Programme	BS Computational Statistics and Data Analytics	Course Code	CSTA-201	Credit Hours	3
Course Title	Applied Regression Analysis				

Course Introduction

Regression Analysis: Regression analysis is central to understanding relationships between variables and making predictions. Students learn linear and nonlinear regression models, model diagnostics, and interpretations of regression coefficients to analyze complex data relationships.

Learning Outcomes

By the end of this course, you should 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 Content		Assignments/Readings
Week 1	**Unit – I** Introduction to Regression Analysis • Definition and purpose • Deterministic and probabilistic models • Types of regression models (simple vs. multiple regression)	
	Unit – II Simple Linear Regression Model • Scatter plots and relationship visualization • Model specification • Interpretation of model parameters	
Week 2	**Unit – III** • OLS estimators of model parameters • Application to real-world problems	
	Unit – IV • Insights from real-world problems	
Week 3	**Unit – V** Assumptions of Simple Linear Regression • Model Assumptions • Diagnostics • Software-based Practice	
	Unit – VI • Inference on the slope and intercept • Numerical Problems	

Week 4	**Unit – VII** • Standard Error of Estimate • Coefficient of Determination	
	Unit – VIII Quiz-1 on simple Linear Regression	
Week 5	**Unit – IX** • Concept of Correlation • Pearson Correlation Coefficient • Numerical Problems • Interpretations	
	Unit – X • Spearman's Rank Correlation • Numerical Problems • Interpretations	
Week 6	**Unit – XI** Multiple Linear Regression Model • Model specification • Matrix Notation of MLR • Interpretation of Model Parameters	
	Unit – XII • OLS estimators of model parameters • Application to real-world problems	
Week 7	**Unit – XIII** • Insights from real-world problems	
	Unit – XIV • Inference on model parameters • Numerical Problems	
Week 8	**Unit – XV** • Queries Session	
	Unit – XVI • Mid-Term Exam	
Week 9	**Unit – XVII** Model Assumptions and Diagnostics • Classical OLS Assumptions • Overview of assumptions	
	Unit – XVIII • Model Diagnostics • Residual Analysis • Residual Plots	
Week 10	**Unit – XIX** Software-based Practice of Residual Analysis	
	Unit – XX Goodness of Fit • Assessing the Goodness of fit	

Week	Unit	
	• R-squared • Limitations of R-squared	
Week 11	**Unit – XXI** Multiple and Partial Correlations • Concept of multiple correlation • Interpretation • Numerical problems • Insights from real-world problems	
	Unit – XXII • Concept of Partial Correlation • Interpretation • Numerical Problems • Insights from real-world problems	
Week 12	**Unit – XXIII** • Quiz-II	
	Unit – XXIV • Concept of Partial Correlation • Interpretation • Numerical Problems • Insights from real-world problems Concept of leverage and influence • Diagnostics of leverage and influence	
Week 13	**Unit – XXV** Methods for Model Specification • Backward Selection • Forward Selection	
	Unit – XXVI • Stepwise Selection • Mallows' Cp	
Week 14	**Unit –XXVII** Choosing the Correct Type of Regression • Continuous Dependent Variables • Categorical Dependent Variables • Count Dependent Variables	
	Unit – XXVIII Introduction to Generalized Linear Models • Logistic Regression	
Week 15	**Unit – XXIX** Logistic Regression • Pre-requisites • Types of Logistic regression	
	Unit – XXX Logistic Regression • Application	

	• Limitations	
Week 16	**Unit – XXXI** Quiz-III	
	Unit – XXXII Queries Session	

Textbooks and Reading Material

Text books

1. Frost, J. (2019). *Regression analysis: An intuitive guide for using and interpreting linear models*. Statistics By Jim Publishing.
2. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). *Introduction to linear regression analysis*. John Wiley & Sons.

Suggested Readings
1. Gunst, R. F. (2018). *Regression analysis and its application: a data-oriented approach. New York*. Routledge
2. Fox, J. (2015). *Applied Regression Analysis and Generalized Linear Models* (3rd ed.). SAGE Publications.

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

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.