ENGR 360 Economic Analysis

Instructor	**Spring Semester**
Dr. Mike Lowry, P.E. Engineering Physics Building, EP 115H 208-885-0139 mlowry@uidaho.edu	Class time: Recorded videos. Class location: No class meetings. Instructor's office hours: M, T, W 11:00 –12:00. Or you can email me and I will set aside time.

Course Description

Economic analysis and comparison of engineering alternatives.
2 credits, prerequisite: junior standing or permission from the instructor.

The syllabus and schedule might change during the semester. The current version and additional materials are online:
http://www.webpages.uidaho.edu/~mlowry/Teaching/syllabus.engr360.pdf

Learning Objectives

This course will prepare students for the engineering economy section of the Fundamentals of Engineering (FE) exam.
Students who successfully complete this course will be able to:

1. Conduct economic analysis for capital investment decisions faced by engineers;

2. Compare alternatives using the following traditional economic analysis methods: a) present worth analysis, b) annual worth analysis, c) future worth analysis, d) internal rate of return analysis, and e) benefit-cost analysis;

3. Calculate capitalized worth;

4. Construct MARR choice tables;

5. Consider non-monetary consequences when comparing alternatives by using the following multiattribute analysis methods: a) dominance, b) satisficing, c) lexicography, d) non-dimensional scaling, and e) additive weight technique;

6. Consider risk and uncertainty when comparing alternatives through:
   a) breakeven analysis, b) sensitivity analysis, c) scenario analysis, and d) probabilistic analysis;

7. Calculate straight-line and MACRS depreciation;

8. Understand and appreciate the role of economic analysis in decision-making.

Required Textbook and Homework Website

1. Textbook: *Engineering Economy*, 17th Edition (2018, Pearson) by W. Sullivan, E. Wicks, and C. Koelling
2. MyLab Homework Website (accessible through Bblearn): *MyLab Engineering for Engineering Economy 17th Edition*.

You will use the textbook for readings. Older editions (14th, 15th, and 16th) can be used for the readings.
You will use *MyLab* to submit homework. Every student needs their own unique access to Pearson *MyLab* and it must be for the 17th edition. *MyLab* is accessed (and can be purchased) through Canvas.

...so here are a few options:
Option 1. Buy the hardcover textbook plus MyLab plus digital etext ($180). (Still access MyLab through Canvas).

Option 2. Buy an older edition on Amazon (about $30) and buy access to *MyLab* for about $65 through Canvas.

There are more options such as digital text or loose-leaf text. The UI bookstore and Amazon have options. Here is the Pearson site with options: https://www.pearson.com/store/p/engineering-economy/P100001008138

Formula Sheet for Exams

Engineering Economics Excerpt_from_FE_Reference.pdf

ENGR 360 Economic Analysis

Session		Date	Discussion	Reading*	Due*
1		12-Jan	Comparing Alternatives with CFDs	1.1 - 1.6	
2		19-Jan	Cost and Benefit Terminology	2.1, 4.1 - 4.5	
3		26-Jan	Single Payment and Uniform Series Formulas	4.6 - 4.9	
4	Fundamentals	26-Jan	Equivalence and Gradient Formulas	4.11 - 4.12	
5		2-Feb	Nominal and Effective Interest Rates	4.14	HW1
6		2-Feb	Periodic and Continuous Compounding	4.15 -4.16	
7		9-Feb	Using Excel and Amortization	4.17	HW2
8		16-Feb	Present, Annual, and Future Worth Analysis	5.1 - 5.5, 6.4.1	P1
9		16-Feb	Capitalized Worth	5.3.3	
10		23-Feb	To Buy or to Rent	FE Ch. 51	HW3
		23-Feb	**Exam 1**	FE Ch. 53	Exam1
11		1-Mar	Internal Rate of Return Analysis	5.6	
12		1-Mar	Graphical Analysis and MARR Choice Tables	6.4.2	
13	Advanced Topics	8-Mar	Benefit-Cost Analysis	10.1 - 10.7	P2
14		8-Mar	Non-Monetary Consequences	14.1 - 14.5	
15		22-Mar	Multiattribute Analysis Methods	14.6 - 14.8	HW4
16		29-Mar	Breakeven Analysis	11.1 - 11.2	
17		5-Apr	Sensitivity Analysis and Scenario Analysis	11.3 - 11.4	
18		12-Apr	Probabilistic Analysis	12.1 - 12.7	P3
19		19-Apr	Tax Deduction for Depreciation	7.1 - 7.4	
20		19-Apr	Income Tax	7.6 - 7.8	
21		26-Apr	Inflation	8.1 - 8.2	HW5
		26-Apr	**Exam 2**	FE Ch. 52	Exam2

I will <u>not</u> accept homework or projects that are late.

