

Division of Engineering and Mathematics
School of Science, Technology, Engineering, and Mathematics
University of Washington Bothell

B ME 482 A - Professional Engineer
Spring 2018

Time and Location: TTh 8:45 - 10:45 in UW2 - 131

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Canvas Homepage: <https://canvas.uw.edu/courses/1210416>

Overview

Professional Engineer focuses on roles and responsibilities of the engineer as an employee in a workplace and member of a profession. It covers several interrelated components of professional practice, including leadership, communication, professional ethics, and engineering economics. It includes units on professional licensure and preparing for the Fundamentals of Engineering (FE) Exam.

A significant part of the course is devoted to economic analysis. Engineering economics deals with techniques for factoring costs into engineering decisions. Rarely are engineering decisions made solely on the basis of technical considerations; cost and time often come into play. An elegant solution that ends up costing more to make than it earns in revenues, or that yields returns below a firm's minimum requirement, is no solution at all. We will learn ways of estimating costs, analyzing cash flows, comparing benefits to costs, and deciding which alternative to choose based on financial metrics set by the engineer's client or employer.

Learning Outcomes

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

1. Apply accounting and economic methods to analyze investments in engineering projects.
2. Choose from among alternative engineering solutions the one that best meets the need given the budgetary, technical, legal, and other constraints.
3. Describe the process of becoming a licensed Professional Engineer (PE), and apply to take the Fundamentals of Engineering (FE) Exam.
4. Describe the ethical, legal, and business contexts of engineering professional practice, and understand the role of the licensed PE within those overlapping contexts.

5. Apply communication models and best practices to design and deliver effective presentations.
6. Identify characteristics of good engineering leadership, and examine their own leadership strengths and weaknesses in relation to them.

ABET Learning Outcomes

The learning outcomes for this course map to ABET outcomes (f), (g), (h), and (i):

- (f) Understanding of ethical and professional responsibility.
- (g) Communicates effectively.
- (h) Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (i) Recognition of the need for, and an ability to engage in, lifelong learning.

Course Materials

The following textbook is required and should be available in the bookstore:

Donald G. Newnan et al, *Engineering Economic Analysis*, Thirteenth Edition (Oxford University Press, 2017). (referred to as “Econ” in course schedule below)

Other required readings will be posted in the Readings folder in the Files section of Canvas. They have file names starting with “Lead,” “PM,” and “FE.” Links to these will be created in the Modules section by date as the course progresses.

The following book is optional and should be available in limited quantity in the bookstore. Though quite expensive, it is very strongly recommended for those planning to take the Fundamentals of Engineering (FE) Exam in Mechanical Engineering.

Michael R. Lindeburg, *FE Mechanical Review Manual* (Professional Publications, 2014).

Also recommended for those interested in taking the FE Exam is the ***FE Reference Handbook, Version 9.4***, produced by the National Council of Examiners for Engineering and Surveying (NCEES). The full text will be available in Canvas; we will use parts of it in the course. The computer-based version of this handbook is the only reference allowed during the FE Exam.

An important resources for anyone thinking of taking the FE Exam is the NCEES website:

<https://ncees.org/engineering/>

I strongly recommend clicking on the **MyNCEES** button at the top of the home page and sign up for an account. Doing so will get you into the system so that you can download resources and register for exams. Other Resources for the FE/PE Exams and Licensure:

- (1) FE Mechanical Exam Specifications (topics covered and approximate number of questions on each topic): <https://ncees.org/wp-content/uploads/FE-Mec-CBT-specs.pdf>

- (2) PE Exam (ME's take the PE exam in one of three specialties: HVAC and refrigeration, machine design and materials, and thermal fluids.): <http://ncees.org/engineering/pe/>
- (3) NCEES Examinee Guide: <https://ncees.org/exams/examinee-guide/>
- (4) Washington State Department of Licensing:
<http://www.dol.wa.gov/business/engineerslandsurveyors/engapply-exam.html>
Although the FE exams are developed and administered by NCEES, which is a national organization, individual states determine eligibility requirements, and ensure that licensed engineers operate in compliance with state laws. In Washington, the governing body is the Board of Registration for Professional Engineers and Land Surveyors (BORPELS).
- (5) National Society of Professional Engineers (NSPE): <https://www.nspe.org>

Assignments

The assignments, due dates, and weightings are as follows:

- 1. Two in-class, closed-book exams, April 19 and May 24 (30 % each, total of 60%):**
The exams consist of economic analysis problems like those in the homework, along with questions on leadership, licensure, and other aspects of professional practice covered in the reading and class meetings. Expect a balance of multiple choice and open-ended questions and problems. Relevant equations, interest tables, and other information will be provided. You may bring one 8-1/2 x 11 inch page of notes, with writing only on one side. This notes page will be turned in with the exam.
- 2. Homework, spread over the quarter (10 %):**
Homework assignments will be posted in Canvas one week before the due date. The problems will draw heavily from the end-of-chapter problems in the Economics textbook. Homework will be collected in class on the day it is due. Because of the large class size, I won't be able to correct errors in problems but instead ask that you check your work against the posted solutions. Work that is complete, neat, and submitted on time will generally receive full credit. Deductions will be made for missing problems, serious and numerous errors, messy work, and late submissions. Lowest grade will be dropped.
- 3. Leadership Self-Assessment (20 %):**
This is a 4-page (~1000 words) self-assessment of your leadership capabilities. It should take the following form:
 - a) First, identify three attributes of leadership from among those we study that you believe are the most important in an engineering leader.
 - b) Assess yourself against the criteria of effective leadership that you identified in a). What are your strengths and weaknesses in relation to those attributes? In which areas do you need to improve?
 - c) Finally, what are you going to do to overcome weaknesses identified in b) to become the best engineering leader you can possibly be?Type out your essay in 12-point font, double-spaced. Upload the essay to Canvas as a pdf document **by 11:59 pm Thursday, June 7.**

