THE UNIVERSITY OF BRITISH COLUMBIA

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MECH 431: Engineering Economics

University of British Columbia

Department of Mechanical Engineering

Course Instructor Prof. Naomi Zimmerman, Ph.D, P.Eng. (*she/her/hers)*

Contact Details	Office Location	Office Hours
Email: nzimmerman@mech.ubc.ca **Note:** I encourage you to send me messages using the Canvas inbox as you are likely to get a faster reply. I aim to reply within 24 hours during weekdays	CEME 2066	My drop-in office hours will be determined after an in-class poll of students' availability and will be posted on Canvas.

Teaching Assistant(s) Janet Sun

Contact Details	Office Location	Office Hours
Email: janet.sun@ubc.ca	N/A	Janet will primarily grade the assignments and can answer questions via email.

Course Requirements/Prerequisites None.

Class Meeting Times and Locations

Monday and Friday 10-11AM in SWING 121; Wednesday 1-2PM CEME 1202

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people.

Course Structure

MECH 431 primarily consists of lectures and problem solving. We will have three hours of lecture every week. You will be provided the course notes in advance, and solutions to in-class problems ("Worked Examples") will be posted to Canvas within 48 hours of a module being completed. We normally work on modules over several classes, so if you do not see the Worked Example solutions posted right away, it is normally because we are not finished with a module.

Learning Outcomes

At the completion of this course, you should be able to:

1. Explain fundamental concepts of engineering economics
2. Use basic financial tools required for engineering decision making (time value of money, taxes, inflation, risk)
3. Perform discounted cash flow calculations to choose between competing engineering projects
4. Prepare and analyze basic financial reports (balance sheets, income statements, etc.)
5. Evaluate corporate performance and competitiveness based on relevant information in financial reports
6. Assess and quantify the uncertainty and risk associated with engineering projects and evaluate investment alternatives
7. Understand the implications of engineering economics in the public sector, including triple bottom line accounting and the role of externalities
8. Develop a basic business plan

Course Schedule and Topics

Week	Content
September 3 – 5	**Module 1:** Introduction: Engineering Costs and Cost Estimation Relevant Chapter(s): 1
September 8 – 12	**Module 2:** Financial Accounting Relevant Chapter(s): 6.1
September 15 – 19	**Module 3:** Interest and Equivalence **Module 4:** Repeated Cash Flows Relevant Chapter(s): 2 (2.1-2.5; 2.7) and 3 **Assignment #1 Due: Friday September 19 11:59PM PT [Mod. 1-3]**
September 22 – 26	**Module 5:** Present Worth Analysis Relevant Chapter(s): 4
September 29 – October 3	**Module 6:** Annual Worth Analysis & Mortgages Relevant Chapter(s): 4, 5.1-5.5, 5.6
October 6 – 10	**Module 7:** Rate of Return Analysis Relevant Chapter(s): 5.1-5.5, 5.6 **Assignment #2 Due: Friday October 10 11:59PM PT [Mod. 4-6]**
October 13 – 17	**Module 8:** Graphical Analysis and Choosing a Method **Module 9:** Selecting a MARR Relevant Chapter(s): 5.8, 12.2, 10.2, 10.5, Appendix 4A **No class October 13 (Thanksgiving)** **Midterm Wednesday October 15, 1PM. Covers Modules 1-6**
October 20 – 24	**Business Plan Guide** **Module 10:** Uncertainty in Future Events Relevant Chapter(s): 12.1, 12.3, 6.2
October 27 – 31	**Module 11:** Replacement Analysis, Part 1 Relevant Chapter(s): 7 **Assignment #3 Due: Friday October 31 11:59PT [Mod. 7-10]**
November 3 – 7	**Module 12:** Depreciation Relevant Chapter(s): 7, 2.6, 8.7
November 10 – 14	**Module 13:** After-tax Cash Flows, Part 1 Relevant Chapter(s): 8 **No class November 10 – 12 (Reading Week)** **Assignment #4 Due: Friday November 14 [Mod. 11-12]**

