

Semester	FIVE
Course	Major (Paper 2)
Paper Code	C3ST230521T
Paper Title	Linear Statistical Models
No. of Credits	4
Theory/Compo site/ Practical	Theory
Minimum No. of preparatory hours per week a student has to devote	4
Number of Module	ONE
Syllabus	Unit 1: Gauss Markov setup Gauss Markov model. Estimability of linear parametric function, least square estimation and BLUE, error space, estimation space and orthogonal projection, estimation of error variance. Classification of linear models. Fundamental theorem of least squares. Tests of general linear hypotheses. [10L] Unit 2: Analysis of Variance Factors of classification. Completely crossed, partially crossed and nested models. Balanced and unbalanced models (definitions and examples)[4L] One factor fixed effects ANOVA model. Two factor completely crossed fixed effects ANOVA model with and without interaction term. [8L] Comparison of treatment effects: Fisher's least significant difference method, Scheffe's method, Tukey's test, multiple range test (Duncan), Newman's Keul's test, Dunnett's test (Applications only) [4L] Analysing random and mixed effects model. [9L] Unit 3: Regression Tests related to simple linear regression, multiple linear regression and polynomial regression. Use of qualitative predictors (ordinal and nominal with two or more categories). R squared and adjusted R squared.[9L] Unit 4: Analysis of Covariance One factor and two factors fixed effects ANCOVA model with p concomitant variables. [8L]

Learning Outcomes	○ To identify Gauss Markov models and estimate parameters in the model. ○ Apply fundamental theory of least squares to test linear hypotheses in a Gauss Markov model. ○ To analyse ANOVA models for testing the main and interaction effects of several factors. ○ To perform multiple comparison of treatment effects. ○ To deal with testing problems related to regression models. ○ To understand the use of concomitant variables in analysing ANCOVA models.	
Reading/Reference List	1. Zimmerman, D. L. (2020): Linear Model theory with examples and exercises, Springer. 2. Rutherford, A. (2011): Introducing ANOVA and ANCOVA: a GLM approach, John Wiley & Sons. 3. Renchner, A. C. and Schaalje, G. B. (2008): Linear Models in Statistics (Second edition), John Wiley & Sons. 4. Scheffe, H. (1959): The Analysis of Variance, John Wiley. 5. Stapleton, J. H. (2009): Linear Statistical Models (Second Edition), Wiley Series. 6. Sengupta, D., Jammalamadaka, S. R. (2003): Linear Models: An Integrated Approach, Vol 6, World Scientific.	
Evaluation	CIA: 30 End-Sem: 70 Total: 100	
Paper Structure for Theory Semester Exam	Short questions (5 marks each) 5 out of 7	Long question (15 marks each) 3 out of 5