

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: IMSc
BRANCH: QEDS

SEMESTER : III
SESSION : MO/2022

SUBJECT: ED211 LINEAR STATISTICAL MODELS & REGRESSION ANALYSIS

TIME: 3:00 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1 Consider the linear model $Y = XB + \varepsilon$, where $Y = (Y_1, Y_2, \dots, Y_n)^T$, $B = (B_1, B_2, \dots, B_p)^T$, and $\varepsilon = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_n)^T$, with $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_n$ independent $N(0, \sigma^2)$ random variables. Find the maximum likelihood estimators of B and σ^2 . [5+5]

Q.2(a) Define BLUE along with a proper example. [5]

Q.2(b) State Gauss Markov-Theorem. [5]

Q.3(a) Use the following data to perform a one-way analysis of variance using $\alpha = 0.05$ ($F_{\alpha, 2, 12} = 3.89$). [10]

Group 1	Group 2	Group 3
51	23	56
45	43	76
33	23	74
45	43	87
67	45	56

Q.4 A research study was conducted to examine the impact of eating a high protein breakfast on adolescents' performance during a physical education physical fitness test. Half of the subjects received a high protein breakfast and half were given a low protein breakfast. All the adolescents, both male and female, were given a fitness test with high scores representing better performance. Test scores are recorded below. [10]

Group	High Protein	Low Protein
Males	10	5
	7	4
	9	7
	6	4
	8	5
Females	5	3
	4	4
	6	5
	3	1
	2	2

Are there any significant main effects or an interaction effect. Interpret your results. ($F_{0.05, 1, 16} = 4.4940$)

Q.5 The following table shows, for each of 18 cinchona plants, the yield of dry bark (in oz.), the height (in inches) and the girth (in inches) at a height of 6" from the ground. [10]

Plant No.	Yield	Height	Girth	Plant No.	Yield	Height	Girth
1	19	8	4	10	32	13	4
2	51	15	5	11	25	5	2
3	30	11	3	12	10	6	3
4	42	21	3	13	20	4	4
5	25	7	2	14	27	8	4
6	18	5	1	15	13	7	3
7	44	10	4	16	49	12	5
8	56	13	6	17	27	6	3
9	38	12	3	18	55	16	7

Find the partial correlation coefficient of yield and height eliminating the effect of Girth. Also, obtain the simple correlation coefficient between yield and height. Compare the results.