

# ISE510 001-601 - APPLIED ENGINEERING ECONOMY

SPRING 2024

## Course objectives/description

The course aims to provide the students with the advanced concepts of engineering economic analysis and various tools to solve capital investment problems. The course will address how to model and solve engineering economy problems in various practical situations. The topics cover cost/revenue estimating techniques, discounted cash flow analysis techniques, sensitivity and breakeven analysis, depreciation and after-tax analysis and decision making under uncertainty (the use of probability theory, various decision rules/criteria).

## Course Topics

- **Economic Decision Making and Cost Concepts**
- **Concepts of Interest and Monetary Equivalence for Cash Flows** (Interest factors)
- **Equivalent Worth Methods** (Present Worth, Future Worth, Annual Worth Analysis)
- **Rate of Return Analysis** (Internal Rate of Return, External Rate of Return)
- **Other Techniques** (Benefit/Cost Ratio Analysis, Payback period)
- **Sensitivity and Breakeven Analysis**
- **Depreciation and After-Tax Analysis**
- **Capital Investment Analysis in an Uncertain World**
  - Analytical methods for risk analysis (use of probability theory)
  - Simulation method for risk analysis
  - Decision rules/criteria for risk and uncertainty

## Learning outcomes

By the end of this course, students will be able to:

1. Understand the important concepts of the engineering economy (time value of money, interest, etc.) and the engineering decision making process.
2. Apply cost/revenue estimating techniques to estimate the parameters for the engineering economy problems
3. Derive and apply various interest formula to solve the cash flow problems in the most computationally efficient way.
4. Understand the capabilities and limitations of the various cash flow analysis techniques for evaluating capital investments.
5. Apply cash flow analysis using computer tools (Excel spreadsheet).
6. Recognize, formulate and solve the engineering economy problems in various practical situations.
7. Do an after-tax analysis of the investment alternatives. Understand the advantages and limitations of different depreciation techniques used for calculating taxes and recognize how they affect the after-tax rate of return of the investments.
8. Apply probability theory and simulation to deal with the random parameters when evaluating the investment alternatives under risk.
9. Apply various decision rules/criteria to evaluate multiple investment alternatives under uncertain states of environment.

**Class Time:** Tuesday-Thursday, 3:00pm-4:15pm

**Teaching mode:** face to face, in the classroom (section 001), online asynchronous (section 601)

**Classroom:** 4134 Fitts-Woolard Hall

**Instructor:** Semra Sebnem AHISKA KING

**Office Location:** 4179, Fitts-Woolard Hall

**Office hours:** Monday-Wednesday, 1:00pm-2:30pm, and Friday, by appointment (available in-person in my office and online with Zoom)

**Email:** [ssahiska@ncsu.edu](mailto:ssahiska@ncsu.edu)

**Teaching Assistants:** Chun-Wei Chang

**Office Location:** 4333 FWH

**TA Office hours:** Thursday-Friday, 10:00-11:00am

**Email:** [cchang25@ncsu.edu](mailto:cchang25@ncsu.edu)

### Prerequisites

An undergraduate course in math or statistics

### Textbook (optional for the student, no purchase is required)

Capital Investment Analysis for Engineering and Management, John R. Canada, William G. Sullivan, Dennis J. Kulonda, John A. White, 3<sup>rd</sup> Edition, 2005, Pearson Prentice Hall, ISBN-13: 978-0131434080, ISBN-10: 013143408X

### Other reference book

Engineering Economic Analysis, Donald G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach, 12<sup>th</sup> Edition, ISBN-13: 978-0199339273, ISBN-10: 0199339279

### Course requirements/Grading

Assignments	Percentage of Final Grade
<b>Homework Assignments (around 10-11)<sup>a</sup></b>	<b>20%</b>
<b>Exam 1</b> (around 6 <sup>th</sup> week, lectures 1-9)	<b>20%<sup>b</sup></b>
<b>Exam 2</b> (around 11 <sup>th</sup> week, lectures 10-17)	<b>30%</b>
<b>Exam 3, Final Exam</b> (Thu, Apr 25, 3:30-6 pm, lectures 18-26)	<b>30%</b>

<sup>a</sup> Students are required to submit at least **nine** HW assignments. The students' average HW grade will be computed considering their best nine HW grades.

