a man entering the station at a random time, during this period will have to wait at least twenty minutes?

Question-18: The mean yield for one-acre plot is 662 kilos with a s.d. 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1,000 plots would you expect to have yield:

- (i) over 700 kilos, (ii) below 650 kilos, and
- (iii) what is the lowest yield of the best 100 plots?

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