MMDSE-3.6

Sl. No.

III Semester M.Sc. Degree Examination, October/November - 2025
MATHEMATICS
Mathematical Statistics
Course : VI
(CBCS SLM Scheme)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

1) Answer any Five full questions.
2) All questions carry equal marks.
3) Use of scientific calculator is permitted.

1. a) Describe the Merits and demerits of Mode

b) Form a grouped frequency distribution from the following Height in cms: 120, 122, 145, 156, 160, 170, 180, 187, 165, 156, 135, 146, 155, 160, 180, 182, 168, 164, 164, 163, 152, 160, 158, 159, 150, 160, 165, 162, 168, 163, 158, 159, 168, 164, 165, 160, 166, 170, 172, 169. [hint take class 120-130, 130-140, so on]. Hence draw histogram and locate mode.

c) Define central tendency. Write the chief characteristics of a good measure of central tendency.

d) The mean of height of 20 boys is 66.5inches. While calculating the average height, a person recorded one value as 63 inches, instead of 68inches. Find the actual mean height. **(4+4+4+4)**

2. a) Derive the expression for standard deviation of two sets of data.

b) Define Bowley's coefficient of skewness. Find the limits of Bowley's coefficient of skewness.

c) State Baye's theorem. A boy is known to speak the truth 4 out of 5 times. He throws a die and reports that the number obtained is a six. Using the theorem find the probability that number obtained is actually six? **(4+6+6)**

[P.T.O.

3. a) Four cards are drawn from a pack of playing cards. What is the probability that

i) All are diamonds, ii) One card of each unit.

b) A continuous random variable X has a pdf $f(x) = \begin{cases} kx^2, & 0 \le x \le 1 \\ 0, & \text{elsewhere} \end{cases}$, find

i) k iii) median v) $P(X > \frac{1}{2}), and$

ii) mean, iv) mode, vi) P(0.25 < X < 0.75)

c) If X and Y are two continuous random variables having joint density function:

$$f(x, y) = \begin{cases} \frac{6 - x - y}{8}, & 0 \le x < 2,\ 2 \le y < 4 \\ 0, & \text{elsewhere} \end{cases}$$

Obtain

i) Marginal probability function of X and Y.

ii) Conditional distribution function of X given Y=1 and Y given X = 2.

iii) Also, find $\mathbb{P}[X < 1 \cap Y < 1], \mathbb{P}[X + Y < 3] and\ \mathbb{P}[X < 1 | Y < 3]$ **(4+6+6)**

4. a) If X and Y are two independent r.v's, then prove that E(XY)= E(X) E(Y), provided all expectations exist.

b) State and prove the central limit theorem

c) In a communication system each data consists of 1000 bits. Due to the noise, each bit may be received in error with probability 0.01. It is assumed bit errors occur independ ently. Find the probability that there are more than 8 errors in a certain data packet. **(4+6+6)**

5. a) On an average a box contains 2 defective items. Find the probability that a randomly selected box has i) no defective items, ii) at the most 2 defective items.

b) Derive expressions for the Mean and Variance of Exponential distribution.

c) Heights of 300 children are normally distributed with mean 120 cms and variance 4 cms^2 .Find the number of children having heights i) greater than 116 cms, ii) between 115 cms and 120 cms, iii) less than 118 cms. **(4+6+6)**

6. a) What is Chi-square distribution? What are its applications?

b) A study has been made to compare the nicotine contents of two brands of cigarettes. Ten cigarettes of brand A has an average nicotine content of 3.1mg with a S.D of 0.5mg, while eight cigarettes of brand B has an average nicotine content of 2.7mg with a. S.D of 0.7mg, assuming that the two sets of data are random samples from normal populations with equal variances. Construct a 95% confidence interval for the true difference in the average nicotine content of the two brands of cigarettes.

c) Construct 90% confidence interval in the variability of amount of fill in 475gm and 850gm cornflakes boxes.

Sample	Size	Sample variance
850 gm boxes	4	40.917
475 gm boxes	15	16.714

(4+6+6)

7. a) Explain one tailed and two tailed test.

b) A company manufactures car tyres. Their average life is 40,000 kilometres and standard deviation 5,000 kilometers. A change in the production process is believed to result in a better product. A test of sample of 100 new tyres has mean life of 41,000 kilometers. Can you conclude at 5% level of significance that the new product gives better result?

c) Describe the steps involved in Small sample test procedure to test the significance of mean of a population. **(4+6+6)**

[P.T.O.

8. a) A random sample of 25 pairs of observations from a normal population with correlation coefficient 0.7. Is this significant of correlation in the population? Explain.

b) Describe the steps involved in F - test for equality of two population variances.

c) A normal variate has standard deviation 3. Fifteen sample observations of the variate have standard deviation 4. Test at 1% level of significance whether the population standard deviation is 3. **(4+6+6)**