Grades are posted on https://canvas.uidaho.edu/ and will be assigned according to the following criteria:

Participation in class or my office	1%
5 Homeworks	24%
3 Projects	15%
2 Exams	60%

> Homework is accessed and submitted through *Pearson MyLab Engineering*.

**Using homework, projects, or exams from previous semesters to study for exams, to help complete your assignments, or for any other purpose whatsoever is strictly prohibited. Violators will be failed. **
** I will <u>not</u> accept late assignments or exam rescheduling without documentation from the Dean of Students or a medical professional. Requests for exam rescheduling must be made prior to the day of the exam.*
I will <u>not</u> accept extra or alternative work to replace assignments or improve your grade.

Note that 4 out of 10 points on each project are for the quality of your report. <u>Please refer to the example on the class</u> webpage or consult the instructor for information about making professional, high quality reports. You can name and organize the sections of your report any way you want, but at least include an "Introduction" and "Conclusion."

P1_Buying_a_house.pdf   P2_Deciding_to_buy_or_rent.pdf   P3_Choosing_the_best.pdf

Professional Report Example
Professional_Report_Example.pdf

Additional Material

Excel Files
Lecture_excel_files.zip

Fundamentals of Engineering Readings and Practice Exams
FE_Ch._51.pdf
FE_Ch._52.pdf
FE_Ch._53.pdf
FE_Diagnostic.pdf

Python Financial Formulas
Every financial formula in Excel is available in Python with the exact same structure:
https://docs.scipy.org/doc/numpy-1.13.0/reference/routines.financial.html
See my CE 215 class notes for instructions on how to install Python with Anaconda:
https://www.webpages.uidaho.edu/~mlowry/Teaching/Analysis&Design/build/html/index.html

Monte Carlo Simulation
Probabilistic_analysis_handout.pdf
MCSim_Instructions.doc
MCSim.zip
http://www3.wabash.edu/econometrics/EconometricsBook/Basic%20Tools/ExcelAddIns/MCSim.htm

More Resources
USDOT_Economic_Analysis_Primer.pdf

Great Articles, Videos, and Podcasts
- PBS "The Ascent of Money" movie series: http://www.pbs.org/wnet/ascentofmoney/
- $185/ton cost of carbon pollution: https://apnews.com/article/science-climate-and-environment-government-politics-4c1e8783694201355f88012079367f27
- Value of Statistical Life: http://freakonomics.com/podcast/kenneth-feinberg/
- Value of Life and Nature: https://www.wnycstudios.org/podcasts/radiolab/episodes/worth
- Strange things you can insure: https://www.google.com/search?q=Strange+things+you+can+insure&rlz=1C1GCEU_enUS993US993&oq=Strange+things+you+can+insure&aqs=chrome..69i57.92467492j0j4&sourceid=chrome&ie=UTF-8
- Decision making: https://www.npr.org/programs/ted-radio-hour/519264798/decisions-decisions-decisions?showDate=2018-09-14
- Predicting future benefits: https://www.npr.org/2017/08/21/545097480/you-2-0-why-were-bad-at-predicting-our-own-happiness-and-how-we-can-get-better
- Investing smart = 1) start today, 2) use dollar cost averaging, 3) diversify, and 4) stay in as long as possible
https://tim.blog/2019/01/17/peter-mallouk/

Extra Information for Engineering Outreach

- Follow the schedule on this syllabus, regardless of the schedule provided by the EO office. In the fall, the live course ends halfway through the semester and so does the EO version. Other semesters the EO version is longer.
- Sometimes live lectures go over or end early, so check preceding and subsequent recordings for specific topics.
- Submit homework through MyLab.
- Submit projects by emailing or dropping in my mailbox on my door or my mailbox in the CE office.
- Submit exams by 5:00pm PST on the due date. You will have a 3-day window to take the exams.
- Class participation points are earned through email correspondence (At least once during the semester send an email to ask me a question so that I know you're interested and engaged).
- Be sure to print and bring the formula sheet for the exams (i.e. the excerpt from FE Reference above)
- On-campus students can request to view a limited number of recorded sessions for a fee. Contact the EO office.

