Georgia Institute of Technology

ISyE 6413: Design of Experiments

Spring 2027

Delivery: 100% Web-Based, Asynchronous

Dates course will run: January 11 – May 6, 2027

Instructor Information

Dr. Yu Ding, Professor
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Ms. Quan Zeng, Head TA
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Quan Zeng is the head TA, and Ahmadreza Chokhachian, Yeonju Lee, and Jingyi Feng are the associate TAs. Together, they form 4 TA groups. Each student will be assigned to one TA group and should communicate primarily with their **assigned TA** regarding course questions or requests.

Office Hours: Weekly office hours via Zoom (see Communication Policy below for details). Attendance is optional but highly encouraged.

General Course Information

Description

ISYE 6413 Design of Experiments teaches the design principles and execution strategies of running both physical and computer experiments and proper procedures and protocols for analyzing the experimental data. The course starts with explaining the basic considerations in running experiments and statistical inference procedures for handling data, including hypothesis tests, linear regression, and analysis of

variance. Then, the course introduces various experimental strategies from one-way and two-way layout designs, randomized block designs, to fractional factorial designs at two levels. The course will further introduce the concept of robustness and robust designs, sequential experimental designs, and finish with the module on computer experiments.

Pre- &/or Co-Requisites

- **ISYE 3030 or equivalent is required,** i.e., an introductory course in Statistics
- **ISYE 6141 or equivalent is preferred** i.e., knowledge on linear regression and statistical testing is necessary
- **Proficiency in computer programming skills like R or Python**

Course Goals and Learning Outcomes

By the end of the course, you will be able to:

1. Describe and apply the basic principles of experimental designs and executions and make inferences using experimental data.
2. Explain and apply the design criteria enabling fractional factorial designs and determine effect aliasing or confounding relationships.
3. Explain the motivation behind robust designs and select the robust parameter settings.
4. Implement response surface methodology to conduct sequential experimental runs.
5. Explain and apply the differences and similarities between physical experiments and computer experiments and their respective design strategies and data analysis approaches.

Course Materials

Course Text

Textbook: C. F. Jeff Wu and Mike Hamada (2021) *Experiments: Planning, Analysis and Optimization*, 3rd Edition, John Wiley.

- A free **PDF of the e-Book** is available online.

Recommended reference book: V. Roshan Joseph (2026). *Experimental Design for Data Science and Engineering.* Chapman & Hall/CRC.

- The **e-book** can be freely downloaded.

All supplemental reading materials are available in Canvas under the 'Reading List' tab.

Additional Materials/Resources

For the Design of Experiments course, you will need access to the following software tools:

- R, Python, or MATLAB

Course Website and Other Classroom Management Tools

The course will be hosted on Canvas.

Course Requirements, Assignments & Grading

Assignment Weight Distribution

Assignment	Weight
Exams (4)	**80%** (20% each)
Quizzes (10)	**10%** (1% each)
Design Project	**10%**

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	85-100%
B	65-85%
C	45-65%
D	0-45%
F	Reserved for violation of the honor code.

Description of Graded Components

Each of the four exams has 20 multiple-choice questions, worth 1 point each, with no partial credit. The exams are closed-book and closed-note, but students may use up to two double-sided, letter-size (8.5 × 11 inches) formula sheets during each exam. The sheets may contain handwritten or printed notes. Each exam lasts 80 minutes, meaning 4 minutes on average per question. The exams are not cumulative, although the knowledge learned in the earlier lessons is still needed for solving problems in the later lessons. The course is structured in eight modules. Each exam covers two modules. They are spaced roughly every 7 video lectures (3.5-4 weeks).

Each of the ten quizzes is a simple exercise and has a 10-minute time limit. Students can use any print materials (notes, books) for quizzes, but digital resources, internet searches, and AI tools (such as ChatGPT) are not allowed. If the quiz is a multiple-choice type of problem, no partial credit is available, whereas if it is a fill-in-the-blank type of problem, partial credit is available. Each quiz is worth one point.

Exam and quiz questions are adapted from selected exercises, often with modifications.

The project is a hands-on experience requiring the student team to conduct actual experiments and produce a video report explaining what the team did and achieved.

Submitting Assignments

All assignments (quizzes, exams, project video report, etc.) must be completed and submitted within Canvas. Sending assignments (quizzes, exams, project video reports, etc.) directly to the professor, whether early, on time, or late, is not permitted and will not be accepted. If there are technical issues, please notify the Canvas help desk, as well as the professor, immediately. Canvas contact information is located under the "Communication Policy" below.

