MMDSE-3.6

Sl.No. :

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

Time : 3 Hours **Max. Marks : 80**

Instruction : Answer any Five full Questions.

Q1) a) Define classification and tabulation. Explain briefly the types of classification and give an example each.

b) Distinguish between primary data and secondary data. Briefly explain the sources collecting primary data.

c) Prepare a grouped frequency distribution for the following data representing marks in Mathematics of 30 students : 50, 92, 63, 88, 65, 62, 61, 63, 68, 66, 63, 95, 64, 67, 68, 96, 86, 64, 63, 77, 68, 60, 73, 63, 64, 66, 67, 72, 61, 90.

[5+5+6]

Q2) a) Define central tendency. State and prove the property of effect of change of origin and change of scale on Arithmetic Mean.

b) Show that standard deviation is not less than mean deviation from mean.

c) Explain skewness. Prove that Karl-Pearson's (S_{KP}) coefficient of skewness lies between $-3 < S_{KP} < 3$.

[6+4+6]

Q3) a) State and prove addition theorem of probability.

b) A box I contains 3 red and 4 yellow balls and another box II contains 4 red and 5 yellow balls. One ball is drawn from one of the boxes, and is found to be red. Find the probability that it was drawn from box I.

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

find (i) k, (ii) mean, (iii) $P(X > 1/2)$.

[5+5+6]

Q4) a) The joint probability mass function of the two discrete random variables X and Y is given by $p(x,y)=\frac{2x+y}{27}$, $x=0, 1, 2;\ y=0, 1, 2$

Obtain:

i) marginal probability function of X

ii) conditional distribution function of X given Y = 1.

b) If X and Y are two independent continuous random variables, then prove that E(XY) = E(X) E(Y), provided all expectations exist.

c) State and prove De-Moivre's Laplace-central limit theorem.

[6+5+5]

Q5) a) Prove that mean and variance of a Poisson (λ) variate are equal.

b) In a college, 70% of the students are boys. In a random sample of 3 students, find the probability of getting (i) two boys, (ii) at least one boy.

c) If X is a normal variate with mean 60, and S.D. 4, find the probability that

i) $X \leq 64$ ii) $55 < X < 65$

[6+5+5]

Q6) a) Define chi-square distribution. Also, write its properties.

b) Define point estimation. Let $X_1, X_2, \ldots, X_n$ be a random sample from a normal population $N(\mu,1)$. Show that $t=\frac{1}{n}\sum_{i=1}^{n}x_i^2$ is an unbiased estimator of μ^2+1.

c) Let X follows exponential distribution with mean θ, then find MLE and MME of θ.

[6+5+5]

Q7) a) Define simple and composite hypothesis with an example.

b) Let X follows Exponential distribution with parameter θ. Obtain sizes of type I and type II error and power of the test if an observation takes at random exceeds 5 then it leads to reject H_0 such that $H_0 : \theta = 3$ against $H_1 : \theta = 4$.

c) A sample of 144 students is chosen from a university. The average height of these students is 160 cm and the standard deviation is 8 cm. At 1% level of significance can we assume that the average height of these university students is 158 cm?

[5+6+5]

Q8) a) A Human Resource manager is interested to determine whether the absenteeism is uniformly distributed throughout the week in production domain of his company. So, he collects the data from past year records which is shown in the table given below:

Day of the week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
No. of absentees:	7	8	11	12	5	13	14

Test whether the absence is uniformly distributed throughout the week at 1% level of significance?

b) The following are the marks obtained by 10 students in science and social tests.

Marks in science	35	37	38	42	44	46	51	54	55	56
Marks in social	40	32	39	42	41	31	50	52	46	55

Calculate the rank correlation coefficient for the data given above and test whether the correlation coefficient differs significantly or not?

[8+8]

