Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

First Semester

Construction Engineering and Management

PSMT2401 - Statistical Methods for Engineers

(Common to Environmental Engineering)

(Use of Statistical Tables can be permitted)

Regulations – 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	Questions	BLT	CO	Marks
1.	Define unbiasedness of an estimators.	L1	1	2
2.	State Neymann Factorization theorem.	L1	1	2
3.	Define Type-I and Type- II error.	L1	2	2
4.	State the uses of chi-square test.	L1	2	2
5.	State any two properties of residuals	L1	3	2
6.	Calculate correlation coefficient $R_{1.23}$ from the following information: $r_{12} = 0.82, r_{13} = 0.57, r_{23} = 0.42$.	L2	3	2
7.	What are the assumptions to be made in Analysis of Variance?	L1	4	2
8.	Why a 2 × 2 Latin square is not-possible? Explain.	L1	4	2
9.	State the general objectives of Principal Component Analysis.	L1	5	2
10.	State any two properties of Multivariate Normal distribution.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No		Questions	BLT	CO	Marks
11.	a.	Prove that $s^2 = \frac{\sum(X_i - \bar{X})^2}{n}$ is not an unbiased estimator of population variance σ^2. From that prove $S^2 = \frac{\sum(X_i - \bar{X})^2}{n-1}$ is an unbiased estimator of population variance σ^2.	L3	1	16
		Or			
	b.	Find the Maximum Likelihood estimator for θ for the probability mass function $p(x) = nc_x \theta^x (1-\theta)^x$ for $x = 0, 1, \ldots, n$.	L3	1	16

12.	a.	Two random samples gave the following results:	L3	2	16

Sample	Size	Sample mean	Sum of the squares of deviations from the mean
1.	10	15	90
2.	12	14	108

Examine whether the samples have come from the same normal population.

Or

	b.	Test of the fidelity and selectivity of 190 radio receivers produced the results shown in the following table:	L3	2	16

Selectivity	Fidelity		
	Low	Medium	High
Low	6	12	32
Medium	33	61	18
High	13	15	0

Use the 0.01 level of significance to test whether there is a relationship between selectivity and fidelity.

13.	a.	The below mentioned table shows the IQ, study hours and annual grades. Find out the correlation among IQ and study hours with Annual grades:	L3	3	16

IQ	10	13	19	16	13	21	23	29	27
Study hours	29	33	41	47	51	43	31	49	71
Annual grades	17	23	21	29	37	41	39	47	43

Or

	b.	Determine the effect of food and water intake of employees in their performance on their job using multiple regressions:	L3	3	16

x_1 (Food intake)	4	6	7	5	8
x_2 (Water intake)	7	13	14	11	15
y (Job performance)	17	23	29	18	33

14.	a.	Four farmers each used four types of manures for a crop and obtained the yields (in quintals) as below:	L3	4	16

Treatments					
		1	2	3	4
Farmers	A	22	16	21	12
	B	23	17	19	13
	C	21	14	18	11
	D	22	15	19	10

If there any significant difference between i) farmers ii) manures using Randomized block design.

Or

b. Analyze the variance in the following Latin Square of yields(in kgs) of paddy where A,B,C,D denote the different methods of cultivation: L3 4 16

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

Examine whether the different methods of cultivation have given significantly different yields.

15. a. Suppose the random variables $X_1, X_2, and X_3$ have the covariance matrix: L3 5 16

$$\Sigma = \begin{bmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 0 & 0 & 2 \end{bmatrix}.$$

Calculate the population principal components and hence find variances and covariance of principal components.

Or

b. Let X be distributed as $N_3(\mu, \Sigma)$ where $\mu^T = (1, -1, 2)$ and $\Sigma = \begin{bmatrix} 4 & 0 & -1 \\ 0 & 5 & 0 \\ -1 & 0 & 2 \end{bmatrix}$. Which of the following random variables are independent? Why? L3 5 16

a) $X_1 \ and \ X_2$

b) $X_2 \ and \ X_3$

c) $X_1 \ and \ X_3$

d) $(X_1, X_3) \ and \ X_2$

e) $X_1 \ and \ X_1 + 3X_2 - 2X_3$