<sup>b</sup> Among the three exams, the one with the lowest grade will be assigned 20%, and the other two exams will be assigned 30% weight.

### Software requirement

Microsoft Excel

**Lecture mode and Class attendance policy:** The instruction mode is “*face to face (F2F) in the classroom*”. In case it becomes impossible to teach F2F for any reason, the lectures will be delivered online. The on-campus (section 001) students are required to attend at least 70% of the lectures in the classroom unless they have a medical excuse. Up to 8 missed lectures can be tolerated given this attendance policy. **Your overall grade will be reduced by 3 points**

**(equivalent to one letter grade) for any additional lecture missed over 8.** Students must sign the attendance sheet by the end of each lecture to prove their presence. The Engineering Online (EOL) students (section 601) are expected to watch the lecture recordings on a timely basis, ideally as soon as they are posted.

### **Course structure**

The lectures will be delivered by the instructor. Many in-class examples will be provided to the students for learning the introduced concepts/techniques. The active participation of the students in solving these in-class examples is strongly recommended. The students will then have the opportunity to enhance their knowledge through challenging HW assignments.

### **Classroom policy**

The use of computers and communication devices for personal purposes (cell phone, tablet, computer, texting, email, internet) and eating/drinking are not allowed during the lectures in the classroom.

### **Course Moodle page**

The Moodle page will be used for posting all the course materials and for HW submissions.

Moodle page for the course is accessible at:

<https://wolfware.ncsu.edu/courses/my-wolfware/>

### **OTHER IMPORTANT NOTES ON HW SUBMISSIONS AND EXAMS:**

- HW submissions will be done online using Moodle by midnight of the HW due date.
- All the homework assignments must be submitted by their due date. Late submissions will be assigned 0 grade. In case you need more time to complete the hw, you should talk with the instructor at least 1 day before the due date, in which case you may be granted an extended deadline if you have an acceptable excuse such as medical.
- All three exams will be **IN-CLASS exams to be taken in the classroom for the on-campus students (section 001). For the Engineering Online (EOL) students (section 601), they will be in-person proctored exams at an approved testing center.**
- On-campus students are required to attend the tests on their scheduled date and time. The EOL students will be provided with an exam period (consisting of a few days) around the exam date scheduled for the on-campus students. No make-up for the tests will be provided unless the student has a medical emergency on the test day. An official note from the doctor must be provided in this case as proof of the medical excuse.

### **Academic integrity policy**

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>. The Code of Student Conduct (NCSU POL11.35.01) serves as the basis for student conduct at NC State. It contains information related to the university's jurisdiction over student behavior, academic and non-academic violations, sanctions available when a violation occurs, and information regarding interim suspension. **Academic violations include cheating, plagiarism, or aiding another to**

**cheat or plagiarize.** Non-academic violations include rules concerning alcohol, drugs, infliction or threat of bodily harm, vandalism, disorderly conduct, harassment, interpersonal violence, and more). All students are strongly encouraged to read and understand the Code of Student Conduct (<https://studentconduct.dasa.ncsu.edu/code/>).

Academic integrity is the cornerstone of education. Plagiarism and cheating are attacks on the very foundation of academic life and cannot be tolerated within universities. All students are strongly encouraged to review the university policies on academic integrity at <https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/>.

The students who are suspected of violating the academic integrity in the tests and HW assignments will be reported to the Office of Student Conduct for academic misconduct. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02) (<https://studentconduct.dasa.ncsu.edu/procedures/>). The procedure followed when a student is accused of violating academic integrity is described at <https://studentconduct.dasa.ncsu.edu/students/procedures-overview/>.

A student who violates the academic integrity policy in HW or exam assignments will fail the course, and lose his/her good academic standing status, which may mean losing several opportunities including TA/RA positions, scholarships, CPT (working off-campus), etc. The student may also be suspended or even terminated from the program.

## **GRADING SCALE**

The following is the standard NCSU grading scale. Based on the overall class performance, the minimum grade required for a particular letter grade may be decreased in favor of the students.

<b>Grade range</b>	<b>Letter grade</b>
97-100	A+
93-96	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-68	D
60-62	D-
<60	F