

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***M.E DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025****First Semester****Construction Engineering and Management****MA4159/ PSMT2401 – Statistical Methods for Engineers****(Common to Environmental Engineering)****(Statistical tables Can be Permitted)****Regulations – 2021/2024****Duration : 3 Hrs****Maximum : 100 Marks****PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)**

Q.No	Questions	BLT	CO	Marks
1.	State the different characteristics of a good estimator.	L1	1	2
2.	Explain the consistency of an estimator.	L2	1	2
3.	Explain the terms sample size and sampling error in random sample?	L2	2	2
4.	A random sample of 200 tins of coconut oil gave an average weight of 4.95 Kgs with a standard deviation of 0.21 Kg. Do we accept that the net weight is 5 Kgs per tin at 5% level of significance?	L2	2	2
5.	Is it possible to get the following from a set of experimental data? $r_{12} = 0.6, r_{23} = 0.8, r_{13} = -0.5$.	L2	3	2
6.	List out the properties of residuals.	L2	3	2
7.	State the basic assumptions in an analysis of variance.	L1	4	2
8.	Compare CRD and LSD.	L2	4	2
9.	Give a real life example of a Multivariate data.	L2	5	2
10.	Every vector can be expressed as a unique linear combination of a fixed basis. Justify with an example.	L2	5	2

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

Q.No	Questions	BLT	CO	Marks
11.	a i If Q_1 and Q_2 are unbiased estimator of the parameter θ , for what condition on K_1 and K_2 is $K_1\theta_1 + K_2\theta_2$ an unbiased estimator of θ .	L3	1	10
	ii Show that $Y = \frac{1}{6}(Y_1 + 2Y_2 + 3Y_3)$ is not an sufficient estimator of θ .	L3	1	6
	Or			
b	Given a sample of n independent observations from the distribution with density $f(x; \theta_1, \theta_2) = \frac{1}{\theta_2} \exp\left[-\frac{(x-\theta_1)}{\theta_2}\right], \theta_1 \leq x < \infty$. Compute the following (i) the Maximum likelihood estimator of θ_2 when θ_1 is known. (ii) the Maximum likelihood estimator of θ_1 when θ_2 is	L3	1	16

known.

(iii) the joint Maximum likelihood estimator of θ_1 and θ_2 .

12. a i Two independent samples of 8 and 7 items had the following values: L3 2 8

I	9	11	13	11	15	9	12	14
II	10	12	10	14	9	8	10	-

Do the two estimates of the population variances differ significantly at 5% level of significant.

- ii A sample of 200 persons with a particular disease was selected. Out of these, 100 were given a drug and the others were not given any drug. The result are as follows: L3 2 8

Number of persons	Drug	No drug	Total
Cured	65	55	120
Not cured	35	45	80
Total	100	100	100

Or

- b i Two independent samples of 8 and 7 items had the following values: L3 2 8

I	9	11	13	11	15	9	12	14
II	10	12	10	14	9	8	10	-

Is the difference between the means of samples significant?

- ii The sales manager of a large company conducted a sample survey in states A and B taking 400 samples in each case. The results were L3 2 8

	State A	State B
Average Sales	Rs. 2,500	Rs. 2,200
S.D	Rs. 400	Rs. 550

Test whether the average sales is the same in the 2 states at 1% level of significance.

13. a Given the following set of data : L3 3 16

x_1	8.5	6.7	1.5	.3	4.6	2.0
x_2	5.0	4.2	8.5	1.4	3.6	1.3
y	25	30	11	22	27	19

- (i) Calculate the least square equation that the best relates these variables.
- (ii) Predict $\hat{Y}$, when $x_1 = 3$ and $x_2 = 2.7$

Or

- b i The simple correlation coefficient of a sample of 20 manufactured products whose length (X_1), weight (X_2) and life (X_3) are as follows: $r_{12}=0.77$, $r_{13}=0.72$, $r_{23}=0.52$. Compute the partial correlation coefficient $r_{12.3}$ and $r_{13.2}$ and also obtain the multiple correlation coefficient $R_{1.23}$. L3 3 8
- ii Discuss in detail about multiple and partial correlation with their uses. L3 3 8
14. a The following table gives the result of experiments on 4 varieties of a crop in 5 blocks of plots. Construct the ANOVA table to test the significance of the difference between the yields of the 4 varieties. L4 4 16

	Blocks				
	B1	B2	B3	B4	B5
A	32	34	33	35	37
B	34	33	36	37	35
C	31	34	35	32	36
D	29	26	30	28	29

Or

- b An experiment was planned to study the effect of sulphate of potash and super phosphate on the yield of potatoes. All the combination of 2 level of super phosphate (p) and 2 levels of sulphate (k) of potash were studied in a randomized block design for four replication for each. The yields obtained are given in the following table. Analyse the data and give your conclusion. (with $\alpha=1\%$) L4 4 16
15. a Compute the co-variance matrix for the two random variables X_1 and X_2 when their joint probability function $p_{12}(x_1, x_2)$ is represented by the entries in the body of the following table. L3 5 16

$x_2 \backslash x_1$	0	1	$p_1(x_1)$
-1	.24	.06	.3
0	.16	.14	.3
1	.40	.00	.4
$p_2(x_2)$	.8	.2	.1

Or

- b Compute the principal components of given covariance matrix L3 5 16

$$\Sigma = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}. \text{ Also find their variances.}$$