

MAL2040: Design and Analysis of Experiments

Instructor: Dr. Brahadeesh Sankarnarayanan

2025–26 (Semester II)

Introduction

We will mainly be following the book [Mon09] by Douglas C. Montgomery titled “Design and Analysis of Experiments” (7th edition, Wiley India, 2009). The S. R. Ranganathan Library has a few copies of the book available. It should also be fine if you have access to some other edition of the book.

The course syllabus is as follows:

1 Course syllabus

- Introduction to Design of Experiments: Fundamental Principles of Experimentation
- Statistical Preliminaries: F-distribution, Theory of random sampling
- ANOVA:
 - One-Way Analysis of Variance
 - Analysis of the fixed effects models
 - Model Adequacy checking
- Randomized Blocks, Latin squares, and Related Designs:
 - Statistical Analysis of the RCBD
 - Model Adequacy Checking
 - Estimating model parameters and general regression significance test
 - The Latin Square Design
 - Statistical Analysis of Balanced Incomplete Block Designs
 - Least square estimation of the parameters
 - Recovery of interblock information in the BIBD
- Introduction to Factorial Designs:

- Basic Definitions and Principles
- The Advantage of Factorials
- Two-Factor Factorial Design
- The 2^k Factorial Design
- Response Surface Methodology:
 - Method of Steepest Ascent
 - Analysis of Second Order Response Surface

1.1 Texts / References / Online Course Material

- [Mon09] Montgomery, Douglas C. *Design and Analysis of Experiments*, 7th ed. Wiley India, New Delhi (2009).
- [TS09] Toutenburg, Helge; Shalabh. *Statistical Analysis of Designed Experiments*, 3rd ed. Springer, New York (2009).
- [Roy01] Roy, Ranjit K. *Design of Experiments Using the Taguchi Approach*. John Wiley & Sons, New Jersey (2001).
- [Cas08] Casella, George. *Statistical Design*. Springer, Berlin, Heidelberg (2008).
- [Mor10] Morris, Max D. *Design of Experiments: An Introduction Based on Linear Models*. Chapman and Hall/CRC, New York (2010).
- [Mai21] Maiti, J. *Design and Analysis of Experiments*. NPTEL Course Material, Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur (2021). <https://nptel.ac.in/courses/110105087>.

2 Lectures and Tutorials

We will have three hours of classes every week. The tutorials will be embedded in the lectures. Since the class size is quite large, it may be difficult to give you the kind of personal attention that is ideal. Therefore the onus is on you to be attentive in the class and make the best use of the lectures. It may not be possible for you to take down the class notes; in fact it is not necessary as the lecture slides will be uploaded on Google Classroom for the course.

Google Classroom Code: **kww3zve2**

This document, as well as the weekly assignments and any announcements, will be added on Google Classroom. **The onus is on you to check your Classroom regularly for any updates.**

You will do well in this course precisely if you attend the classes regularly and study systematically from the first day. You are strongly encouraged to read the reference books.

The course will involve programming assignments in the R language. Remember: The best way to learn programming is by doing. You are, of course, welcome to approach either the instructor or your teaching assistant for any guidance or help regarding the course.

3 Policy on Attendance

Attendance in the lectures is compulsory. Students who do not meet 80% attendance requirement will be given an F grade. In case you miss lectures for *valid* (e.g., medical) reasons, *inform the instructor promptly*. Arbitrary requests for leniency in the attendance policy will strictly not be entertained.

4 Evaluation Plan

The dates mentioned below are tentative and subject to change. Please check Google Classroom for confirmed dates.

1. There will be **two quizzes of 10 points each**. These will be on 28th January 2026 and 30th March 2026.
2. The **minor exam** will be for **25 points**.
3. The **major exam** will be for **40 points**.
4. There will be a **group project** worth **10 points**. The final presentations of the group project will be held on 20th April 2026.
5. The remaining **5 points** will go towards your attendance.

5 Instructor and Teaching Assistants

Instructor	Dr. Brahadeesh Sankarnarayanan Department of Mathematics Internal phone: 1469 E-mail: brahadeesh@iitj.ac.in
Teaching Assistant	Darshana PhD student, Department of Mathematics E-mail: p22ma001@iitj.ac.in
Teaching Assistant	Shivam PhD student, Department of Mathematics E-mail: p23ma0012@iitj.ac.in

6 Schedule of Lectures and Tutorials

The lectures will be held in slot D in the institute's timetable in the lecture hall PH101:

MON	11–11:50 AM
WED	11–11:50 AM
FRI	10–10:50 AM

Also take note of the dates when the timetable is adjusted as per the Academic Calendar. There is no separate slot for tutorials in this course. Doubt clarifications will be done on a time that will be fixed on mutual convenience of the instructor/teaching assistants and student(s).