Title: Linear Models and Regression Analysis **Paper: I (Major)**
Course No: STSC1822M. **Semester: 8th** **No. of Credits: 4+2**

Course Objectives: To introduce to students the basic and advanced concepts of general linear model and regression analysis.

Course outcomes: On successful completion of this course, the students will be able to

- Comprehend the concepts of linear models and regression analysis.
- Apply the concepts of linear models to areas like design of experiments, econometrics, survival analysis and demography.

Theory: 4 credits

UNIT-I

Introduction to linear model, Theory of linear estimation, Gauss-Markov linear models, estimable functions, error and estimation space, normal equations and least square estimators, estimation of error variance, estimation with correlated observations, properties of least square estimators, the generalized inverse of a matrix, and solution of normal equations, variances, and covariance of least square estimators.

UNIT-II

Test of hypotheses for one and more than one linear parametric functions, Tests of linear hypotheses, estimable linear hypotheses, confidence intervals and prediction intervals, generalized F-test, generalized t-test.

UNIT-III

One-way and two-way classifications, fixed, random, and mixed-effects models. Experimental design models: Point estimation, Re-parameterization, Regression models, Multiple comparison tests due to Tukey, Scheffe.

UNIT-1V

Simple linear regression fit of polynomials, Residual and their plot as tests for departure from assumption such as fitness of model, normality, and homogeneity of variances and detection of outliers, Analysis of covariance, estimation and testing, one way model with one covariance.

Practical: 2 credits

Practical based on:

- Normal equations and least square estimators of linear models.
- The generalized inverse of a matrix.
- Generalized F test, generalized t test.
- One-way and two-way classifications.
- Multiple comparison tests due to Tukey.
- Simple linear regression fit of polynomials.

Recommended Text Books & References:

- Nalini Ravishanker and Dipak K. Dey (2002): A First Course in Linear Model Theory
- Douglas C. Montgomery, Az Elizabeth A. Peck, Ga G. Geoffrey Vining; Introduction to Linear Regression Analysis
- Cookers.and Weisberg, S (1982). Residual and Influence in Regression
- Draper,N.R. and Smith, R.L. (1998). Applied Regression Analysis(3rd Ed), Wiley.
- Gunst, R.F. and Mason, R.L. (1980). Regression Analysis and its Applications- A Data Oriented Approach, Marcel and Decker.
- Regression Analysis (Dr. Shalabh Notes, IIT Kanpur) Chapter-1,2 and 3
- Roa, C.R. (1973). Linear Statistical Inference and its Applications, Wiley Eastern.
- Weisberg, S. (1985). Applied Linear Regression, Wiley.