

CIVENV 205 – ECONOMICS AND FINANCE FOR ENGINEERS
Spring 2023

Instructor	Pablo L. Durango-Cohen Office: Tech A319 Office Hours: Monday 11:00–12:30, and by appointment Phone: (847)491-4008 Email: pdcc@northwestern.edu
Teaching Assistants	
Cal Skiles	Office Hours: Monday 4:30–6:30, and by appointment Location: Tech A211 Email: callahan.skiles@northwestern.edu
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Grader	Qianni Wang (qianniwang2022@u.northwestern.edu) Office Hours: Please email, and include CivEnv 205 in the subject
Class Times and Locations	
Lecture:	Monday and Wednesday 3:00–4:20 (Tech M345)
Discussion:	Tuesday 12:00–12:50 (Tech A110) – CS Tuesday 4:00–4:50 (Frances Searle 3220) – HZ
Class Website	Northwestern Course Management System

Office hours and discussion sections will begin the week of April 3.

COURSE DESCRIPTION

The course introduces students to fundamental concepts in finance and economics in the context of decisions that arise in contemporary planning and management of social and environmentally-relevant (civil) engineering systems. These concepts underlie quantitative analysis techniques, e.g., evaluating/solving systems of equations or optimization models, to assess and select between alternative investment projects.

INTENDED AUDIENCE

The intended audience for this course consists of undergraduate students in Engineering and Science. The course satisfies a **basic engineering** requirement in the *systems engineering and analysis* category.

OBJECTIVES

The course objectives are to:

- Instill in students a recognition and appreciation that large-scale, long-term engineering projects have complex economic, environmental, and social consequences and tradeoffs. In this context, the course aims to provide students technical tools to represent, evaluate, and select among projects based on their financial consequences;
- Prepare students to become financially conversant in their professional careers and personal lives;
- Train students to become proficient in the use of commercial software, i.e., MS Excel, to solve engineering problems; and
- Prepare students to take advanced courses in systems engineering, financial engineering, and managerial accounting.

PREREQUISITES

This course has no formal prerequisites. Previous coursework in calculus (MATH 220-1, 220-2, 228-1), probability, and statistics (CivEnv 306, IEMS 202, or IEMS 303) may be useful but not necessary. Familiarity with MS Excel will also be helpful.

Due to significant overlap, CivEnv 205 should not be taken concurrently or after CivEnv 304, Econ 360-1, KELLG_FE 310-0, and probably BUS_INST 304. Take advantage of being at NU to build additional skills in finance and economics.

MATERIALS

The **required** textbook for the class is D. G. Newnan, T. G. Eschenbach, J. P. Lavelle, and N. Lewis (2019), *Engineering Economic Analysis*, 14th Edition. Readings and homework problems from this edition of the textbook will be assigned approximately on a weekly basis.¹

Other useful reference texts include:

1. C. S. Park (2022), *Contemporary Engineering Economics*, 7th Edition.
2. D. G. Luenberger (2014), *Investment Science*, 2nd Edition.
3. deNeufville, R. (1990), *Applied Systems Analysis*, McGraw-Hill. This book is out of print, but available on-line for free at http://ardent.mit.edu/real_options/ASA_Text/asa_Text_index.html.

OUTLINE

The first part of the course will introduce basic concepts and tools in finance to evaluate and select projects in deterministic situations. The second part of the course presents analysis tools that are appropriate in situations where decision-makers have to contend with uncertainty. Throughout, the objective is to integrate methodological tools with contemporary applications that arise in planning and management of (civil and environmental) engineering systems. Lectures will be devoted to learning the tools and solving problems to reinforce the material. In addition, there will be sessions devoted to learning how to solve the problems using commercial software (MS Excel). The content includes:

Topic	Approximate Duration
<i>Deterministic Financial Evaluation & Selection</i> Cash-flow evaluation Project selection Sensitivity analysis Depreciation and taxes	5 weeks
<i>Evaluation & Selection under Uncertainty</i> Decision analysis & value of information Utility Theory Portfolio Optimization Theory	5 weeks

¹It is possible to rely on other/older editions of the textbook, as long as it is understood that the student is responsible for completing the assigned readings and homework problems. We will NOT make readings/problems from the book available, or provide a map or conversion table to navigate other/older editions.

The required textbook has the lowest total ownership costs among competing textbooks. In particular, if you choose to purchase a used hard-copy, you can probably sell it at the end of the quarter for the same price you buy it now. Electronic access to the textbook can be purchased directly from <https://global.oup.com/ushe/product/engineering-economic-analysis-9780190063467?q=newnan&cc=us&lang=en>. With the discount code STUDENT23, I think the price is \$49.95.

Finally, I note that the required textbook is available in the Course Reserves section at the Main Library.

This outline is subject to change in order to accommodate time and interests.

REQUIREMENTS AND ASSESSMENT

1. Homework assignments (20%). Homework will be assigned approximately on a weekly basis and will be due by the start of class as indicated on the assignments. Homework submission will be via file upload to Canvas. While all file types will be accepted, we strongly suggest that you restrict yourself to .pdf, .docx, .xlsx, .jpg files. Taking pictures or scanning work that you do by hand, and uploading spreadsheets is probably the most efficient approach. To avoid technical problems and various restrictions, links to cloud files/drives or other storage devices will not be accepted. Long story short, if we can't access your homework, we can't grade it. Solutions will be posted shortly after the assignments are due. Therefore, no late homework can be accepted; however, the 2 assignments with the lowest scores (by percentage) will be dropped from the final homework score. Given the size of the class and the available resources, 30–50% of the homework problems may be selected at random and graded thoroughly. You should start working on the homework early so that you have time to ask questions in class, during discussion sections, and during office hours before the due date. Please feel free to work in groups, or to ask for help from fellow students, the instructor, or the teaching assistants. However, please note that each student must submit **their own work** unless otherwise stated. To earn credit on assignments, you must **show your work**, i.e., writing an answer, even if correct, is not sufficient to earn credit. If you have grading questions, please email the grader. If the issue persists, please contact the instructor.

The assignments may have some in-depth problems that will be labeled “Extra Credit”. These problems are not required for the course but thorough solutions may be rewarded with extra credit. To avoid getting side-tracked, you should only work on the extra-credit problems once you complete the required problems.

2. Two case-studies (15% each). The case studies are meant to give the students experience addressing problems that are richer (in scale and scope) than textbook problems. At their core, the case studies will involve formulating quantitative models for the problems, using software to solve them, and making recommendations. A short report will be submitted for each case study. The report will give the students an opportunity to discuss issues that may not be captured in the models. Students will have 2–3 weeks to complete the case studies. Specific instructions will be provided along with the first case study. Students are highly encouraged to work in groups of 4–5. Each group will submit one report.
3. Two exams (25% each). The exams will be designed to test your understanding of the material presented in class and in the homework assignments. The first exam is scheduled **3:00–4:20 on Monday, May 1.**² The second exam is scheduled **3:00–4:20 on Wednesday, May 31.** Special arrangements for the exams must be discussed with the instructor at least two weeks prior to the exam's scheduled date.

ACCOMMODATIONS

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact ACCESSIBLENU to move forward with the university's established accommodation process (accessiblenu@northwestern.edu; or 847-467-5530). If you already have established accommodations with ACCESSIBLENU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

²Graded exams will be available by Thursday, May 4, in advance of the May 5 deadline to drop courses.