



# ENGG\*3240 Engineering Economics

01

Fall 2022

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 07, 2022

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## 1 Course Details

### 1.1 Calendar Description

This course covers the principles of project evaluation; analysis of capital and operating costs of engineering alternatives, benefit-cost ratio; break-even studies, evaluations recognizing risk, replacement and retirement of assets; tax considerations, influence of sources of funds.

**Pre-Requisites:** 10.25 credits including, MATH\*1210

**Restrictions:** Registration in the Engineering program.

### 1.2 Course Description

The main goals of the course are:

1. Acquire and independently apply concepts and techniques of economic analysis used to form engineering decisions.
2. Assess cost implication in engineering design and application.
3. Select a preferred course of action based upon monetary and non-monetary considerations
4. Assess risks and uncertainty associated with engineering economic decisions.

### 1.3 Timetable

#### Lectures

Section 1: Tue, Thurs: 4:00 to 5:20 PM - AD-S, Room Virtual

Section 2: Tues, Thurs: 1:00 to 2:20 PM - AD-S, Room Virtual

## 1.4 Final Exam

Tuesday, Dec 13, 8:30 - 10:30 AM, location TBD

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## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Soha Eid Moussa  
**Email:** smoussa@uoguelph.ca  
**Telephone:** +1-519-824-4120 x56141  
**Office:** THRN 1341  
**Office Hours:** open door policy or by appointment

### 2.2 Teaching Assistants

**Teaching Assistant (GTA):** Akul Bhatt  
**Email:** akul@uoguelph.ca  
**Office Hours:** TBA

**Teaching Assistant (GTA):** Megan Smith  
**Email:** msmith72@uoguelph.ca  
**Office Hours:** TBA

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## 3 Learning Resources

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3240 Courselink site. You are responsible for checking the site regularly.

### 3.1 Required Resources

#### Custom CoursePack for ENGG\*3240 (Notes)

This custom document must be purchased from the Bookstore and brought to all classes, assessments and the final exam. It contains the interest tables as well as the various equations needed to be able to perform economic analysis of cash flows.

#### Webcam (Equipment)

### 3.2 Recommended Resources

#### E-Book (Textbook)

Needed for the MyLab components of the course:

1. Assignments, not graded

Fraser, N.M, Jewkes, E.M., Pirnia, M. and Schmitt, K. (2021) Engineering Economics: Financial Decision Making for Engineers, 7th Edition. Pearson Education, Canada

### 3.3 Additional Resources

**Lecture Information:** All the lecture notes will be posted on Courselink (week #1-#12).

**Lab Information:** N/A

#### Assignments

1. Download the assignments and solutions from CourseLink.
2. Access the Pearson Mylab questions via CourseLink.

**Miscellaneous Information:** Other information may also be posted on the web page.

### 3.3 Communication and Email Policy

Please use lectures and office hours as your main opportunity to ask questions about the course. Major announcements will be posted to the course Courselink website. **It is your responsibility to check the course Courselink website regularly.** As per University regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Apply the concepts of time-value of money, taking into consideration the impact of interest on investment decisions by comparing between potential candidates and identifying the better investment
2. Select the appropriate evaluation method for comparing between alternate investment opportunities by identifying important factors such as life expectancy and measure of interest (dollar value vs rate of return)
3. Demonstrate understanding that assets having different life expectancies can not be directly compared through use of common life concepts or by using annual worth

comparisons

4. Evaluate different project/investment opportunities to select the most beneficial by applying the appropriate evaluation method
5. Determine the rate of return of a project through analysis of cash flows, whether they are positive or negative, and how frequently they change from positive to negative.
6. Determine the book value of an asset for accounting and tax purposes by applying knowledge of depreciation
7. Understand basic accounting concepts through identification of elements of a balance sheet and income statement
8. Determine the after-tax viability of a project through the application of after-tax cash flow analysis using capital tax factors, capital salvage factors, tax rates, and depreciation rates.
9. Evaluate when an asset should be replaced through the use of replacement analysis both before and after tax by determining its economic life.
10. Demonstrate ability to calculate asset/project value due to inflation through application of concepts of real dollars versus actual dollars.
11. Recommend public-sector projects to be implemented by applying benefit cost ratio analysis

