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M.Sc. (Mathematics) (Semester-3rd)

MATHEMATICAL STATISTICS

Subject Code: MMAT1313

Paper ID: [19220513]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It carries 16 marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 8 marks each. The student has to attempt any 3 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(4 marks each)**

Q1. The joint distribution of X and Y is given by $f(x,y) = 4xye^{-(x^2+y^2)}$. Find the Marginal Density functions of X and Y.

Q2. Derive the mean and M.G.F. of Binomial distribution.

Q3. State and prove additive property of Chi-square variates.

Q4. Explain briefly the *t*-test and its applications.

Section – B **(8 marks each)**

Q5. Let X_1 and X_2 be independent random variables each having a pdf

$$f(X) = e^{-X}; X > 0 \text{ and } f(X) = 0, \text{elsewhere.}$$

Show that $Y_1 = X_1 + X_2$ and $Y_2 = \frac{X_1}{X_2}$ are statistically independent.

Q6. Define Normal distribution. Prove that all the odd ordered central moments of Normal distribution are zero.

Q7. Prove that for large degrees of freedom, t-distribution tends to standard normal distribution.

Q8. A random sample of 10 boys had the following I.Q's:

70, 120, 110, 101, 88, 83, 95, 98, 107, 100.

Do these data support the assumption of a population mean I.Q. of 100?

(Tabulated value of *t* at 5% level of significance for 9 degrees of freedom is 2.262.)

Section – C **(10 marks each)**

Q9. (a) State and prove Chebychev's inequality for continuous random variable.

(b) Derive M.G.F. of Gamma distribution and also find mean and variance.

Q10. Derive Snedecor's F-distribution.

Q11. The three varieties of rice (X, Y, Z) are grown on 4 plots each allocated completely at random and the following data is obtained.

Varieties	I	II	III	IV
X	7	5	7	6
Y	7	6	4	3
Z	2	5	6	3

Test the significance of difference between yield of varieties.