

Course Title:	Regression Analysis
Course Code:	STAT-201
Semester:	III
Credit Hours:	3 Credit Hours
Pre-requisites:	N / A

### **Learning Outcomes**

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

1. Select, implement and interpret appropriate regression models to explain real-world phenomena.
2. Demonstrate an understanding of the limitations and uncertainties associated with regression models.
3. State the assumptions of regression models and investigate these assumptions using appropriate plots and statistics.
4. Demonstrate a command of the mathematical foundations of regression models.
5. Demonstrate competence in using statistical software to implement regression procedures.

### **Course Contents**

#### **1- Introduction to Regression Analysis**

Definition and purpose, Deterministic and probabilistic models, Types of regression models (simple vs. multiple regression)

#### **2- Simple Linear Regression**

Scatter plots and relationship visualization, Model specification, Interpretation of model parameters, OLS estimators of model parameters, Application to real-world problems, Assumptions of Simple Linear Regression, Model Assumptions, Diagnostics, Software-based Practice, Standard Error of Estimate, Coefficient of Determination

#### **3- Correlation**

Concept of Correlation, Pearson Correlation Coefficient, Numerical Problems and its interpretations, Spearman's Rank Correlation, Numerical Problems and interpretations

#### **4- Multiple Linear Regression**

Model specification, Matrix Notation of MLR, Interpretation of Model Parameters, OLS estimators of model parameters, Application to real-world problems, Insights from real-world problems

#### **5- Model Assumptions and Diagnostics**

Classical OLS Assumptions, Overview of assumptions, Model Diagnostics, Residual Analysis, Residual Plots, Software-based Practice of Residual Analysis

**6- Goodness of Fit**

Assessing the Goodness of fit, R-squared, Limitations of R-squared

**7- Multiple and Partial Correlations**

Concept of multiple correlation, Numerical problems and interpretations, Insights from real-world problems, Concept of Partial Correlation, Numerical problems and interpretations, Insights from real-world problems.

**8- Leverage and Influential Values**

Concept of leverage and influence, Diagnostics of leverage and influence

**9- Methods for Model Specification**

Backward Selection, Forward Selection, Stepwise Selection, Mallows' Cp

**10- Choosing the Correct Type of Regression**

Continuous Dependent Variables, Categorical Dependent Variables, Count Dependent Variables

**11- Introduction to Generalized Linear Models**

Logistic Regression, Pre-requisites, Types of Logistic regression, Application, Limitations

- **Teaching-learning Strategies:**

Class Lecture method, which includes seminars, discussions, assignments and projects. (Audio-visual tools are used where necessary)

- **Assignments-Types and Number with calendar:**

According to the choice of respective teacher.

- **Assessment and Examinations:**

According to the University's Semester Rules.

Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	It takes place at the mid-point of the semester.
2	Formative Assessment	25%	It is continuous assessment. It includes: Classroom participation, attendance, assignments, and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

### **Textbook**

Frost, J. (2019). *Regression analysis: An intuitive guide for using and interpreting linear models*. Statistics By Jim Publishing.

### **Suggested Readings**

1. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). *Introduction to linear regression analysis*. John Wiley & Sons.
2. Gunst, R. F. (2018). *Regression analysis and its application: A data-oriented approach*. New York: Routledge.
3. Fox, J. (2015). *Applied Regression Analysis and Generalized Linear Models* (3<sup>rd</sup> ed.). SAGE Publications.