

ISYE 4133 Syllabus

Advanced Optimization, 3.000 credits

Fall 2026

- Days: Tuesdays and Thursdays
- Time: 03:30 PM - 04:45 PM
- Location: Scheller College of Business — Room 203

Instructor

Dr. Johannes Milz
(he/him/his)

Study Sessions

- Days: Wednesdays
- Time: 5–6 pm
- Location: George Tower 1011B Meeting

I will be present for the first 20 minutes; the session may extend to the full hour depending on attendance and interest.

Teaching Assistants

Shalini Mehra

Study Sessions

- Days: Tuesdays
- Time: 1-2pm
- Location: <https://teams.microsoft.com/join/254131820730733?p=0Y5qKUG3U6wHr01jaW>

Instructor Team Email

isy4133fall2026@gatech.edu

This email address allows the entire instructor team to view your email and respond more quickly as a team. Please use this email for any questions related to course content or logistics.

General Information

Course Description

ISyE 4133 is the second optimization course in the undergraduate ISyE curriculum, designed with three key learning objectives:

- Reinforce fundamental concepts introduced in ISyE 3133 (Engineering Optimization).
- Provide a solid mathematical foundation for understanding linear, nonlinear, and combinatorial optimization algorithms.
- Facilitate the transition from theory to practice by solving complex optimization problems that cannot be addressed with straightforward methods. The course will emphasize the application of state-of-the-art software tools for solving these advanced optimization problems.

Prerequisites

- ISyE 3133 (Engineering Optimization) or equivalent knowledge with basic notions of optimization formulations.
- Prior exposure to linear algebra and algorithms. We will review all relevant mathematical concepts as we need them.
- Basic computer programming. We will mostly be using Python, CVXPY, and GUROBI/GUROBIPY.

Course Goals and Intended Learning Outcomes

Upon successful completion of the course students will be able to:

- apply key concepts, theory, and algorithms of linear optimization and integer optimization
- apply advanced modeling techniques for formulating linear, convex nonlinear, and integer optimization problems
- understand fundamental algorithmic schemes for solving linear, nonlinear, and integer optimization problems
- apply modern optimization modeling language and solvers in order to implement and solve optimization problems

Course Requirements & Grading

Grading Policy

The grade will be determined from the following grading scheme:

Initial survey	2%
Individual homework assignments	8%
Weekly in-person quizzes (10 minutes)	40%
Extended in-person quizzes (4 in total, 30 minutes)	35%
Group project	15%

Extra Credit Opportunities

None.

Description of Graded Components

Initial Survey

The initial survey will be available in Canvas. It will be released on the first day of class, and is due by in the first week of class on Friday at 11:59 p.m. This early deadline allows the instructional team to review your responses and use them to tailor the course starting from the second week. This survey is designed to help the instructional team get to know you better, including your background, interests, and learning preferences. Your responses will provide valuable insights that will allow the instructional team to tailor the course content to better meet your needs and ensure that your learning experience is both relevant and engaging. You will receive full credit upon submission, and an anonymized summary will be shared via Canvas.

Individual homework assignments

There will be approximately 4 graded individual homework assignments. Each homework assignment will have about 2 to 4 homework problems. Their due date are given in the course schedule below. Homework assignments and their due dates will be posted on Canvas.

- You may discuss your assignments with the professor, teaching assistants, fellow students, and others. However, you are expected to write up your solutions to individual homework on your own.
- You are welcome, even encouraged, to work on your homework assignments during our [Study Sessions](#).
- You are welcome, even encouraged, to typeset your homework, but handwritten homework is also OK. Reports must be submitted as a pdf.