4. **CMAPP analysis of an oral presentation of *either* your capstone project, *or* an engineering internship or research experience you've had as a student (5%):** Assume the product is an extemporaneous presentation, with slide projection, to an audience of your classmates, professors, and members of our ME industry advisory board (see readings for April 3 and 5 in the schedule). The analysis is done in bullet points, using the categories of context (C), message (M), audience (A), purpose (P), and product (P). At the end, write an introduction of 150 - 250 words that you would say at the start of your presentation to capture the audience's attention, establish your credibility, and lead into the body of the presentation (tell 'em what you're gonna tell 'em.). Type it all out in 12-point font, affix your name at the top, print it, and submit it to me in class at your convenience but **not later than May 22**.
5. **Impromptu 4-minute oral presentation of *either* your capstone project, *or* an engineering internship or research experience you've had as a student (5%):** Ok, since you know to expect it, it's not truly "impromptu," but you will not know exactly when you will be called upon to present—only that it will be **sometime between April 10 and May 31!** The time is strictly limited to 4 minutes. It may be shorter than 4 minutes; a practical minimum is around 3 minutes. Assume your audience is what it is, but with the hypothetical addition of a few engineers from local employers dispersed across the room to check us out; in other words, you want to be at your best. Follow the guidelines for effective presentations (see reading for April 5 in the schedule). Start working NOW on what you want to say; write it out, time yourself, try it out on a friend or family member or pet. You must neither read your talk nor use notes. Maintain eye contact with the audience, speak with authority and confidence, and make it seem spontaneous, even though it will have been rehearsed. We'll try to do 3, 4 or 5 presentations between April 10 and May 31, inclusive, until all students have spoken. Names will be draw randomly. If you're not there when your name is called, you're out of luck.

Policies

A list of STEM School policies and resources can be found here: <http://www.uwb.edu/getattachment/stem/about/stem-policies/classroom-policies-stem-fc-1-12-17.pdf>

Grading: All assignments will be graded on a 100-point scale. At the end of the course, an overall weighted average grade will be calculated and converted to the 4-point grade scale using the following linear conversion: $\geq 95=4.0$, $94=3.9$, $93=3.8$, $92=3.7$, $91=3.6$, $90=3.5$, ..., $85=3.0$, ..., $80=2.5$, ..., $65=1.0$, $62=0.7$ (lowest passing grade), $< 62=0$.

Grades on exams and other major assignments may be curved within Canvas to maintain consistency of grade distributions. More information on the UW grading system can be found here: http://www.washington.edu/students/genclat/front/Grading_Sys.html

Absences, late and missed assignments: If you must miss an exam, notify me as far as possible in advance; at my discretion, a make-up exam may be scheduled, most likely *before* the exam is given in class. Unless you can furnish proof that an emergency has occurred, missing an exam without informing me in advance will result in a grade of zero. Missed classwork may not be turned in late. Late homework will receive a 10-point deduction for each late day. Except for the leadership essay, no assigned work will be accepted electronically.

Schedule

Date	Topic	Reading	Activity
Mar 27	Introduction What makes a PE?	Econ, Ch 1 (skim)	
Mar 29	Project Costs and Benefits Qualities of Project Leaders	Econ, Ch 2 Lead 1	
April 3	Interest & Equivalence Communication Models	Econ, Ch 3 Lead 2	Homework 1
April 5	Repeated Cash Flows Effective Presentations	Econ, Ch 4 Lead 3	
April 10	Present Worth Analysis Professional Responsibility	Econ, Ch 5 Lead 4	Homework 2
April 12	Annual Worth Analysis Professional Codes	Econ, Ch 6 Lead 5	
April 17	Contracts, Liability, and Ethical Practice for the Professional Engineer (PE)	PE 1	Homework 3 Guests from <u>BHC Consultants</u>
April 19	Exam 1		Exam 1 (closed book)
April 24	Rate of Return Analysis	Econ, Ch 7	
April 26	Credentials, Licensure, and the FE Exam	PE 2, PE 3	Homework 4 Guest from <u>Kenworth</u>
May 1	Comparing Project Alternatives	Econ, Chs 8&9	
May 3	NSPE Code of Ethics and Application to Self-Driving Cars; Take quiz at http://moralmachine.mit.edu	PE 4, PE 5	Guest from <u>HDR, Inc.</u> (tent.) Print out and bring quiz result to class.
May 8	Depreciation in Economic Analysis FE Exam Prep: Thermo	Econ, Ch 11 FE 1	Homework 5
May 10	Corporate Income Taxes FE Exam Prep: Fluids	Econ, Ch 12 FE 2	
May 15	Public Sector Projects FE Exam Prep: Heat Transfer	Econ, Ch 16 FE 3	Homework 6
May 17	Corporate Finance for Engineers	Econ, Ch 17	
May 22	Leadership: Steve Jobs, Jessica McKellar	Lead 6, 7	Homework 7
May 24	Exam 2		Exam 2 (closed book)
May 29	Leadership: Robert Gates, Hyman Rickover	Lead 8, 9	
May 31	Leadership: You	Lead 10	