Student Conduct and Policies

Each student is expected to assist in maintaining a classroom environment that is conducive to learning. In order to assure that all students have the opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from engaging in any other form of distraction. Inappropriate behavior in the classroom shall result, minimally, in a request to leave class.

- **Attendance.** Attendance at all course activities is expected. Missing more than one class period is considered excessive. You are expected to arrive to class on time.
- **Deadlines**. Assignments must be turned in by the due date and time unless prior arrangements have been made. I will not accept late assignments or exam rescheduling without documentation from the Dean of Students or a medical professional. Requests for exam rescheduling must be made prior to the day of the exam.
- **Extra or Alternative Credit**. I will not accept extra or alternative work to replace assignments or improve your grade.
- **Classroom Engagement.** Use of personal phones, music players, tablets, iStuff, etc. is not permitted in class. This includes texting. Please place your ringer on silent before entering class. Reading or working on other materials while in this class is strongly discouraged.
- **Student Conduct**: All students are expected to honor the UI Student Code of Conduct. Violations include, but are not limited to: copying homework assignments completed by others, plagiarism, and cheating. Please be aware that any violation of the UI Student Code of Conduct may result in a course grade of "F". http://www.uidaho.edu/DOS/judicialaffairs/studentcodeofconduct
- **Plagiarism**: Plagiarism occurs when you use but do not cite someone else's work, even if it is re-worded, or by not indicating that a passage (paragraph, sentence, or even a small part of sentence) is directly quoted even if the reference is cited. Following the structure or organization of someone else's work is also plagiarism. Students caught plagiarizing will be given a grade of "F".
- **Cheating**. Using assignments, projects, or exams from previous semesters to study for exams, to help complete your assignments, or for any other purpose whatsoever is strictly prohibited. Violators will be failed.

University of Idaho Classroom Learning Civility Clause

In any environment in which people gather to learn, it is essential that all members feel as free and safe as possible in their participation. To this end, it is expected that everyone in this course will be treated with mutual respect and civility, with an understanding that all of us (students, instructors, professors, guests, and teaching assistants) will be respectful and civil to one another in discussion, in action, in teaching, and in learning.

Should you feel our classroom interactions do not reflect an environment of civility and respect, you are encouraged to meet with your instructor during office hours to discuss your concern. Additional resources for expression of concern or requesting support include the Dean of Students office and staff (885-6757), the UI Counseling & Testing Center's confidential services (5-6716), or the UI Office of Human Rights, Access, & Inclusion (885-4285).

Disability Support Services

Reasonable accommodations are available for students who have documented temporary or permanent disabilities. All accommodations must be approved through Disability Support Services, located in the Idaho Commons Building, Room 306. Contact DSS at 208-885-6307, email dss@uidaho.edu or go to www.uidaho.edu/dss .

London, September 19, 1772

Dear Sir,

In the Affair of so much Importance to you, wherein you ask my Advice, I cannot for want of sufficient Premises, advise you what to determine, but if you please I will tell you how.

When these difficult Cases occur, they are difficult chiefly because while we have them under Consideration all the Reasons pro and con are not present to the Mind at the same time; but sometimes one Set present themselves, and at other times another, the first being out of Sight. Hence the various Purposes or Inclinations that alternately prevail, and the Uncertainty that perplexes us.

To get over this, my Way is, to divide half a Sheet of Paper by a Line into two Columns, writing over the one Pro, and over the other Con. Then during three or four Days Consideration I put down under the different Heads short Hints of the different Motives that at different Times occur to me for or against the Measure. When I have thus got them all together in one View, I endeavour to estimate their respective Weights; and where I find two, one on each side, that seem equal, I strike them both out: If I find a Reason pro equal to some two Reasons con, I strike out the three. If I judge some two Reasons con equal to some three Reasons pro, I strike out the five; and thus proceeding I find at length where the Ballance lies; and if after a Day or two of farther Consideration nothing new that is of Importance occurs on either side, I come to a Determination accordingly.

And tho' the Weight of Reasons cannot be taken with the Precision of Algebraic Quantities, yet when each is thus considered separately and comparatively, and the whole lies before me, I think I can judge better, and am less likely to take a rash Step; and in fact I have found great Advantage from this kind of Equation, in what may be called Moral or Prudential Algebra.

Wishing sincerely that you may determine for the best, I am ever, my dear Friend, Yours most affectionately

B. Franklin