- We recommend starting your homework assignments early to give yourself ample time to work through the problems. By beginning early, you will have the opportunity to thoroughly understand the material, troubleshoot errors, and seek help if needed, ensuring a more successful and less stressful learning experience.
- You will submit your homework assignments via Canvas. You are responsible for ensuring that your homework solutions are easily read by the graders, that all pages of your solution are included in the submission, and that no part of the solution was cut off during the upload to Canvas. Corrupted files will receive zero credit; again, it is your responsibility to ensure that any file uploaded to Canvas is readable to the instructor team.
- If you used software to generate your solutions, you must submit your code. Further details will be provided in the homework assignments.
- Late assignments and extensions are not allowed. There will be a short grace period for Canvas uploads after the deadline. Any submission received beyond the grace period will be considered late.
- After the due date detailed solutions to the homework problems will be made available electronically.
- Your lowest homework grade will be dropped.

Quizzes

This course uses two types of in-person quizzes to reinforce understanding and provide regular feedback on your learning progress.

- **Weekly Quizzes (10 minutes).**
 - Each week, a short quiz will be given **in person at the start of the first lecture of the week**. Weekly quizzes are designed to reinforce key ideas from recent material. They will begin promptly at the scheduled start time, and late arrivals may not be given extra time.
 - Weekly quizzes will **not** be held during weeks that include an extended quiz, holidays, breaks, or the first day of class.
 - To allow for occasional absences or conflicts, your **lowest weekly quiz score will be dropped**.
- **Extended Quizzes (30 minutes).**
 - Four longer quizzes will be given during the semester in place of traditional midterm and final exams. These extended quizzes will cover a broader range of material, integrating concepts from multiple weeks. They will be conducted **in person** and follow the same format as weekly quizzes but at greater depth. Extended quiz dates will be announced in advance. During a week with an extended quiz, there will be no weekly (short) quiz.
 - The final extended quiz will take place during final exam week, scheduled at the time the course's regular final exam would have been held, according to the official [Georgia Tech Final Exam Matrices](#).
 - To allow for occasional absences or conflicts, your **lowest extended quiz score will be dropped**.

Scheduling note. The “first lecture of the week” means the first class meeting on the course calendar for that week. For example, if our meetings are Tuesday/Thursday, the weekly quiz will typically occur on Tuesday (except during extended-quiz weeks, holidays, or breaks).

Coverage. Quizzes will cover all material up to and including the previous week's lectures, including homework. The first quiz may also assess prerequisite topics. Extended quizzes will assess cumulative material from multiple weeks.

Quiz conditions. All weekly and extended quizzes are closed-book and closed-notes. No reference materials may be used, including textbooks, lecture notes, homework solutions, formula sheets, cheat sheets, or other written materials. Electronic devices, including laptops, tablets, smartphones, smartwatches, and calculators, are not permitted.

Accessibility. If you are eligible for extended time, please contact the instructor during the first week of the semester so we can arrange an alternative plan (e.g., taking the quiz earlier in the day or completing it at the testing center through the Office of Disability Services). Because quizzes occur at the beginning of class and lecture starts promptly afterward, extended time cannot be accommodated during the regular class period.

Exams

There are **no traditional midterms or final exam** in this course. Instead, assessment will take place through the four extended in-person quizzes described above. These are designed to evaluate your understanding of course concepts in a cumulative and applied manner, replacing the structure of conventional exams.

The final extended quiz will be held during final exam week at the time the course's regular final exam would have been scheduled, according to the official [Georgia Tech Final Exam Matrices](#).

Group Project

A group project is required. It is designed to foster collaboration and allow you to apply the concepts learned in class to more complex, real-world problems. Below are the details and instructions you need to follow:

- **Group Formation:** Each group will consist of up to four students. You are responsible for forming your own group and submitting the group name along with the list of members through Canvas by the specified deadline. If you have difficulty forming a group, please contact the instructor for assistance.
- **Project Selection:** Later in the semester, a collection of project topics will be announced. Each group will choose one project from a selection of at least two topics.
- **Submission Requirements:** Only one submission per group is required, which must be uploaded via Canvas. The submission should include: A typed project report that clearly states your group's answers. The numerical results, data, and computer code required by each problem.
- **Project Report:** Your report should be well-structured and professional. Clearly specify which problems each group member worked on, and describe how each member contributed to the overall project.
- **Collaboration Policy:** Collaboration within your group is essential and encouraged. Collaboration between different groups is strictly prohibited.

