

King Fahd University of Petroleum and Minerals
Department of Mathematics
STAT 513 Syllabus, Term 261 (2026-27)
Instructor: Dr. Nasir Abbas (nasirabbas@kfupm.edu.sa)

Course Title: Statistical Modelling

Course Credit Hours: 3-0-3

Textbook: A. Agresti. Foundations of Linear and Generalized Linear Models, Wiley (2015).

Reference Books:

- Linear Regression Models - Applications in R by John P. Hoffman, Chapman & Hall/CRC (2021).
- Introduction to Linear Regression Analysis by Montgomery, Peck and Vinning, 6th edition, Wiley (2021).
- An Introduction to Statistical Learning with Applications in R by G. James, D. Witten, T. Hastie and R. Tibshirani, 2nd Edition, Springerlink 2021.

Software Package: R language and R studio.

Course Objective:

- Introduce statistical tools for modeling;
- Develop models that learn from the observed data;
- Implement statistical models based on the statistical analysis.

Course Description: Statistical tools for learning from the data by doing statistical analysis on the data with an emphasis on the implementation using various software, toolboxes, and libraries like R, Scikit-Learn, and Stats models. Topics include simple and Multiple Linear Regression, Polynomial Regression, Splines, Generalized Additive Models; Hierarchical and Mixed Effects Models; Bayesian Modeling; Logistic Regression, Generalized Linear Models, Discriminant Analysis; Model Selection.

Prerequisite: STAT 503

Course Learning Outcomes: Upon successful completion of the course, a student should be able to

- Develop statistical models to describe the observed data using computational tools;
- Describe different statistical tools to analyze data;
- Measure the effectiveness of models;
- Present effectively through oral presentation and written reports outcome of the models;
- Interpret the statistical models.

Grading Policy:

Activity	Weight
Classwork (quizzes, assignments, attendance, bonuses, etc.)	15%
Project	20%
Midterm Exam	30%
Final Exam (Comprehensive)	35%

Coverage Plan

No	List of Topics	Contact hours
1	Statistical Learning - What is Statistical Learning - Descriptive Analysis - Probability and Sampling Distributions - Inferential Analysis - Introduction to R language	3
2	Simple Linear Regression - Estimating the Coefficients - Assessing the Accuracy of the Coefficient Estimates - Assessing the Accuracy of the Model	3
3	Multiple Linear Regression - Estimating Regression Coefficients - Some Important Questions - Other Considerations in the Regression Model - Qualitative Predictors - Extensions of the Linear Model - Model fitting using R	6
4	Polynomial Regression - Introduction to Polynomial Regression - Step Functions - Basis Functions - Polynomial Regression Fitting using R	3
5	Linear and Non-Linear Spline Fitting - Regression Splines - Piecewise Polynomials - Constraints and Splines - Smoothing Splines - Spline Fitting using R	3
6	LOGIT and PROBIT models - Models with a Binary Response Variable - Logistic Regression Models - Probit Regression Models - Estimating the Parameters in a Logistic Regression Model - Interpretation of the Parameters in a Logistic Regression Model - Fitting LOGIT and PROBIT Models using R	6
7	Poisson Regression - Introduction to Poisson Regression - Application of Poisson Regression using R	3
8	Generalized Linear Models - Link Functions and Linear Predictors - Parameter Estimation and Inference in the GLM - Prediction and Estimation with the GLM - Residual Analysis in the GLM - Using R to Perform GLM Analysis	6
9	Model Building Techniques - Best Subset Selection - Stepwise Selection - Choosing the Optimal Model - Model Selection Using R	6

10	Bayesian Modeling • Testing and Comparing Models • Making the Most Accurate Predictions • Interpreting Results Quickly & Effectively	3
11	Non-Linear Regression • Linear and Nonlinear Regression Models • Origins of Nonlinear Models • Nonlinear Least Squares • Transformation to a Linear Model • Parameter Estimation in a Nonlinear System • Statistical Inference in Nonlinear Regression • Examples of Nonlinear Regression Models Using R	3
Total		45

Academic Integrity: All KFUPM policies regarding ethics and academic honesty apply to this course.

Excuse: In case a student misses an exam (Midterm or Final) for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get a score of zero in the missed exam.

Cheating and Plagiarism: Cheating or any attempt at cheating by use of illegal activities, techniques and forms of fraud will result in a grade of DN in the course along with reporting the incident to the higher university administration for further action. Cheating in exams includes (but is not restricted to):

- Looking at the papers of other students.
- Talking to other students.
- Using mobiles, smart watches or any other electronic devices.

Mobiles: The use of mobiles is *strictly banned* during class. Students are required to keep their phones off/silent and placed inside their pockets during the class timings.

Project: Project Guidelines will be uploaded to Blackboard, and guidelines for the report will also be posted there. The instructor will form project groups.

Letter Grades: The letter grades will follow a grading curve, which depends on the average of all students enrolled in the course.

Attendance Notes:

Students are expected to attend all lectures.

- If a student misses a class, he/she is responsible for any announcement made in that class.
- After being warned twice by the instructor, a DN grade will be awarded to any student who accumulates
 - 6 unexcused absences (20%), or,
 - 10 excused and unexcused absences (33%)

Use of AI Tools (like ChatGPT):

- Students are encouraged to use AI responsibly as a learning aid for understanding lecture content, practicing statistical concepts, and preparing for exams.
- However, the use of AI during quizzes and exams is *strictly prohibited* and will be treated as an academic integrity violation.