Roll No…….. **Total No. of Printed Pages: 1**

Total No. of Questions: [09]

B.Sc. (HONS.) Math (Semester – 3rd)

MATHEMATICAL STATISTICS

Subject Code: BMATS1302

Paper ID: [19131212]

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

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of 2 marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 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 **(2 marks each)**

Q1. Attempt the following:

a) Write the classical definition of probability.
b) Write the three axioms of probability.
c) Four cards are drawn at random from a pack of 52 cards. Find the probability that they are a king, a queen, a jack, and an ace.
d) Define random variable with an example.
e) Write the properties of cumulative distribution function.
f) A continuous random variable X has a pdf $f(x) = kx(1 - x)$; $0 \leq x \leq 1$. Find the value of k.
g) Write the mean and variance of negative binomial distribution.
h) Let $P(X = x) = e^{-2}\frac{2^x}{x!}; x = 0, 1, 2, \ldots$ Find $E(X)$.
i) Define 'critical region'.
j) Write the applications of Student's t-distribution.

Section – B **(5 marks each)**

Q2. If A and B are any two events of sample space S and both are not disjoint. Show that

$$P(AUB) = P(A) + P(B) - P(AUB).$$

Q3. Define moment generating function and write its important properties.

Q4. Let $X \sim Bin(n, p)$ and $Y \sim Bin(m, p)$ and both are independent. Show that

$$X + Y \sim Bin(n + m, p).$$

Q5. If X and Y are independent Poisson variates such that $P(X = 1) = P(X = 2)$ and $P(Y = 2) = P(Y = 3)$. Find the variance of $X - 2Y$.

Q6. Explain the concepts of Type-I and Type-II errors in hypothesis testing.

Section – C **(10 marks each)**

Q7. State and prove Baye's Theorem.

Q8. The joint pdf of random variables of X and Y is given by:

$$f(x, y) = \left\{ \frac{(6-x-y)}{8},\ 0 \leq x \leq 2,\ 2 \leq y \leq 4 \quad 0, \qquad elsewhere. \right\}$$

Find

(a) $P(X < 1, Y < 3)$
(b) $P(X + Y < 3)$
(c) $P(X < 1/Y < 3)$
(d) $P(2X + Y > 3)$.

Q9. Define the sampling distribution of Chi-square and derive the expression for its moment generating function.