Grading Scale

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

A	[90%, 100%]
B	[80%, 90%)
C	[70%, 80%)
D	[60%, 70%)
F	[0%, 60%)

According to policy, grades at Georgia Tech are interpreted as follows:

A	Excellent (4 quality points per credit hour)
B	Good (3 quality points per credit hour)
C	Satisfactory (2 quality points per credit hour)
D	Passing (1 quality point per credit hour)
F	Failure (0 quality points per credit hour)

See <http://registrar.gatech.edu/info/grading-system> for more information about the grading system at Georgia Tech.

Course Materials

Course Text

There is no required textbook for this course. Yet, the following text provides very useful material:

- Ronald L. Rardin, Optimization in Operations Research, 2nd edition, 2017, Pearson

Additional Materials/Resources

My lecture notes will be made available to you through Canvas.

Course Website

The instructional team will use the course Canvas page throughout the semester. On the Canvas page, you should be able to access important information about the course including but not limited to the most updated version of the syllabus and lecture slides, quizzes, homework assignments, solutions to homeworks as well as course announcements. The instructional team will also use the Canvas page to provide feedback on your homework assignments, quizzes, and record grades. Please make sure that you check the Canvas system regularly so you do not miss out on important course information.

Compute and Additional Resources

Most homework assignments will have coding assignments. Any commercial software required for the course will be available through the computer labs on campus and/or free academic licenses.

- The VLab provides Georgia Tech students, faculty and staff a way to access a Windows Desktop with certain software preinstalled from any computer with Internet access. See <https://it.iac.gatech.edu/services/vlab>.
- Georgia Tech is providing Overleaf Professional features for all students, faculty and staff. See <https://www.overleaf.com/edu/gatech>.
- Some assignments will require generating graphical illustrations of sets. We recommend using WolframAlpha (see <https://www.wolframalpha.com>) and/or Mathematica for this purpose. Georgia Tech offers an academic license for Mathematica, which you can access at <https://software.oit.gatech.edu>.
- The Office of Information Technology (OIT) provides AI tools and resources, including Google Gemini (<https://gemini.g.gatech.edu>) and NotebookLM (<https://notebooklm.g.gatech.edu>). See also <https://oit.gatech.edu/ai>.

Course Expectations & Guidelines

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. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>. Any student suspected of cheating or plagiarizing on an exam or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

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 <http://disabilityservices.gatech.edu/>, 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 in order to set up a time to discuss your learning needs.

Responsible Use of Course Materials

The materials provided in this course, including lecture notes, slides, recordings, and any other instructional content, are intended solely for the personal use of enrolled students. Redistribution, reproduction, or publication of these materials, in any form, including posting on external websites or sharing with individuals not enrolled in the course, is strictly prohibited without explicit permission from the instructor. These materials are protected under intellectual property laws, and violations of this policy, as outlined by the Georgia Tech guidelines on Responsible Use of Course Materials, may result in disciplinary action. For more details, refer to: <https://generalcounsel.gatech.edu/legal-affairs/responsible-use-course-materials>.

Participation

While attendance is not mandatory, I strongly encourage you to attend the lectures. Regular attendance will keep you engaged with the material and provide opportunities for deeper understanding and interaction. All students are expected to: (i) complete and submit all homework assignments on time, and (ii) take the exams at their scheduled times.

I firmly believe that regular attendance is essential for achieving the highest level of success in your academic pursuits. Consistent participation not only deepens your understanding but also maximizes the benefits of your educational experience.

