Soochow University

# MAT 405 Applied Linear Models II

## Winter 2024

**Course Credits:** 4
**Contact Hours:** 56 hours
**Instructor:** TBA
**Email:** TBA

## COURSE OBJECTIVES

This course introduces students to the principles and applications of experimental designs within the context of linear models. Students will learn how to design experiments, analyze data, and draw meaningful conclusions for real-life problems. The course covers multi-way ANOVA, randomized block and Latin square designs, response surface methods, random and mixed effects models, and provides an introduction to generalized linear models. Emphasis is placed on practical applications, model diagnostics, and hands-on experience with statistical software.

Upon completion of this course, students will be able to:

1. Explain the fundamental principles of experimental design including randomized block designs and Latin square designs, and their significance in scientific research;

2. Be proficient in using multi-way Analysis of Variance (ANOVA) techniques to analyze data from experiments involving multiple factors or variables;

3. Design experiments to efficiently explore the response surface and make informed decisions;

4. Incorporate random effects to account for variability due to uncontrolled factors and how to interpret mixed effects models;

5. Understand generalized linear models (GLMs), learn how to extend linear modeling techniques to handle non-normally distributed response variables and apply GLMs to various types of data;

6. Identify assumptions of the models, diagnose potential issues, and interpret the results in practical settings.

## PREREQUISITES

MAT 404 Applied Linear Models I

## GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

| ITEM | POINTS |
|---|---|
| Assignments | 40 Points |
| Midterm 1 | 15 Points |
| Midterm 2 | 15 Points |
| Final Project | 30 Points |
| Total | 100 Points |

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

## COURSE MATERIALS

**Required Texts:**

Michael Kutner, Christopher Nachtsheim, John Neter and William Li, *Applied Linear Statistical Models*, 5th Edition, McGraw-Hill, 2005.

**Recommended (Optional) Texts or Other Materials:**

None

## COURSE TOPICS

| MODULE | TASKS |
|---|---|

| | |
|---|---|
| Module 1 | **Topics:**<br>Topic 1: Recap of Linear Regression Basics<br>Topic 2: Multiple Regression Analysis<br>Topic 3: Logistic Regression, Poisson Regression<br>Topic 4: Generalized Linear Models<br>**Assessments:**<br>Assignment#1 |
| Module 2 | **Topics:**<br>Topic 5: Introduction to the Design of Experimental and Observational Studies<br>Topic 6: Single-Factor Studies<br>Topic 7: Analysis of Factor Level Means<br>Topic 8: ANOVA Diagnostics and Remedial Measures<br>**Assessments:**<br>Assignment#2 |
| Module 3 | **Topics:**<br>Topic 9: Two-Factor Studies with Equal Sample Sizes<br>Topic 10: Two-Factor Studies-One Case per Treatment<br>Topic 11: Randomized Complete Block Designs (RCBD)<br>Topic 12: Analysis of Covariance<br>**Assessments:**<br>Assignment#3<br>Midterm#1 |
| Module 4 | **Topics:**<br>Topic 13: Two-Factor Studies with Unequal Sample Sizes<br>Topic 14: Multi-Factor Studies<br>Topic 15: Random and Mixed Effects Models<br>Topic 16: Nested Designs, Subsampling, and Partially Nested Designs<br>**Assessments:**<br>Assignment#4<br>Midterm#2 |
| Module 5 | **Topics:**<br>Topic 17: Repeated Measures and Related Designs<br>Topic 18: Balanced Incomplete Block, Latin Square, and Related Designs<br>Topic 19: Exploratory Experiments: Two-Level Factorial and Fractional Factorial Designs<br>Topic 20: Response Surface Methodology<br>**Assessments:**<br>Final Project |

## ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to

decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

## LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.

2) Assignments submitted in the wrong format will be counted as not submitted.

3) Failure to submit or fulfill any required course component results in failure of the class.

4) Make-up for midterm and final exams only with valid excuses, as defined by the University.

5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

## TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (e.g., note taking, reading course documents).

## ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the

academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

## DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.