**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BSc DEGREE EXAMINATION DECEMBER 2022**
(Third Semester)

Branch –**MATHEMATICS**

**MATHEMATICAL STATISTICS - I**

Time: Three Hours Maximum: 50 Marks

**SECTION-A (5 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 1 = 5)

1. When a coin is tossed 'n' times what is the probability of getting even number of heads?
   (i)1/2 (ii) 2/3 (iii) 3/4 (iv) None of these
2. If X is a continuous random variable and Y=ax+b then var(Y)=.. ...
   (i) $a^2V(x)$ (ii) aV(x)+b (iii) a V(x)-b (iv) $a^2$ V(x)
3. What is moment generating function?
   (i) $M_x(t)=E(e^{tx})$ (ii) $M_x(t)=E(e^{-tx})$ (iii)$M_x(t)=E(e^{2tx})$ (iv) $M_x(t)=E(e^t)$
4. A linear Combination of independent normal variate is
   (i) Binomial variate (ii) Normal variate
   (iii)Poisson variate (iv) None
5. The independent variable is used to explain the dependent variable is called.....
   (i) Linear Regression analysis (ii) Multiple regression analysis
   (iii) Non-linear Regression analysis (iv) None of these.

**SECTION - B (15 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. a. A box contains 4 red , 2 white ,3 black balls. When a ball is drawn at random. What is the probability that it will be (i) red (ii) white (iii)black.

**OR**

b. Two dices are thrown simultaneously and the sum of the numbers obtained is found to be 7. What is the probability that the number 3 has appeared at least once?

7. a. A random variable $X$ has the following distribution:

| $X$ | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| $P(x)$ | 0.1 | K | 0.2 | 2k | 0.3 | k |

Determine i) k ii) Mean iii) Variance

**OR**

b. Prove that $E(X+Y) = E(X) + E(Y)$ for both discrete and continuous cases.

8. a. Explain the marginal distribution function.

**OR**

b. Find the moment generating function of

$$F(x) = \begin{cases} x, for & 0 < x < 1 \\ 2 - x \; for & 1 < x < 2 \\ 0, & otherwise \end{cases}$$

9. a. Explain the concept of a Discrete Probability Distribution.

**OR**

b. Derive a characteristics function of Normal distribution.

**Cont...**

10. a. Explain $x^2$- distribution and state its applications

**OR**

b. Calculate the coefficient of correlation between X and Y series from the following data:

| | X series | Y series |
|---|---|---|
| No. of pairs of observations | 15 | 15 |
| Arithmetic mean | 25 | 18 |
| Standard deviation | 3.01 | 3.03 |
| Sum of squares of deviation from mean | 136 | 138 |

Summation of product deviations X and Y series from their respective arithmetic mean=122

## SECTION -C (30 Marks)

Answer **ALL** questions

**ALL** questions carry **EQUAL** Marks (5 x 6 = 30)

11. a. State and prove Baye's theorem .

**OR**

b. In a coin tossing experiment if the coin shows up head 1 die is thrown and the result is recorded but if the coin shows tail two dies are thrown and their sum is recorded. What is the probability that the recorded number will be 2

12. a. A sample of 4 items is selected at random from a box containing 12 items of which 5 are defective. Find the expected number of defective items.

**OR**

b. Is the function defined as follows a density

$$f(x) = \begin{cases} e^{-x} \text{ if } x \geq 0 \\ 0, \quad x < 0 \end{cases}$$

If so determine probability that the variate having this density will fall in the interval (1, 2). Find the Cumulative Probability function $F(2)$.

13. a. Let the random variable X assumes the value 'r' with the probability law

$$P(X = r) = q^{r-1}p; r = 1,2,3$$

Find the MGF of X and hence its mean and variance.

**OR**

b. Two random variables X and Y have the joint pdf

$$f(x,y) = \begin{cases} 2 - x - y, & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{Otherwise} \end{cases}$$

Find (i) V(x)& V(y) (ii) Cov(X,Y).

14. a. Find the probability distribution P(x>4) and P(x≤ 4).

| x | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| P(x) | 0 | A | a/2 | a/2 | a/4 | a/4 |

**OR**

b. If X is a normal variate with mean 30 and standard deviation 5. Find

(i) $P(26 \leq X \leq 40)$ (ii) $P(X > 40)$

15. a. Calculate Karl Pearson's coefficient of correlation from the given data given below:

| x | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| Y | 12 | 14 | 16 | 18 | 20 |

**OR**

b. Fit a regression line of Y on X for the following;

| X | 40 | 70 | 50 | 60 | 80 | 50 | 90 | 40 | 60 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|
| Y | 2.5 | 6 | 4.5 | 5 | 4.5 | 2 | 5 | 3 | 4.5 | 3 |

7-7-7 END