November 17 – 21	**Module 13:** After-Tax Cash Flows, Part 2 Relevant Chapter(s): 8
November 24 – 28	**Module 14**: Inflation and Price Change **Module 15:** Triple Bottom Line, Externalities, Corporate Sustainability, Part 1 Relevant Chapter(s): 9, 10.1, 10.3, 13.1, 13.3 **Assignment #5 Due: Friday November 28 [Mod. 13-14]**
December 1 – 5	**Module 15:** Triple Bottom Line, Externalities, Corporate Sustainability, Part 2 Final Review Relevant Chapter(s): 10.1, 10.3, 13.1, 13.3 **Business Plan Due – Monday Dec 1 11:59PM** **Business Plan Peer Review Due – Friday Dec 5 11:59PM**

Learning Activities

- Attending in-class lectures
- In-class / synchronous participation in class knowledge "check-in" quizzes
- Submitting 5 formative assignments to assess your understanding
- Writing a group business plan

Learning Materials

Canvas: Your primary course hub. You will find lecture notes here, assignment calendars, and links to other platforms as required. You will submit your assignments on Canvas, as well as files in your business plan. Lecture slides will be posted to Canvas at least 24 hours prior to lecture on this platform under the appropriate module.

Textbook for further reading and hundreds of sample problems: Engineering Economics: Financial Decision Making for Engineers, 8th edition
Author(s): Niall M. Fraser, Ketra Schmitt
ISBN: 9780138294076
Availability: UBC Bookstore (List Price: $105.99 for eTextbook rental + MyLab (has some interactive examples). Can purchase e-textbook only for $77.99 (here). Used or older versions are also acceptable.

Assessment, Evaluation, and Grading

Assessment Plan:

- Assignments (5) 15%
- Project (Business Plan) 15% (13% from the plan; 2% for completing a peer-review)
- Midterm 25%
- Final Exam 45%

- **Midterm (25%):** The midterm will occur in-class at 1PM PT on Wednesday October 15th.

- **Final Exam (45%):** The final exam will at the scheduled final exam time.

- **Assignments (15%):** Solving problem sets. Each assignment is 4-5 questions. Roughly 2/3 of the questions will be graded in full, and 1/3 are "credit-no credit". The questions that will be graded in full are chosen randomly in class after the submission deadline. Late assignments will be accepted up until the point I post the solutions, with a 10% penalty per day. If an assignment is submitted after solutions are posted, students can only receive points for the "credit-no credit" questions, with the 10% daily penalty still in effect.

- **Business Plan (15%)**: You will work in teams of 4-5 to prepare a business plan. Submission of the business plan involves uploading a PDF and Excel Spreadsheet on Canvas. Full details are in the Business Plan assignment. 2% of the 15% weighting is for completing 1 peer review of another group.

Note: In undergraduate MECH courses where at least 50% of the final grade is assigned to examinations, students may only pass the course if they achieve a weighted average examination grade of at least 50% for undergraduate students, 60% for master's students, and 68% for doctoral students. The "examination grade" includes scores from the final examination, midterms, and other tests done individually in a classroom setting. In the event of a student receiving an "examination grade" of less than 50% for undergraduate students, 60% for master's students, and 68% for doctoral students, the "examination grade" total will be entered as their final grade for the course.]

Generative AI Teaching & Learning Guidelines

Students are permitted to use AI tools for formative work such as gathering information or brainstorming but may not use it on any assessed work or final submission.

Privacy and confidentiality guidelines: In line with FIPPA and UBC Information Security Standards, do not share any personal, private, or confidential information when interacting with GenAI tools that have not undergone a Private Impact Assessment (PIA) review and have not been approved for use with such information, as this data may be available to vendors, could be used for training models, and could end up in later outputs.

- This includes information such as names and personal email addresses of students, faculty, and staff; student numbers; and grades attached to identifiable students. It also includes anything that you would not, or do not have permission to make public, such as exam questions or other confidential data or materials.
- Most GenAI tools can only be used in teaching and learning at UBC with low-risk information. As of May 2024, no GenAI tools have been approved for use at UBC with personal or other sensitive information.

See Guidelines here for more general guidance: https://genai.ubc.ca/guidance/teaching-learning-guidelines/learning-with-genai/

Concession Requests

Eligibility: Under certain circumstances, students may be eligible for an academic concession, which, if approved, is an allowance determined by your instructors for you to make up missed coursework or an assessment. Academic Concessions can be requested for in-term work (all graded assignments, quizzes, and midterms during the UBC term dates) and final exams (exams scheduled during the UBC exam period). Before applying for a concession, students should:

- Review UBC's policy on Academic Concession (https://vancouver.calendar.ubc.ca/campus-wide-policies-and-regulations/academic-concession)
- Ensure the reason that you are requesting an academic concession fits within one of the following approved categories:
  - Conflicting responsibilities
  - Medical circumstances
  - Compassionate grounds
- Refer to this course syllabus for more specific information about what types of concessions may be available in applicable circumstances.

