23MCU418N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Fourth Semester)

Branch – **MATHEMATICS WITH COMPUTER APPLICATIONS**

ADVANCED MATHEMATICAL STATISTICS - II

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	A selection procedure of a sample having no involvement of probability is a) convenience sampling b) judgement sampling c) Quota sampling d) all the above	K1	CO1
	2	The estimator $\frac{\Sigma X_i}{n}$ of population mean is a) an unbiased estimator b) a consistent estimator c) both (a) and (b) d) neither (a) nor (b)	K2	CO1
2	3	By the method of moments one can estimate : a) all constants of a population b) only mean and variance of a distribution c) all the moments of a population distribution d) all of these	K1	CO2
	4	A maximum likelihood estimator is not necessarily : a) unbiased b) consistent c) sufficient d) efficient	K2	CO2
3	5	Level of significance is the probability of a) Type I error b) Type II error c) both (a) and (b) d) not committing any error	K1	CO3
	6	Range of the statistic - t is a) -1 to 1 b) -∞ to ∞ c) 0 to ∞ d) 0 to 1	K2	CO3
4	7	When conducting a two tailed z-test, the tabulated value at 1% level of significance is a) 1.96 b) 2.58 c) 1.645 d) 2.33	K1	CO4
	8	The test statistic for a paired t-test is a) $\frac{\lvert\bar{X}-\mu\rvert}{s/\sqrt{n}}$ b) $\frac{\lvert\bar{X}-\mu\rvert}{\sigma/\sqrt{n}}$ c) $\frac{\lvert\bar{d}\rvert}{s/\sqrt{n}}$ d) $\frac{\lvert\bar{d}\rvert}{\sigma/\sqrt{n}}$	K2	CO4
5	9	In a 3X3 contingency table, the degrees of freedom is a) 9 b) 6 c) 7 d) 4	K1	CO4
	10	In χ^2 test , no expected frequency should be a) less than 1 b) more than 1 c) less than 5 d) more than 5	K2	CO4

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.	Identify and describe the different methods of simple random sampling with relevant examples.	K3	CO1
		(OR)		
	11.b.	Solve and Show that the function $\frac{\Sigma x_i(\Sigma x_i-1)}{n(n-1)}$ is an unbiased estimator of p^2 for the sample $x_1, x_2, \ldots x_n$ drawn on x which takes the 1 or 0 with respect to probabilities p and 1-p.	K3	CO1

Cont...

2	12.a.	Identify and state the properties of the Maximum Likelihood Estimators (MLE).	K3	CO2
		(OR)		
	12.b.	Let $x_1, x_2, \ldots. x_n$ denote random sample of size n from uniform population with p.d.f $f(x,\theta) = 1, \theta - \frac{1}{2} \leq x \leq \theta + \frac{1}{2}$, $-\infty \leq x \leq \infty$. Solve and obtain the MLE of θ.		
3	13.a.	Explain the terms (i) Simple and Composite hypothesis (ii) One tailed and two tailed tests (iii) Level of significance	K2	CO3
		(OR)		
	13.b.	Explain the derivation of the probability function of Student's t-distribution with necessary steps and assumptions.		
4	14.a.	Random samples of 200 bolts manufactured by machine A and 100 bolts manufactured by machine B showed 19 and 5 defective bolts respectively. Test if there is a significant difference between the performances of the two machines?	K4	CO4
		(OR)		
	14.b.	Explain the procedure for testing the equality of two variances.		
5	15.a.	Analyze the procedure for testing the independence of attributes in a 2×2 contingency table.	K4	CO4
		(OR)		
	15.b.	For the following contingency table, test the independence of the attributes using χ^2 test.		

Attendance	Income level			
	Low	Middle	High	Total
Never	27	44	15	86
Occasional	25	63	14	102
Regular	22	74	12	108
Total	74	181	41	296

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	Compare and contrast different non-probability sampling methods with examples.	K4	CO1
2	17	For the double Poisson distribution $P(x) = \frac{1}{2}\frac{e^{-m_1}m_1^x}{x!} + \frac{1}{2}\frac{e^{-m_2}m_2^x}{x!}$; x=0,1,2..... Show that the estimates for m_1 and m_2 by the method of moments are $\mu_1' \pm \sqrt{\mu_2' - \mu_1' - \mu_1'^2}$.	K4	CO2
3	18	Analyze the steps involved in the general procedure of hypothesis testing.	K4	CO3
4	19	Two independent samples of 6 and 7 items gave the following data:	K4	CO4

Sample A	9	11	13	11	15	9	12	14
Sample B	10	12	10	14	9	8	10	

Examine whether the difference between the means of the two samples is significant at 5% level?

5	20	A book has 700 pages. The number of pages with various numbers of misprints is recorded below. At 5% significance level test whether the misprints are distributed according to Poisson distribution?	K4	CO4

No. of misprints	0	1	2	3	4	5
No. of pages	616	70	10	2	1	1

Z-Z-Z END