



# ENGG\*3700 Optimization for Engineers

01

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 serves as an introduction to optimization. Topics to be covered include but are not limited to: linear programming, sensitivity analysis, linear integer programming technique, dynamic programming, Markov chains, transportation method, decision analysis, and queuing theory.

**Pre-Requisites:** MATH\*2130, MATH\*2270, (CIS\*1300 or CIS\*1500)

### 1.2 Course Description

The main goal of this course is to help you learn how to determine the best choice among a set of alternatives.

### 1.3 Timetable

**Lectures:**

Wed, Fri; 01:00 PM - 02:20 PM; AD-S, Room Virtual

**Tutorials:**

Section 101 (Thur, 3:30 – 5:20 PM) AD-S, Room Virtual

Section 102 (Wed, 3:30 – 5:20 PM) AD-S, Room Virtual

Section 103 (Tues, 7:00 – 8:50 PM) AD-S, Room Virtual

## 1.4 Final Exam

December 14, 2020 11:30 am - 1:30 pm, location TBA

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Soha Eid Moussa Ph.D., P.Eng.
<b>Email:</b>	smoussa@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x56141
<b>Office:</b>	THRN 1341
<b>Office Hours:</b>	open door policy or by appointment

### 2.2 Teaching Assistants

<b>Teaching Assistant:</b>	Brooklin Caren
<b>Email:</b>	bcaren@uoguelph.ca
<b>Teaching Assistant:</b>	Mayada Elkhalifa
<b>Email:</b>	elkhalim@uoguelph.ca
<b>Teaching Assistant:</b>	Shashank Shekhar
<b>Email:</b>	sshekhar@uoguelph.ca

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## 3 Learning Resources

### 3.1 Required Resources

#### Course Website (Website)

<https://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3700 Courselink site. You are responsible for checking the site regularly.

#### Webcam (Equipment)

Assessments may be administered using the Respondus invigilation system which requires students to have a webcam.

### 3.2 Recommended Resources

Operations Research An Introduction, 10th ed, Hamdy A. Taha, Pearson Education Incorporated, 2017 (Textbook)

### 3.3 Additional Resources

Lecture Information (Notes)

All the lecture notes will be posted on the web page (week #1 - #12).

#### **Suggested Problem Sets (Other)**

Suggested problem sets to be discussed in the tutorials will be posted on CourseLink.

#### **Miscellaneous Information (Other)**

Other information may be posted on the web page.

### **3.4 Communication & Email Policy:**

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course 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. Utilize the Simplex Algorithm to solve Linear Programming Problems.
2. Utilize Branch and Bound technique to solve Integer Programming Problems.
3. Formulate a solution method and solve Dynamic Programming Problems.
4. Apply the appropriate optimization technique to optimize a system.
5. Concisely and articulately communicate the results of an optimization solution procedure.

### **4.2 Engineers Canada - Graduate Attributes (2018)**

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 3, 4
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2, 3, 4
2	Problem Analysis	1, 2, 3, 4
2.1	Formulate a problem statement in engineering and non-engineering terminology	1, 2, 3, 4
2.2	Identify, organize and justify appropriate information, including assumptions	1, 2, 3, 4
2.3	Construct a conceptual framework and select an appropriate solution	1, 2, 3, 4

#	Outcome	Learning Outcome
	approach	
2.4	Execute an engineering solution	1, 2, 3, 4
2.5	Critique and appraise solution approach and results	1, 2, 3, 4
5	Use of Engineering Tools	4
5.1	Select appropriate engineering tools from various alternatives	4
5.2	Demonstrate proficiency in the application of selected engineering tools	4
5.3	Recognize limitations of selected engineering tools	4
7	Communication Skills	5
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	5
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	5
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	5

## 5 Teaching and Learning Activities

### 5.1 Lectures

Topic	Learning Objectives
What is Operations Research?	
Modeling with Linear Programming	1, 4, 5
The Simplex Method and Sensitivity Analysis	1, 4, 5
Duality and Post-Optimal Analysis	1, 4, 5
Integer Linear Programming	2, 4, 5
Dynamic Programming	3, 4, 5
Transportation Method	4, 5
Other topics	4, 5

## 5.2 Tutorials

Tutorial Sessions will be used to discuss/explain solution methods of the Suggested Problem Sets. Students are encouraged to attempt to solve the problems prior to their tutorial session and come prepared with questions related to challenges faced.

## 5.3 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: last day of class (replaces Thanksgiving, Monday Schedule in effect)

Friday, 4 December 2020: last day to drop classes

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

## 6 Assessments

### 6.1 Marking Schemes & Distributions

The grades of the top five quizzes will count toward the final grade, the remaining two will be dropped.

Name	Scheme A (%)
In Class Practice Problems Submission	10
Quizzes	40
Final Exam	50
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 method 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 day they were started in class. Grade for assignment will be based on submission of solution attempt, not correct response. There are approximately 15 submissions worth about 0.7% each, total up to a maximum of 10%.

### Quizzes (40%)

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

- Quiz 1, Linear Algebra/Simplex Method, Oct. 8
- Quiz 2, Sensitivity Analysis, Oct. 15
- Quiz 3, Duality, Oct. 22
- Quiz 4, Integer Programming, Oct. 29
- Quiz 5, Dynamic Programming, Nov. 12
- Quiz 6, Transportation Models, Nov. 19
- Quiz 7, Markov Models, Nov. 26

Each quiz has an 8% weight of the total mark in the course. It may consist of true/false, multiple choice and/or a problem to solve. Quizzes will cover material covered in the topic listed. All quizzes will be open book/notes, have a duration of 15 minutes, and must be completed between 7 pm and 11:59 pm on the date scheduled. The top five out of seven quizzes will count towards the final grade.

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

### Final Exam (50%)

**Date:** Mon, Dec 14, 11:30 AM - 1:30 PM, TBA on Webadvisor

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

## 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.

## 6.4 Relationships with other Courses & Labs

### Previous Courses:

- **CIS\*1500:** Introduction to Programming
- **MATH\*2130:** Numerical Methods
- **MATH\*2270:** Applied Differential Equations

**Follow-on Courses:** N/A

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# 7 School of Engineering Statements

## 7.1 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.

## 7.2 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.

## 7.3 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.

## 8 University Statements

### 8.1 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.

### 8.2 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>

### 8.3 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>

### 8.4 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.



## 8.5 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>

## 8.6 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>

## 8.7 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.

## **8.8 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>

## **8.9 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.

## **8.10 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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