Collaboration & Group Work

Students may not copy solutions from any source, but are encouraged to use academic references, such as textbooks or research papers as needed. You are encouraged to discuss homework problems with your classmates and learn from each other, but each person must write up and submit their own homework solutions. Copying or rephrasing someone else's work is unacceptable. Further, copying someone else's work is a disservice to your own understanding of the material. There is a big difference between the ability to read and understand a solution and the ability to create and write one. You are allowed to use the materials listed in the syllabus in preparation of your homework responses. If you use material outside those listed in the syllabus, you should cite the material used.

Responsible Use of Generative Artificial Intelligence (AI) Tools

In this course, the use of Generative AI tools (such as Microsoft Copilot) is encouraged as part of your learning and creative process. These tools can support brainstorming, revising drafts, exploring alternative perspectives, and practicing communication with emerging technologies. However, responsible use is expected. See https://gatech.service-now.com/home?id=kb_article_view&sysparm_article=KB0044077 for more details.

Expectations You are expected to critically engage with any AI-generated content and ensure your final work reflects your own understanding and academic voice. Generative AI should **never** be used to fabricate data, cite non-existent sources, or bypass learning objectives.

Use of Generative AI must comply with Georgia Tech's *Honor Code* and academic integrity guidelines.

At Georgia Tech, the Office of Information Technology (OIT) provides a range of AI tools and resources designed to support students, faculty, and staff in their academic and research activities. For more detailed information and resources, please visit <https://oit.gatech.edu/ai>.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Late assignments will be accepted only and make-up exams will be given only for documented reasons of illness, family emergency, or participation in approved Institute activities (see <http://catalog.gatech.edu/rules/12/> for more information). Final exams will be re-scheduled in accordance with Georgia Tech's policy, also found at <http://www.catalog.gatech.edu/rules/12/>.

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 <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation 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.

Student Use of Mobile Devices in the Classroom

Research on learning shows that unexpected noises and movement automatically divert and capture people's attention, which means that one student's use of a mobile devices (laptops, cell phones, tablets, etc.) can distract another student and disrupt their ability to learn. In addition, students using mobile devices often become engaged in matters that are not related to the class they are attending. Further, research indicates that students taking notes on laptops tend to process less as they take notes, and the depth of their learning suffers.

Although students may use laptop and tablet devices, these devices should be used only for matters related to our class. For the reasons listed above, I encourage students to be mindful in terms of how using laptop and tablet devices may be impacting their own learning. Cell phones should be silenced and stored during classroom time. In the synchronized sessions, cell phone, tablet and laptop can be used to follow the class, not to become a distraction.

Email

When sending emails to isye4133fall2026@groups.gatech.edu, please use your Georgia Tech email address and include "ISYE 4133" in the subject line. This will make sure that your email gets properly filtered in my inbox and allow the instructor team to provide a more timely response.

Regrading requests

If you think there has been an error in the grading of your assignment or exam, you have seven calendar days from the day it was returned to the class to submit it for a re-grade. When you submit a regrade request, you must provide a written explanation of the suspected grading mistake. Re-grading entails re-grading the entire assignment or exam; therefore, the re-grade process may result in your submission receiving a higher or a lower score after all of the problems have been reconsidered. Regrade requests must be submitted through Gradescope.

Recordings of Class Sessions and Required Permissions

Classes may not be recorded by students without the express consent of the instructor unless it is pursuant to an accommodation granted by the Office of Disability services. Class recordings, lectures, presentations, and other materials posted on Canvas are for the sole purpose of educating the students currently enrolled in the course.

Students may not record or share the materials or recordings, including screen capturing or automated bots, unless the instructor gives permission. Digitally proctored exams may require students to engage the video

camera, but those recordings will not be shared with or disclosed to others without consent unless legally permitted.

If students are identifiable by their names, facial images, voices, and/ or comments, written consent must be obtained before sharing the recording with persons outside of currently enrolled students in the class.

