

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)BSc DEGREE EXAMINATION MAY 2026
(Third Semester)

Branch: MATHEMATICS

MATHEMATICAL STATISTICS - I

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	The probability that both events A and B occur is denoted as _____. a) $P(A \cup B)$ b) $P(A \cap B)$ c) $P(A) + P(B)$ d) $P(A B)$	K1	CO1
	2	If a die is rolled once, what is the probability of getting an even number? a) 1/2 b) 1/3 c) 1/6 d) 2/3	K2	CO1
2	3	A random variable is: a) A constant value in an experiment b) A function that assigns a real number to each outcome of a sample space c) A number chosen arbitrarily d) Always a continuous variable	K1	CO2
	4	The cumulative distribution function (CDF) $F(x)$ of a random variable X is defined as: a) $F(x) = P(X=x)$ b) $F(x) = P(X>x)$ c) $F(x) = P(X<x)$ d) $F(x) = P(X \leq x)$	K2	CO2
3	5	The function used to uniquely determine the probability distribution of a random variable is called _____. a) Probability Mass Function b) Moment Generating Function c) Cumulative Distribution Function d) D) Probability Density Function	K1	CO3
	6	The distribution of a subset of random variables obtained from a joint distribution is called _____. a) Conditional Distribution b) Marginal Distribution c) Joint Distribution d) D) Probability Mass Function	K2	CO3
4	7	Normal distribution can also be obtained as a limiting case of _____ with the parameter $\lambda \rightarrow \infty$. a) Binomial Distribution b) Poisson Distribution c) Uniform Distribution d) Exponential Distribution	K1	CO4
	8	In a Poisson distribution, the mean and variance are: a) Equal b) Variance > mean c) Variance < mean d) None	K2	CO4
5	9	A finite subset of statistical individuals in a population is called a _____. a) Parameter b) Sample c) Statistic d) Population	K1	CO5
	10	In stratified random sampling, the population is: a) Divided into equal groups and sampled randomly. b) Divided into homogeneous groups and samples are taken from each group. c) Sampled in every k^{th} interval. d) Randomly sampled without any grouping.	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	11.a.	Two cards are drawn one after another from a pack of 52 cards without replacement. Find the probability that: a) Both are kings b) First is a king and second is a queen c) At least one is a king	K1	CO1																				
	(OR)																							
	11.b.	State and prove the Generalized Addition Theorem for two events.																						
2	12.a.	Distinguish between discrete and continuous random variables with suitable examples.	K3	CO2																				
	(OR)																							
	12.b.	If X and Y are random variables then $E(X + Y) = E(X) + E(Y)$, provided all the expectations exist.																						
3	13.a.	Given the following bivariate probability distribution, obtain (i) Marginal distributions of X and Y, (ii) The conditional distribution of X given Y = 2. <table><tr><td></td><td>X</td><td>-1</td><td>0</td><td>1</td></tr><tr><td>Y</td><td>0</td><td>1/15</td><td>2/15</td><td>1/15</td></tr><tr><td></td><td>1</td><td>3/15</td><td>2/15</td><td>1/15</td></tr><tr><td></td><td>2</td><td>2/15</td><td>1/15</td><td>2/15</td></tr></table>		X	-1	0	1	Y	0	1/15	2/15	1/15		1	3/15	2/15	1/15		2	2/15	1/15	2/15	K5	CO3
		X	-1	0	1																			
	Y	0	1/15	2/15	1/15																			
	1	3/15	2/15	1/15																				
	2	2/15	1/15	2/15																				
(OR)																								
13.b.	Define the moment generating function (MGF) of a random variable. State and prove any two important properties of MGF.																							
4	14.a.	Explain the Poisson distribution. Derive its mean and variance. Give a practical example.	K4	CO4																				
	(OR)																							
	14.b.	Define simple linear regression. Explain how the regression line is obtained using the least squares method.																						
5	15.a.	Fit a straight line to the following data. <table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>8</td></tr><tr><td>Y</td><td>2.4</td><td>3</td><td>3.6</td><td>4</td><td>5</td><td>6</td></tr></table>	X	1	2	3	4	6	8	Y	2.4	3	3.6	4	5	6	K5	CO5						
	X	1	2	3	4	6	8																	
	Y	2.4	3	3.6	4	5	6																	
(OR)																								
15.b.	Explain stratified random sampling and mention when it is preferred over simple random sampling.																							

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	State and prove Baye's Theorem.	K1	CO1												
2	17	A discrete random variable X has the following probability function: <table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>P(X=x)</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.3</td><td>0.1</td></tr></table> Find: a) The E(X) b) The Var(X)	x	0	1	2	3	4	P(X=x)	0.1	0.2	0.3	0.3	0.1	K3	CO2
x	0	1	2	3	4											
P(X=x)	0.1	0.2	0.3	0.3	0.1											
3	18	What is meant by the conditional distribution of Y under the condition that $X = x$? Consider separately the cases where (i) X and Y are both discrete. (ii) X and Y are both continuous.	K2	CO3												
4	19	Let $X_1, X_2, \dots, X_n$ be a random sample from a normal population with mean μ and variance σ^2 then (i) $\bar{X} \sim N(\mu, \sigma^2/n)$ (ii) $\sum_{i=1}^n \left(\frac{X_i - \bar{X}}{\sigma} \right)^2$ is a χ^2 variate with (n-1) d.f., and	K4	CO4												
5	20	State the principle of least squares. Explain how it is used to fit a straight line.	K5	CO5												