



ENGG*4070

Life Cycle Assessment for Sustainable Design

Winter 2018

School of Engineering
(January 9, 2018)

1 INSTRUCTIONAL SUPPORT

1.0 Instructor

Instructor: Bassim E. Abbassi, Ph.D.
Office: THRN 2333, ext. 52040
Email: babbassi@uoguelph.ca
Office hours: Mo. & Wed. (3:30 PM to 5:00 PM) and by appointment

1.1 Teaching Assistants

GTA	Email	Office Hours
Akul Bhatt	akul@uoguelph.ca	TBA on Courselink

2 LEARNING RESOURCES

2.0 Course Contact Hours (Lectures, Labs, & Tutorials)

The lectures, labs and tutorials are the primary means used to support your learning in this course. Lectures will be the primary means for course news and announcements in addition to provision of course materials. Lecture attendance is expected. Tutorials will be the primary means for the instructional team to coach you. Tutorial attendance is expected. Labs will be the primary means for some hands-on experience. Lab attendance is required.

2.1 Course Website

ENGG*4070 Courselink site will provide copies of lecture slides, project descriptions, assignments, and links to additional resources.

2.2 Required Resources

1. **Life Cycle Assessment: Quantitative Approaches for Decisions That Matter** (2015). H. Scott Matthews, Chris T. Hendrickson and Deanna H. Matthew (a pdf copy of this book is posted on CourseLink)
2. Other resources posted on Courselink are required readings.

2.3 Recommended Resources

1. **Sustainable Engineering: Concepts, Design & Case Studies** (2012). David T. Allen and David R. Shonnard. Prentice-Hall.
2. **The Hitch Hiker's Guide to LCA** (2004). Henrikke Baumann and Anne-Marie Tillman. Studentlitterature.
3. Some additional suggestions will be posted on Courselink site.

2.4 Additional Resources

Lecture Information: All the lecture slides will be posted on the Courselink site.

Lab Information: Posted on Courselink.

Assignments: Posted on Courselink.

Miscellaneous Information: See Courselink.

2.5 Communication & Email Policy

Communication associated with course material is delivered by a combination of the lectures, lab/tutorials and the Courselink site. It is your responsibility to receive communication from ALL of these sources – there will be some mutual reinforcement between these sources but they are not completely redundant sources. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

3 ASSESSMENT

3.0 Dates and Distribution

Assignments*	40%	Due one week after the posting date
LCA project (report and presentation) ^{*/**}	30%	
Final Exam	30%	

* individual work ** group work

3.1 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 **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>

Passing grade: Students must obtain a grade of 50% or higher.

Missed test: If you miss a test due to grounds for granting academic consideration or religious accommodation then a deferred midterm will be scheduled at the earliest possible common date for all affected students.

Late Reports: Late submissions (without instructor permission based on suitable grounds and documentation) will be penalized.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.0 Calendar Description

This course will introduce students to the fundamental concepts of environmental management systems and issues related to interaction of industrial and environmental/ecological systems, sustainability challenges facing the current generation, and systems-based approaches required to create sustainable solutions for society. Students will understand the concepts and the scientific method as it applies to a systems-based, transdisciplinary approach to sustainability, and will be prepared to identify problems in sustainability and formulate appropriate solutions based on scientific research, applied science, social and economic issues. The basic concepts of cleaner production and environmental impact assessment will be discussed along with the basic concepts of life cycle assessment (LCA), life cycle inventory (LCI) and life cycle impact assessment (LCIA) including the social and economic dimensions. The application of life cycle assessment methodology using appropriate case studies will be presented.

Prerequisite(s): ENGG*2100, ENGG*3240

4.1 Course Aims

This course aims to build an environmental management and life cycle thinking and techniques in support of advancing sustainable designs.

