# ISyE 4311: Capital investment analysis

Instructor: Dr. Shijie Deng (deng@gatech.edu)
Course Prefix and Number: ISYE 4311 A
Term: Spring 2027
Time and Location: 8 – 9:15 M/W.

## Course Information

Students learn the core concepts, issues and advanced techniques for engineering economy and financial engineering. Students also learn the economic decision analysis frameworks for analyzing complex capital investment problems, managing and valuing project risk, incorporating managerial flexibility, the value of information, and dynamic decision-making in uncertain environments.

## Prerequisites:

ISYE 2027, ISYE 3030, minimum grade of C. Or, working knowledge of Calculus and linear algebra, including the ability to differentiate, integrate, perform matrix inversion, and compute basic statistics.

## Textbook:

There is no required text. Notes, handouts and exercises will be posted regularly and represent an integral part of the course. The following references may be useful for developing a foundational understanding of the course topics.

***Reference text:*** *Corporate Finance*, 2nd edition by J. Berk and P. DeMarzo. Pearson, 2011.
***Supplemental reading:*** *Investment Science* by Luenberger, Oxford University Press, 1998.

## Course Objective

This course introduces fundamental principles and quantitative methods for financial valuation, investment analysis, and decision-making under uncertainty. Emphasis is placed on applying no-arbitrage principles, discounted cash flow analysis, portfolio theory, and option-oriented valuation techniques to evaluate investments, assess risk-return tradeoffs, and support strategic decisions. Students will develop analytical frameworks for valuing financial assets and real investment projects, incorporating managerial flexibility, the value of information, and dynamic decision-making in uncertain environments.

## Course Outcomes:

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

- Use the time value of money, present value calculations, and no-arbitrage principles to value cash flows, financial assets, and investment.
- Evaluate investment projects using discounted cash flow methods, incorporating strategic considerations, project options, and the value of information.

- Apply mean-variance portfolio theory to assess investment risk, diversification benefits, and optimal portfolio allocation.
- Use the Capital Asset Pricing Model (CAPM) and risk-adjusted rates of return to estimate required returns and assess investment opportunities.
- Integrate option valuation and dynamic decision-making frameworks to evaluate project flexibility, optimal investment timing, and strategic decisions under changing market conditions.

## Software:

Excel spreadsheets and/or Python programming may be needed for solving problems in course assignments and/or course tests.

## Grading Policy:

Course grades will be based on assessment of students' understanding of the material covered thoughout the semester through course assignments and exams. Course assignments, tests and their respective weights in the course grade are as follows. 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 (10%): There will be a homeowrk assignment approximately every 1-2 weeks.
In-class assignments (15%): 3-4 such assignments will be given throughout the semester.
Midterms (40%): in-class close-book close-note.
Final Exam (35%): Cumulative exam, in-class close-book close-note.

In-class assignments are based on (1) past course materials, (2) reading assignments or (3) material covered during the current lecture. Midterms and final exam are timed, closed-book, and closed-notes (with one-page formula sheet on one page of 8x11 paper allowed). Your cellphone must be placed face down directly in front of you in plain view in all exams. All unexcused absences will result in an exam grade of zero.

Thresholds for letter grade assignment: A: 90%; B: 80%; C: 70%; D: 60%; F: <60%. The right to adjust the thresholds to avoid certain extreme cases is reserved.

## Course Policy:

Participation is important in this class. Class attendance is mandatory and recorded by signing Attendance Sheet. Unexcused absences may affect your final grade. Up to three non-excused absences are allowed without questions asked. Interviews, family trips, meetings for other courses are not excused.

Working together on homework 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 homework assignments on Canvas by the due date/time (usually 11PM). No late homework will be accepted. Make-up exams 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 homework or tests on Canvas for considering re-grading. We reserve the right to re-grade the entire homework or exam. So keep in mind, you may lose more points than you gain when we re-grade your homework or exam. Please let us know any special situation you may have during the semester ASAP.

## 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 in order to set up a time to discuss your learning needs.

## 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. In-class tests and exams are to be your own work. All in-class tests and exams will be closed-book and closed-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 to 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.

## Extensions, Late assignments, and Re-scheduled/missed exams

Late submission of assignments will not be accepted. No make-up assignments.