Register No : ____________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

First Semester

Construction Engineering and Management

PSMT2401/MA4159-Statistical Methods for Engineers

(Common to Environmental Engineering)

(Use of 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.	Define consistency.	RE	1	2
2.	List out the characteristics of a good estimator.	UN	1	2
3.	Explain Consumer's risk and Producer's risk.	UN	2	2
4.	List out the condition for applying chi-square test.	UN	2	2
5.	Prove that a multicorrelation coefficient can never be negative	UN	3	2
6.	State any two properties of residuals.	RE	3	2
7.	Compare CRD and RBD.	UN	4	2
8.	Explain 2^2 factorial design.	UN	4	2
9.	Define random vector.	RE	5	2
10.	Explain correlation of variables and components.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	If $x_1, x_2, \dots x_n$ are random observations on a Bernoulli variable X taking the value 1 with probability θ and the value 0 with probability (1- θ), show that $\frac{\tau(\tau-1)}{n(n-1)}$ is an unbiased estimate of θ^2, where $\tau = \sum_{i=1}^{n} x_i$.	AP	1	7
		ii	Compute the maximum likelihood estimator for p when $\mathrm{f(x\,;p) = p^x(1-p)^{1-x}}$ for $\mathrm{x = 0,1}$	AP	1	6
			Or			
	b		For random sampling from normal population N(μ,σ^2). Find the maximum likelihood estimators for (i) μ when σ^2 is known. (ii) σ^2 when μ is known. (iii) Simultaneous estimation of μ and σ^2.	AP	1	13

12. a i Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same at 5 % level. AP 2 7

ii Time taken by workers in performing a job are given below, AP 2 6

Method I	20	16	26	27	23	22
Method II	27	33	42	35	34	38

Test whether there is any significant difference between the variances of time distribution.

Or

b i The following table gives the number of accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. AP 2 7

Days	Mon	Tue	Wed	Thu	Fri	Sat
No of Accidents	15	19	13	12	16	15

ii Two salesman A and B are working in a certain area. From a sample survey conducted by the central office, the following information was obtained. AP 2 6

Salesman	No of sales	Average sales (Rs.)	S.D (R.s)
A	200	170	20
B	180	205	25

Test whether there is any significant differtence in the average sales between the two salesmen at 5% level.

13. a Compute the partial correlation coefficients $r_{12.3,} r_{13.2,} r_{23.1,} and\ r_{1.23}$ from the following correlation coefficients AP 3 13

$r_{12} = 0.82,\ r_{13} = 0.77\ and\ r_{23} = 0.80$

Or

b Fit a straight-line trend by the method of least squares to the following data. Assuming that the same rate of change continues, what would be the predicted profit for the year 1986? AP 3 13

Year	1979	1980	1981	1982	1983	1984	1985
Profit (in lakes)	672	824	968	1205	1464	1758	2058

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. AP 4 13

	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		The following table is a Latin square design when 4 varieties of seed are being tested. Set up the analysis of variance table and state your conclusion.	AP	4	13

A 100	B 100	C 130	D 120
C 120	D 130	A 110	B 110
D 120	C 100	B 110	A 120
B 100	A 140	D 100	C 120

15.	a	i	Compute the covariance matrix with the following data.	AP	5	8

X \ Y	0	1	$P_i(X_i)$
-1	0.24	0.06	0.3
0	0.16	0.14	0.3
1	0.40	0	0.4

		ii	Prove that all the subsets of X are normally distributed.	AP	5	5

Or

	b		Let $X_{3\times1}$ be $N_3(\mu,\sigma) with$ $\Sigma = \begin{pmatrix} 4 & 1 & 0 \\ 1 & 3 & 0 \\ 0 & 0 & 2 \end{pmatrix}$, Are X_1, X_2 independent?	AP	5	13

*PART – C (Marks 1*15 = 15)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
16.	a		Two independent samples of 8 and 7 items had the following values	AP	2	15

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

Test whether the two samples were coming from same normal population.

Or

	b		Compute the principal components to the following matrix	AP	5	15

$$A = \begin{pmatrix} 5 & 0 & 3 \\ 4 & 2 & 5 \\ 2 & -2 & 2 \end{pmatrix}$$