Assignment Due Dates

All assignments will be due at the times listed in the course schedule. These times are subject to change, so please check Canvas announcements. Please convert from Eastern Time to your local time zone using a Time Zone Converter.

Late and Make-up Work Policy

Late submissions of assignments will not be accepted. Make-up is allowed for approved Institute activities and excuses. Please refer to Student Rule IV in its entirety regarding approved Institute activities and permissible make-ups. **Missing an assignment due to some special occasions** could be allowed for make-up, ONLY IF **the student** and **the instructor** agree upon the make-up *prior to* that event. **Missing an assignment due to an emergency or unforeseen circumstances that are out of a student's own control is already covered in Student Rule IV and will be allowed for make-ups. Proper documentation may be needed for make-ups.**

Grading and Feedback

Exams and quizzes are conducted in Canvas and will be graded by the computer as soon as students finish the test. The correct answers to an exam or a quiz are viewable for a period after the end of the said exam/quiz. If a student misses the online viewing period or a student still has questions regarding the test, please contact one's assigned TA to schedule an individual online session in which the TA can explain the reason for the answers. Students are responsible for reviewing their grades promptly after release and must submit viewing/re-evaluation requests within one calendar week of the grade posting date. After this period, grades will be considered final.

Technology Requirements and Skills

Computer Hardware and Software

- High-speed Internet connection
- Laptop or desktop computer with a minimum of a 2 GHz processor and 2 GB of RAM
- Windows for PCs OR Mac iOS for Apple computers.
- Complete Microsoft Office Suite or comparable and ability to use Adobe PDF software (install, download, open and convert)
- Latest versions of Mozilla Firefox, Chrome and/or Safari browsers

Technology Skills

Students are expected to possess and apply a range of essential technology skills to be successful in this course. These include the ability to navigate a computer operating system (Windows, macOS, or Linux), install and launch applications, and manage files through downloading, saving, compressing (ZIP), and uploading to Canvas. Students should be comfortable using a web browser to conduct online research, connect to and troubleshoot Internet access, and send and respond to emails using professional communication etiquette. Basic proficiency with Microsoft Word and PowerPoint (or equivalent) is required for preparing reports and presentations. In addition, students must be able to use Zoom, MS Teams, or a mobile device to make a video for the project submission.

Onboarding Quiz and Proctoring Information

All Georgia Tech online degree and certificate students are required to complete the Onboarding Quiz with Honorlock in the first week of the course. Honorlock is utilized for student identity verification and to ensure academic integrity. Honorlock provides student identity verification via facial and ID photos. You may also be asked to scan the room around you. The Onboarding Quiz is needed to help make sure that your identity is verified and that your system is set up to work with the Honorlock online proctoring tool. You are required to complete this quiz early in the semester to avoid problems when taking proctored exams.

Technology Help Guidelines

30-Minute Rule: When you encounter struggles with technology, give yourself 30 minutes to 'figure it out.' If you cannot, then post a message to the discussion board; your peers may have suggestions to assist you. You are also directed to contact Digital Learning Support.

When posting or sending email requesting help with technology issues, whether to Digital Learning Support, message board, or the instructional team, use the following guidelines:

- Include a descriptive title for the subject field that includes 1) the name of the course 2) the issue. Do NOT just simply type "Help" into the subject field or leave it blank.
- List the steps or describe the circumstance that preceded the technical issue or error. Include the exact wording of the error message.
- When possible, always include a screenshot(s) demonstrating the technical issue or error message.
- Also include what you have already tried to remedy the issue (rebooting, trying a different browser, etc.).

Course Policies, Expectations & Guidelines

Communication Policy

- Email personal and confidential concerns to me privately using yu.ding@isye.gatech.edu. For course-related technical questions, please first contact your assigned TA.
    - Do NOT submit posts of a personal nature to the discussion board unless it is a private post on Ed Discussions. On the other hand, please keep emails only for personal matters that cannot be shared on Ed Discussions; otherwise, all students should use Ed Discussions for their questions.