4.2 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Understand the concept of a life cycle and its various stages (Ch1 10-31)
2. Learn the cleaner production approach and EIA as an environmental management system
3. Apply appropriate skills for qualitative and quantitative analysis (Ch2, 34-63)
4. Describe the types of costs that are included in a life cycle cost analysis (Ch3, 64-78)
5. Describe the four major phases of the ISO LCA Standard (Ch4, 80-97)
6. Perform an interpretation analysis and data acquisition for life cycle inventory analysis (Ch5, 98-157)
7. Define, build, and use a process matrix LCA model (Ch9, 242-284)
8. Select and justify Life Cycle Impact Assessment LCIA methods (Ch10, 285-321)
9. Illustrate the value of life cycle techniques in the development of more sustainable designs
10. Demonstrate use of SimaPro and associated databases to support an LCA study

4.3 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1,2,3,4,5,6	Assignments, Project, Final Exam
2. Problem Analysis	-	
3. Investigation	-	
4. Design	7, 8	Project
5. Use of Engineering Tools	10	Assignments, Project, Final Exam
6. Individual and Teamwork	All	Assignments, Project
7. Communication	All	Assignment#, Project
8. Professionalism	-	
9. Impact of Engineering on Society and the Environment	All	Projects, Assignments
10. Ethics and Equity	-	
11. Business & Project Management	-	
12. Life-Long Learning	1, 2,10	Projects

4.4 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/D2L but these are not intended to be stand-alone course notes. 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 project.

4.5 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. 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.

4.6 Relationships with other Courses & Labs

Previous Courses:

CHEM*1040/1050: The environmental side of life cycle techniques addresses inventories and impacts of elements and chemicals.

ENGG*1100/2100/3100: Design skills including multi-objective decision making. Introduction to sustainable design concepts.

ENGG*3240: Full Cost Accounting.

Follow-on Courses:

This is likely your final semester!

5 TEACHING AND LEARNING ACTIVITIES

5.0 Timetable

Lectures:

Mon, Wed, Fri 2:30 - 3:20 PM MCKN, Room 311

Tutorials & Labs

Mon 9:30- 11:20 AM THRN, Room 2313 (Comp. Lab)

Mon 9:30- 11:20 AM MCKN, Room 224 (Classroom)

5.1 Lecture Schedule* (approximate!)

Lectures	Lecture Topics	Learning Objectives
1-2	Introduction to Sustainability	ALL
3-4	Life Cycle Thinking	1, 3, 4, 5
5-6	Quantitative and Qualitative Methods Supporting LCA	1,3
7-8	Cleaner Production CP	2
9-10	Environmental Impact Assessment EIA	2
11-12	Life Cycle Cost Analysis LCCA	1,4
13-14	LCA legal Framework (ISO 14040)	5
15-16	Data Acquisition and Management	1,6,9,10
17-21	Multi-function system and LCA Model Process Matrix	1,3,4,5,6,7,10
22-23	Input-Output LCA	3,9
24-28	Process Matrix LCA	7
29-33	Life Cycle Impact Assessment LCIA	1,3,4,5,6,7,8
34-35	Uncertainty Analysis in LCA	9,10
36	Wrap-up, Course Evaluation	ALL

**Dr. Poritosh Roy will be a guest lecturer on February 23 and March 16.*

5.2 Other Important Dates

Monday, January 8, 2018: Classes commence
Monday– Friday (February 19 - 23, 2018): Winter Break
Friday, March 9, 2018: last drop date – 40th class day
Friday, April 6, 2018: Classes conclude

6 LAB SAFETY

6.0 School of Engineering Policy

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.

If the laboratory rules are not followed, consequences will include removing student's access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

7 ACADEMIC MISCONDUCT

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 discourages misconduct. 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.

7.0 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

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

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:

<http://www.academicintegrity.uoguelph.ca/>

Please also review the section on Academic Misconduct in your [Engineering Program Guide](#).

The School of Engineering has adopted a Code of Ethics that can be found at:

<http://www.uoguelph.ca/engineering/undergrad-counselling-ethics>

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Student Accessibility Services as soon as possible.

For more information, contact SAS at [519-824-4120](tel:519-824-4120) ext. 56208, email csd@uoguelph.ca or see the website: <http://www.uoguelph.ca/csd/>

9 RECORDING OF MATERIALS

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

10 RESOURCES

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

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>