How to Submit a Request: Requests for academic concession for in-term work must be submitted using the APSC online form (https://academicservices.engineering.ubc.ca/exams-grades/academic-concession/) within 72 hours of the missed deadline or exam time. A copy of the request will automatically be forwarded to the instructor for verification and approval – students should double check that they have correctly entered the instructor's email address into the online form. Academic concessions are not guaranteed and submitting a request does not mean it will be approved. A concession request is only approved when the student has received confirmation of approval from the instructor.

Concessions Related to Final Exams: Students requesting academic concession for a missed final exam should read through the information, policy, and application procedure for Standing Deferred (SD) academic concession requests at https://academicservices.engineering.ubc.ca/exams-grades/academic-concession/. A request for a Standing Deferred academic concession should be made as soon as a student is aware that they will miss their scheduled exam.

Assignments: Students are expected to work independently, except in the case of group projects. Offering and accepting solutions from others is an act of plagiarism, which is a serious offense and all involved parties will be penalized according to the Academic Honesty Policy. Discussion amongst students is encouraged, but when in doubt, direct your questions to the professor or teaching assistants.

Attendance and Absences: Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials. In the case of missed assignments or examinations with an approved academic concession, weighting may be shifted to other assignments or examinations, and assignment deadlines for major deliverables may be shifted.

Academic Misconduct

Academic honesty is a fundamental requirement of your studies. It is the obligation of all students to inform themselves of the applicable standards for academic integrity. Students must be aware that standards at UBC may be different from those in secondary schools or at other institutions. Breaching those expectations or failing to follow the applicable policies, regulations, rules, or guidelines with respect to academic integrity constitutes academic misconduct and may have serious consequences. More information about UBC's policy on academic misconduct is available at https://vancouver.calendar.ubc.ca/campus-wide-policies-and-regulations/student-conduct-and-discipline/discipline-academic-misconduct

Respectful and Inclusive Environment

It is the Department of Mechanical Engineering's expectation that all students participating in our courses conduct themselves professionally and ethically. It is the obligation of all students to inform themselves of the applicable standards for appropriate conduct as a student and UBC community member. Students are at all times expected to uphold the UBC Engineering Code of Ethics and act in a manner consistent with the EGBC Code of Ethics.

The Department is committed to providing a respectful and inclusive learning experience and affirms the UBC Statement on Respectful Environment. Students are invited to advise the instructor if they wish to be addressed by or referred to with particular pronouns.

Students who are not conducting themselves in a respectful, professional, and ethical manner may be subject to consequences for non-academic misconduct or lack of professionalism. At a Department or course level, this may result in loss of access to facilities or equipment, impacts to course grades, changes to course arrangements, or other measures directly related to the conduct and applicable course. At a University level, non-academic misconduct can result in disciplinary measures ranging from probation to

suspension or expulsion. Students who have concerns about of non-academic misconduct or behaviour within our courses that is not consistent with the UBC Respectful Environment Policy can contact the department by emailing concerns@mech.ubc.ca or speak to any Mechanical Engineering faculty member or staff member.

For group work:

- **BE PROFESSIONAL** Students should be polite and contribute to their group in a positive way when working as a team. Students are expected to treat each other with respect and integrity, and work together as a team to achieve their common objectives.
- **RESPECTFUL ENVIRONMENT** As per the UBC statement on Respectful Environment, disrespectful behaviour will not be tolerated. All team members are to do their part to ensure that everyone feels comfortable contributing as part of the group.

When contacting instructors or teaching assistants:

- Students should include the course code in their subject heading, and include their name and student number in all communications. It is expected that students will refer to their course syllabus and updates on Canvas first before asking a question – the information may already be published.

Policies and Resources to Support Student Success

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here.

Mechanical Engineering has a Student Services Office (students@mech.ubc.ca), located in CEME 2054, where there are staff who can provide support, academic advising, and refer students to appropriate resources. They are open Monday-Friday, 8:00am-4:00pm.