

U.G. 5th Semester Examination - 2020**STATISTICS****[HONOURS]****Course Code : STAH-CC-12****(Linear Models)**

Full Marks : 50(40+10)

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.**Notations and symbols have their usual meanings.*1. Answer any **five** questions: $2 \times 5 = 10$

- Write down the linear model for one-way classified data with assumptions.
- What is BLUE?
- What is the condition of estimability of linear parametric function in the Gauss-Markov linear model?
- Write down the two-way mixed effects model with assumptions.
- What is ANCOVA?
- What is regression diagnostics?
- Give a practical example where random effects model is used.

- What is the problem heteroscedasticity and how is it solved?

2. Answer any **two** questions: $5 \times 2 = 10$

- Consider the model $E(y_1) = \theta_1 - \theta_2$, $E(y_2) = \theta_1 + \theta_2$, $E(y_3) = \theta_1$, $E(y_4) = \theta_2$. Find the rank of the estimation space and obtain an error function.
- Derive the analysis of one way fixed effects model.
- Write down the two-way fixed effects model with more than one but equal number of observations per cell and prepare the corresponding ANOVA table.
- Complete the following ANOVA table by supplying the missing entries:

Source of Variation	Degrees of freedom	SS	MS	F
A	5	315.25	-	-
B	4	517.23	-	-
Error	-		-	
Total	29	1020.48		

Also test for the effects of Source B at 5% level of significance.

[Turn over]

3. Answer any **two** questions: $10 \times 2 = 20$

- a) Derive the analysis of two-way random effects model.
- b) Derive the analysis of one-way fixed-effects model with one concomitant variable.
- c) Consider the model

$$E(y_{ij}) = \alpha_i + \beta_j x_{ij}; j = 1, 2, \dots, n_j, i = 1, 2, \dots, p, \sum n_i = n.$$

Assuming normality with homoscedastic variance, derive the test statistics for testing that the regression lines are (i) parallel and (ii) identical.

- d) Consider the model

$$E(y_i) = \alpha + \beta_1 x_{i1} + \dots + \beta_p x_{ip}; i = 1, 2, \dots, n \quad \text{and}$$

$$D(y) = \sigma^2 I_n.$$

Assuming normality perform tests of the following hypotheses:

- i) $H_{01} : \beta_1 = \beta_2 = \dots = \beta_p = 0$ and
- ii) $H_{02} : \beta_p = 0$

[Internal Assessment: 10]