- Email will be checked at least daily during weekdays. I will respond to all emails within 24 hours, except when I am on an international trip. If there are special circumstances that will delay my response, I will make an announcement to the class in Canvas. It is also advised to copy every email to me and the head TA as well.
- Ed discussion boards will be checked every day by the TAs, excluding holidays and weekends.
    - Virtual office hours will be held using Zoom. I will hold a Virtual Office Hour once per week. Each of the TAs will hold a virtual office hour per week, so there is an office hour every weekday. **A student can attend any of the office hours, not necessarily that of his/her assigned TA.** If a student cannot make it to any of the office hours, please email the assigned TA for additional accommodation. The instructional team's office hours (Eastern Time ET) are as follows:
        - **Monday 8-9pm**, Ahmadreza Chokhachian (TA)
        - **Tuesday 12 noon – 1pm**, Jingyi Feng (TA)
        - **Wednesday 8-9pm**, Yu Ding (Professor)
        - **Thursday 12 noon-1pm**, Yeonju Lee (TA)
        - **Friday 12 noon-1pm**, Quan Zeng (TA)
- If a student lives in the Atlanta area or comes to Atlanta for visits and would like to meet in person, please email me for an in-person meeting time.
- For questions related to technology, contact the Digital Learning Support team. You can also reach the Canvas Hotline by phone at 1(877) 259-8498 or by email at support@instructure.com.

Online Student Conduct and (N)etiquette

Although it is not expected to be a problem in a graduate-level class, students are asked to behave in discussions and other class interactions professionally and civilly. If you are in doubt, do not post it! Instructors reserve the right to remove any postings deemed inappropriate, unprofessional, or otherwise distracting from the course.

University Use of Electronic Email

A university-assigned student e-mail account is the official university means of communication with all students at Georgia Institute of Technology. Students are responsible for all information sent to them via their university-assigned e-mail account. If you choose to forward information to your university e-mail account, you are responsible for all information, including attachments, sent to any other e-mail account. To stay current with university information, students are expected to check their official university e-mail account and other electronic communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

Plagiarism & Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools, and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation

for which no credit can be given and for which appropriate sanctions are warranted and will be applied. Please visit Georgia Tech's Academic Honor Code for more information. Any student suspected of cheating or plagiarizing a quiz, exam, or assignment will be reported to the Office of Student Integrity, which will investigate the incident and identify the appropriate penalty for violations.

Collaboration & Group Work

In this course, quizzes and exams are individual work, and no collaboration or group work is allowed. Please follow strictly quiz and exam instructions for using notes or outside resources. Group work and collaboration are encouraged and in fact, are the default setting for the course project. By default, a project's score is the same for all members in a group.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or their website as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible to set up a time to discuss your learning needs.

Copyright

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty members and the student body. See Student-Faculty Expectations for an articulation of some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be communicated via the Canvas announcement tool. It is your responsibility to check email messages and course announcements to stay current in your online courses.

Course Schedule

All times are Eastern Time (ET)

Course Activities	Release Dates	Due Dates
Module 1: Basic Principles & Data Analysis		
Lecture Videos	January 11, 8:00 am	N/A

Course Activities	Release Dates	Due Dates
Quiz #1	January 15, 12:00 noon	January 19, 12:00 noon
Quiz #2	January 22, 12:00 noon	January 25, 12:00 noon
Design Project	January 11, 8:00 am	April 27, 11:59 pm
Module 2: Experiments with a Single Factor		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #3	January 29, 12:00 noon	February 1, 12:00 noon
Exam #1 (Modules 1 & 2)	February 5, 8:00 am	February 8, 8:00 pm
Module 3: Experiments with More Than One Factor		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #4	February 12, 12:00 noon	February 15, 12:00 noon
Quiz #5	February 19, 12:00 noon	February 22, 12:00 noon
Module 4: Full Factorial Experiments		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #6	February 26, 12:00 noon	March 1, 12:00 noon
Exam #2 (Modules 3 & 4)	March 4, 8:00 am	March 7, 8:00 pm
Module 5: Fractional Factorial Experiments		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #7	March 19, 12:00 noon	March 22, 12:00 noon
Module 6: Robust Parameter Design		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #8	March 26, 12:00 noon	March 29, 12:00 noon
Exam #3 (Modules 5 & 6)	April 2, 8:00 am	April 5, 8:00 pm
Module 7: Sequential Physical Experiments		

Course Activities	Release Dates	Due Dates
Lecture Videos	January 11, 8:00 am	N/A
Quiz #9	April 9, 12:00 noon	April 12, 12:00 noon
Module 8: Computer Experiments		
Lecture Videos	January 11, 8:00 am	N/A
Quiz #10	April 16, 12:00 noon	April 19, 12:00 noon
Exam #4 (Modules 7 & 8)	April 30, 8:00 am	May 3, 8:00 pm