ISYE 6227: INTRODUCTION TO FINANCIAL ENGINEERING

Instructor: Dr. Shijie Deng (deng@gatech.edu)
Course Prefix and Number: ISYE 6227 AQ
Term: Summer 2026
Classroom: Asynchronously delivered through Canvas.

Course Information

Introduction to advanced techniques for economic analysis of capital investment and portfolio management. Basic terminology and financial engineering concepts for asset pricing and risk management. Real options valuation and applications in systems engineering.

Prerequisites:

Graduate level ISYE 6650 and ISYE 6669 (or, equivalent undergraduate probability and optimization courses) with minimum grade of C, or prior consent by instructor - basically, students are expected to have basic knowledge on: a) probability distributions and computing probabilities/expected values/variances/ covariances of random variables, b) quadratic optimization with constraints). Students shall be able to use at least one programming tool (such as Python, R, Excel VBA) to solve problems in homework/project when necessary.

Textbook:

The required text is *Investment Science* by Luenberger, Oxford University Press, 1998 or 2013 edition.

Course Objective

The objective of this course is to introduce the core concepts and advanced techniques in financial engineering. Upon completion of the course, students shall be able to construct the economic decision models for analyzing capital investments, pricing financial derivative securities, optimizing portfolio strategies, and managing investment risks.

Course Outcomes:

At the end of this course, we hope to help students build the following skills.

- Model deterministic/random cash flows and apply different criterions to compare cash flows.
- Demonstrate ability to evaluate common cash flow patterns, obtain yields and different types of interest rates based on fixed-income securities, and construct immunization strategy based on the duration and convexity of a fixed-income portfolio.
- Understand the characteristics of term structure of interest rates; how to construct interest rate curves and use them to value/immunize cash flows.
- Achieve proper tradeoffs between rewards and risks of portfolios through mean-variance portfolio optimization framework.
- Apply Capital Asset Pricing Model and its extensions to address asset valuation and trading problems.

- Understand the no-arbitrage pricing principle and apply classical options pricing models in derivative pricing and dynamic hedging problems.

Software:

Students shall be able to use at least one programming tool (such as Python, R, Excel VBA) to solve problems in homework/project when necessary.

Grading Policy:

Course grades will be based on assessment of students' understanding of the material covered throughout the semester through course assignments, quizzes and exams. Homework and tests are graded for correctness, with partial credit awarded for partial answers (e.g. work shown) or to account for minor errors. Homework assignments, project, tests and their respective weights in the course grade are as follows:

Homework (15%): There will be a homework assignment approximately every 1-2 weeks.

Quizzes (20%): 4 timed-quizzes (offered through Canvas, open-book, open-notes).

Midterm project (30%): analyze a mean-variance portfolio optimization problem using any programming tools (e.g. Python, R, C++ or Excel), due on June 19 (Friday).

Final Exam (35%): Cumulative timed-exam through Canvas and proctored by Honorlock, open-book open-notes, scheduled on July 30 (Tuesday).

Thresholds for letter grades: A >= 85%; 85% > B >= 75%; 75% > C >= 65%; 65% > D >= 50%; F <50%. The right to adjust the thresholds to avoid certain extreme cases is reserved.

Course Policy:

Working together on course assignments is allowed, but your handed-in solutions should be personal and show individual effort (NOT identical to the others' assignments nor the previous solutions). For the regular assignments, the students need to submit their solutions on Canvas by the due date/time (usually 11PM). Penalty will be imposed on late submission of assignments as specified in Late Submission Policy. In addition, we ask students to type homework and project reports in Word or Latex format. Make-up tests are not permitted except in cases of serious illness, Institute Approved absences, Dean's office recommended absences, or GT Athletic Association conflicts with appropriate documentations. All course materials and grades will be posted on Canvas. You are responsible to check if your posted grades are correct. You have three days from the day we return assignment or tests on Canvas for considering re-grading. We reserve the right to re-grade the entire assignment or test. So, you may lose more points than you gain when we re-grade your assignment or test. Please let us know any special situation you may have during the semester ASAP.

Late Submission Policy

1) No make-up assignments. 5% grade deduction if submission received within 24 hours passing the due time. 15% grade deduction if submission received within 48 hours passing the due time. 50% grade deduction if submission received later than 48 hours after the due time.

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. Review Georgia Tech's Honor Code and the student Code of Conduct. Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations document (https://catalog.gatech.edu/rules/22/) articulates 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.

Accommodations for Students with Disabilities:

Georgia Tech provides upon request appropriate academic accommodations for students with disabilities. https://disabilityservices.gatech.edu/. If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to discuss the 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.

Core IMPACTS

Not applicable. (https://www.usg.edu/curriculum/core-impacts/ is the University System of Georgia's General Education curriculum.)

Collaboration, Group Work, and Use of Generative AI

You are allowed to work in groups on all homework and out-of-class assignments, but any work you turn in must be written in your own hand. Tests and exams are to be your own work. All tests and exams will be open-book and open-notes.

In general, use of Generative AI as assistant for learning course materials is allowed. However, direct use of AI-generated solutions (without writing them in your own hand) and/or any previous semester course materials (such as homework solutions and project submissions) as submissions of course assignments are prohibited in this course. Using these materials will be considered a direct violation of academic policy and will be dealt with in accordance with the GT Academic Honor Code. When in doubt regarding what constitutes a violation, do not guess the answer and post on Piazza for clarifications.