Campus Resources for Students

These are resources on campus that are available to students:

- **The Counseling Center:** <https://counseling.gatech.edu/>
The Counseling Center educates students for life by providing a variety of services and programs that are consistent and consonant with the strategic plan goals of the Institution and the Division of Student Life. Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, crisis intervention, referral services, as well as outreach programming, and consultation for faculty and staff, family and friends of Georgia Tech students. All counseling services are confidential and free of charge for eligible students. The Counseling Center provides brief or short-term therapy for a variety of presenting issues.
- **The Center for Assessment, Referral, and Education (CARE):** <https://care.gatech.edu/>
CARE is the primary resource for mental health support at Georgia Tech.
- **The Division of Student Life:** <https://studentlife.gatech.edu/content/get-help-now>
Student Engagement & Well-Being provides a number of services to assist students with medical and personal emergencies.
- **Office of the Dean of Students:** <https://studentlife.gatech.edu/about/dean-students>
The Office of the Dean of Students provides a number of services to assist students with medical and personal emergencies.

Tentative Course Schedule

Note: The instructor reserves the right to modify the course content, sequence of topics, and course assignments during the progress of the course. *Please note that weekly quiz dates are not listed in the course schedule.*

Class days are numbered sequentially and printed in bold. The course schedule is tentative.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Aug 24th	25th 1 Introduction, course logistics	26th	27th 2 HW1 released Advanced LP Formulations	28th Initial survey due 11:59 pm
31st	Sep 1st 3 Advanced LP Formulations, robust optimization	2nd	3rd 4 Advanced LP Formulations, robust optimization	4th
7th Labor Day <i>Official Institute Holiday – Campus Closed.</i>	8th 5 Duality	9th	10th 6 HW1 due 11:59 pm HW2 released Duality	11th

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
14th	15th 7 Numerical aspects, relative and absolute differences, termination tolerances	16th	17th 8 Column Generation	18th
21st	22nd 9 Extended Quiz I Dantzig Wolfe	23rd	24th 10 HW2 due 11:59 pm HW3 released Practice Problems	25th
28th	29th 11 MIP Formulations	30th	Oct 1st 12 MIP Formulations, robust optimization	2nd
5th Fall Break <i>No Classes – Campus Open.</i>	6th Fall Break <i>No Classes – Campus Open.</i>	7th	8th 13 Project topics released Traveling Salesperson Problem	9th
12th	13th 14 Convex quadratic optimization, least squares	14th	15th 15 Project team formation due 11:59 pm Convex quadratic optimization, LASSO	16th
19th	20th 16 Extended Quiz II Convex optimization, applications	21st	22nd 17 HW3 due 11:59 pm HW4 released Advanced Topics Survey Released Nonlinear Optimization	23rd
26th	27th 18 Practice Problems	28th	29th 19 Advanced Topics Survey Due Iterative methods, gradient descent	30th

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Nov 2nd	3rd No class – INFORMS	4th	5th 20 HW4 due 11:59 pm Iterative methods, gradient descent	6th
9th	10th 21 Iterative methods, Newton’s method	11th	12th 22 Iterative methods, interior point methods for LPs	13th
16th	17th 23 Extended Quiz III Constrained optimization and optimality conditions	18th	19th 24 Project reports due 11:59 pm Practice Problems	20th
23rd	24th 25 Sequential decision-making	25th <i>Student Recess</i> <i>No Classes – Campus Open.</i>	26th <i>Thanksgiving Break</i> <i>Official Institute Holiday – Campus Closed.</i>	27th <i>Thanksgiving Break</i> <i>Official Institute Holiday – Campus Closed.</i>
30th	Dec 1st 26 Sequential decision-making	2nd	3rd 27 Sequential decision-making	4th
7th <i>Final instructional class days for Fall 2026</i>	8th 28 <i>Final instructional class day for Fall 2026</i> Sequential decision-making	9th Reading Day	10th Reading Period No exams 8:00 AM–2:10 PM	11th
14th	15th Reading Period No exams 8:00 AM–10:50 AM Extended Quiz IV 2:40 PM–5:30 PM	16th	17th <i>End of Fall 2026 term</i>	18th