## 4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	2, 6
1.3	Recall, describe and apply fundamental engineering principles and concepts	2, 6
2	Problem Analysis	1, 2, 3, 4, 5, 8, 9, 10, 11
2.1	Formulate a problem statement in engineering and non-engineering terminology	2, 3, 4, 5, 8, 9, 10, 11
2.2	Identify, organize and justify appropriate information, including assumptions	1, 2, 3, 4, 5, 8, 9, 10, 11
2.3	Construct a conceptual framework and select an appropriate solution approach	1, 2, 3, 4, 5, 8, 9, 10, 11

#	Outcome	Learning Outcome
2.4	Execute an engineering solution	2, 3, 4, 5, 8, 9, 10, 11
2.5	Critique and appraise solution approach and results	2, 3, 4, 5, 8, 9, 10, 11
11	Economics and Project Management	4, 5, 8, 9, 10, 11
11.3	Estimate economic impact and feasibility of an engineering project or design using techniques such as cost benefit analysis over the life of the project or design	4, 5, 8, 9, 10, 11

## 5 Teaching and Learning Activities

### 5.1 Seminar

Thu, Sep 8, 12:00 AM - Fri, Dec 2, 11:30 PM

#### Topics:

#### Problem Sets

Problem sets will be issued throughout the semester. Students are expected to complete these at their own pace to prepare for the quizzes and final. GTA hours are set aside to access additional help and discussed the solutions if needed. **All problem sets are not graded.**

1. Problem Sets and solutions taken directly from course text Fraser et al., Edition 7.
2. Pearson MyLab interactive problems will be identified and linked to CourseLink. These interactive problems provide hints and solutions.

### 5.2 Lecture Schedule

Topic

Learning Objectives

Making economic decisions, sea of problems, role of engineering economics analysis, decision making process, engineering costs, cost estimation methods, estimation of benefits.	1
Cash flow diagram, computing cash flow, time value of money, interest and equivalence, compound interest formulas: single payment, uniform series, arithmetic and geometric gradient series, nominal and effective interest rates and continuous compounding. Assumptions in solving economic problems, economic rules, application of present worth analysis, Annual cash flow analysis, annual cash flow calculation. Analysis period.	1, 2
Equivalent Uniform Annual Cost (EUAC). Equivalent Uniform Annual Benefits (EUAB). Annual worth analysis Evaluation of Alternatives with: equal lives, common multiple lives, continuous lives, and fixed study period.	1, 2, 3
Internal rate of return, Minimum attractive rate of return. Present worth versus Interest Rate. Calculation of internal rate of return. Incremental internal rate of return. Multiple IRRs. External Rate of Return (ERR). Modified Internal Rate of Return (MIRR). Selection of best alternative by incremental and graphical analysis.	4
Future worth, minimum attractive rate of return, benefit cost and payback period analysis techniques. Sensitivity and break-even analysis	4
Concept of depreciation, book value, depreciation methods, depreciation and asset disposal, depreciation for tax purpose (capital cost allowance factor), and calculation of capital coat allowance factor.	5
The role of accounting in engineering economy. Divisions within an organization, Balance sheet and income statement, Assets, liabilities, equity and evaluation of indices (Ratios).	6
Taxes. Individual and corporate, incremental nature of taxes, combined	7

tax rates. After tax cash flow analysis, taxable income, after tax present worth and rate of return.

Replacement Analysis. Factors affecting replacement, Replacement analysis techniques. Concept of challenger and defender. Challenger is different from defender. Sequence of identical challengers, challenger is not repeated and defender and challenger with unequal lives. Complications in replacement analysis. After tax replacement analysis.

Inflation in engineering economy. Measurement of Inflation. Relationship between actual dollar and real dollar. Price Indexes. Inflation and tax calculations. Effect of inflation on MARR and IRR.

Economic analysis in the public sector. Public decision factors. Interest rates for public projects Benefit-Cost Ratio, conventional and modified B/C and Incremental B/C. Financing duration and politics of investments

Uncertainty in engineering economic analysis. Range of estimated values for evaluation. Probability and joint probability distributions, expected value, measurement and consideration of risk

### 5.3 Other Important Dates

Thursday, 08 September 2022: Classes begin

Monday, 10 October 2022 Thanksgiving holiday

Tuesday, 11 October 2022: Fall Study Day

Thursday, 1 December 2022: replaces Study Break Day (Tuesday Schedule in effect)

Friday, 2 December 2022

1. last day to drop course

2. last day of class (replaces Thanksgiving, Monday Schedule in effect)

Please refer to the undergraduate calendars for the semester scheduled dates.

## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
In class Practice Problems	10
Quizzes (best 6/8)	42
Final Exam	48
Total	100

### 6.2 Assessment Details

#### In class Practice Problems (10%)

Lectures will contain in-class practice problems. Students will be responsible for attempting the problems and submitting them to Dropbox to be assessed by the professor. The goal of the assignments is to allow students to obtain feedback and assistance in the application of the concepts taught. They will not be graded for content but will be used to personalize feedback to students and assist with learning. These assignments will be due by 11:59 pm on the Friday following the class in which they were started. Grade for assignment will be based on submission of solution attempt, not correct response. The submissions will be equally weighted, worth a total of 10% of the final grade.

#### Quizzes (42%)

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

- Quiz 1, Time Value of Money, September 28
- Quiz 2, Cash Flow Analysis, October 5
- Quiz 3, Comparison Methods Part 1, October 12
- Quiz 4, Comparison Methods Part 2, October 19
- Quiz 5, Financial Accounting and Replacement Decisions, November 2
- Quiz 6, Taxes, November 9



- Quiz 7, Inflation, November 16
- Quiz 8, Public Sector Decision Making, November 23

Eight quizzes will be provided with the best six quizzes counting towards the final grade. Each quiz will be worth 7% of the final grade for a total of 42%. The quizzes will cover the content from the unit listed as well as any prior units needed to be able to complete the questions successfully. Each quiz may consist of problems that you will have to solve, true/false questions, and/or multiple choice/multi-select questions. The questions will be generated randomly for each student but will cover the same content. Students will get feedback on each quiz.

All quizzes are closed book and notes except for the Required Course Custom Supplement containing the interest tables and equations. Quizzes have a duration of 20 minutes and must be completed between 7 pm and 11:59 pm on the date scheduled. No collaboration or communication with others of any type is allowed. The quizzes are to be done alone.

The purpose of the quizzes is to assess your understanding of the material covered in the unit. It is an opportunity for you to ensure that you have mastered the concepts covered up to that point. This is particularly important since the material of the following units will build on what has already been covered. Therefore, inability to successfully complete a quiz implies that you will have difficulty with all subsequent material if remedial action is not taken. It is therefore an indication that you have not yet mastered the material up to that point of the course and that additional time should be spent reviewing the units that have just been completed.

***The instructor reserves the right to change the quiz dates to be the later of the stated date or the Wednesday immediately following the topic listed having been covered in class. Any changes to quiz dates will be announced on CourseLink.***

#### **Final Exam (48%)**

**Due:** Tue, Dec 13, 8:30 AM - 10:30 AM, TBA on Webadvisor

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

You must pass the final exam to pass the course. Failure to do so will result in a grade of 48 at best.

### **6.3 Course Grading Policies**

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement

due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Missed Quizzes:** If you miss more than two quizzes due to grounds for granting academic consideration or religious accommodation, the weight of the missed quizzes in excess of two will be added to the weight of the final exam. There will be no makeup quiz.

**Passing grade:** In order to pass the course, you must obtain a grade of 50% or higher on the final exam. Failure to do so will result in a grade of at most 48.

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## 7 Course Statements

### 7.1 Course Grading Policies

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Missed midterm tests:** If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

**Passing grade:** In order to pass the course, you must obtain a grade of 50% or higher in the course.

### 7.2 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website [hyperlink to the website] and circulated by email.

### 7.3 Illness

The University will not require verification of illness (doctor's notes) for the fall 2020 or winter 2021 semesters.

## **8 School of Engineering Statements**

### **8.1 Instructor's Role and Responsibility to Students**

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

### **8.2 Students' Learning Responsibilities**

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

### **8.3 Lab Safety**

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

## **9 University Statements**

### **9.1 Email Communication**

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### **9.2 When You Cannot Meet a Course Requirement**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions  
<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses  
<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

### 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website  
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such

changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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