**22STU204N / 22STU204**

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

**BSc DEGREE EXAMINATION MAY 2025**
(Second Semester)

Branch - **STATISTICS**

**PROBABILITY THEORY**

Time: Three Hours — Maximum: 75 Marks

**SECTION-A (10 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (10 × 1 = 10)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 1 | Classical probability is also known as:<br>(a) Laplace's probability (b) mathematical probability<br>(c) a priori probability (d) all the above | K1 | CO1 |
| | 2 | Classical probability is measured in terms of:<br>(a) an absolute value (b) a ratio<br>(c) absolute value and ratio both (d) none of the above | K2 | CO1 |
| 2 | 3 | If X and Y are two random variables, then<br>(a) $E(XY)^2 = E(X^2)E(Y^2)$ (b) $E(XY)^2 = E(X^2Y^2)$<br>(c) $E(XY)^2 \geq E(X^2)E(Y^2)$ (d) $E(XY)^2 \leq E(X^2)E(Y^2)$ | K1 | CO2 |
| | 4 | If X is a random variable and its p.d.f. is f(x), E (log~x) represents:<br>(a) arithmetic mean (b) geometric mean<br>(c) harmonic mean (d) logarithmic mean | K2 | CO2 |
| 3 | 5 | If X is a random variable the $E(t^x)$ is<br>(a)CGF (b) MGF (c) PGF (d) xth moment | K1 | CO3 |
| | 6 | The heights of fathers and their sons form bivariable variables are ________ type of variables.<br>(a) continuous variables (b) discrete variables<br>(c) pseudo variables (d) none of the above | K2 | CO3 |
| 4 | 7 | The law of large numbers shows a relationship between the theoretical probability and the ___.<br>(a) sample size (b) exponential probability<br>(c) experimental probability (d) rational probability | K1 | CO4 |
| | 8 | What values are required to calculate Chebyshev's inequality?<br>(a) The mean and median<br>(b) The mean and standard deviation<br>(c) The median and standard deviation<br>(d) The variance and distribution | K2 | CO4 |
| 5 | 9 | A random variable X follows a standard normal distribution and a function of X as Y = 3x + 2 is given. If μx = 0 and σx = 1, what are the mean (μy) and standard deviation (σy) of Y?<br>(a) μy = 0, σy = 1 (b) μy = 2, σy = 1<br>(c) μy = 2, σy = 3 (d) μy = 0, σy = 3 | K2 | CO5 |
| | 10 | A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the probability that exactly two of the three balls were red, the first ball being red, is<br>(a).1/3 (b).4/7 (c).15/28 (d).None of the above | K2 | CO5 |

Cont...

## SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 11a | Define probability. Brief about the various approached of probability. Illustrate. | K3 | CO1 |
| | | (OR) | | |
| | 11b | State and prove the additive theorem of probability of two events. | | |
| 2 | 12a | Deleneate about continuous Distribution function and its properties. | K3 | CO2 |
| | | (OR) | | |
| | 12b | State and Prove the multiplicative theorem property of Expectation. | | |
| 3 | 13a | Explain joint probability mass function – Illustrate. | K3 | CO3 |
| | | (OR) | | |
| | 13b | Delineate about Bivariate Distribution – Illustrate. | | |
| 4 | 14a | Illustrate the properties of MGF. | K3 | CO4 |
| | | (OR) | | |
| | 14b | State and prove the Chebyche's Inequality. | | |
| 5 | 15a | Derive the distribution of the additive of two random variable. | K4 | CO5 |
| | | (OR) | | |
| | 15b | P.T V(X) = E [V(X/Y)] + [E(X/Y)]. | | |

## SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 16 | In a certain town there are equal number of male and female residents. It is known that 5% females and 20% males are unemployed. If any unemployed person is picked-up at random, what is the probability that:<br>A)it is male and B)it is female? Use Bayes law | K4 | CO1 |
| 2 | 17 | a) Define co variance and its properties<br>b) Let $X_1 X_2$ .....xn be 'n' random variables, then show *that*<br>$V\left(\sum_{i=1}^{n} a_i x_i\right) = \sum ai^2 V(x_i) + 2\sum_{i=1}^{n}\sum_{j=1}^{n} a_i a_j Cov(x_i x_j)$ (i<j) | K4 | CO2 |
| 3 | 18 | Two random variables X and Y have the following point probability density function<br>$f(x,y) = \begin{cases} z-x-y;\ 0\le x\le 1, 0\le y\le 1 \\ 0 \quad ;\ otherwise \end{cases}$<br>find (i) Managerial density function of X and Y<br>(ii) Conditional density functions<br>(iii) Var (x) and Var (Y) and<br>(iv) covariance between X and Y | K4 | CO3 |
| 4 | 19 | State and prove that the Weak Law of Large Numbers. | K4 | CO4 |
| 5 | 20 | Prove that<br>i. The joint p.d.f g(u,v) of the transformed variables U and V is g(u,v) = f(x,y) \|J\|<br>ii. If X and Y are independent continuous random variable, then the pdf of U =X +Y is given by<br>h(u)= $\int_{-\infty}^{\infty} f(v)f(u-v)dv$ | K4 | CO5 |

Z-Z-Z END