



# ENGG\*3240 Engineering Economics

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Fall 2020

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 08, 2020

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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:**

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: Tuesday and Thursday Virtual via Zoom 08:30 to 09:50

### 1.4 Final Exam

Thursday Dec. 17, 2020 @ 08:30 to 10:30 using CourseLink and Respondus

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## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Richard G. Zytner Ph.D., P.Eng., FEC, FCSCE  
**Email:** rzytner@uoguelph.ca  
**Telephone:** 53859  
**Office:** THRN 2337  
**Office Hours:** Drop in session on Zoom Tuesday from 11:00 to 12:00 h. Additional time via Teams can be arranged via e-mail. Not Fridays.

### 2.2 Teaching Assistants

**Teaching Assistant:** Zhe Xu  
**Email:** zxu02@uoguelph.ca  
**Office Hours:** TBA on Courselink

**Teaching Assistant:** Mostafa Elkurdy  
**Email:** melkurdy@uoguelph.ca  
**Office Hours:** TBA on Courselink

**Teaching Assistant:** Anush Agarwal  
**Email:** agarwala@uoguelph.ca  
**Office Hours:** TBA on Courselink

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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, midterms 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. Bookstore will ship via regular mail.

#### E-BOOK

Fraser, N.M, Jewkes, E.M. and Pirnia, M. (2016) Engineering Economics: Financial Decision Making for Engineers, 6th Edition. Pearson Education, Canada

## 3.2 Additional Resources

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

**Lab Information:** N/A

**Assignments:** Download the assignments, all the solutions will be posted.

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

## 3.2 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
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	4, 5, 8, 9, 10, 11

#	Outcome	Learning Outcome
	project or design	

## 5 Teaching and Learning Activities

### 5.1 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 tax rates. After tax cash flow analysis, taxable income, after tax present worth and rate of return.	7
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.	6, 7
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.	8
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	9
Uncertainty in engineering economic analysis. Range of estimated values for evaluation. Probability and joint probability distributions, expected value, measurement and consideration of risk	3

## 5.2 Other Important Dates

Thursday, 10 September 2020: First class

Monday, 12 October 2020 Thanksgiving holiday

Tuesday, 13 October 2020: Study Break Day

Thursday, 3 December 2020: replaces Study Break Day (Tuesday Schedule in effect)

Friday, 4 December 2020

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.

### 5.3 Short Answer Quizzes

Short answer quizzes will occasionally take place during the lecture period. The CourseLink platform will be used.

Quizzes are used to measure class grasp of the various concepts. There is no grade associated with the quizzes.

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## 6 Assessments

### 6.1 Marking Schemes & Distributions

The Final Exam is comprehensive, covering the entire course. If the grade of the Final Exam is greater (20% or more) than the combined average of Mid-Term 1 and Mid-Term 2, the weighting of the course is as follows:

Mid-Term 1: 12.5 %

Mid-Term 2: 12.5 %

Final Exam: 75 %

### 6.2 Assessment Details

#### Midterm 1 (25%)

**Date:** Thu, Oct 8, 8:30 AM, Online via CourseLink Using Respondus

**Learning Outcome:** 1, 2, 3, 6

duration 80 minutes

#### Midterm 2 (25%)

**Date:** Thu, Nov 12, 8:30 AM, Online via CourseLink Using Respondus

**Learning Outcome:** 1, 2, 3, 4, 5, 7, 9

duration 80 minutes

#### Final Exam (50%)

**Due:** TBA, Online via CourseLink Using Respondus

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

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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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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 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 (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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