



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

MIE1715F: Life Cycle Engineering

Fall 2017

Instructor: Payam Rahimi, PhD, PEng

Email: payam.rahimi@utoronto.ca

Office Hours: by appointment

Teaching Assistant: Sijin He

Email: sijin.he@mie.utoronto.ca

Office: by appointment

Other Consultation Information:

The course instructor is available for individual student consultation in person or by electronic means. A reasonable expectation regarding the amount of time a student should expect to wait for a response to electronic communication is 36 hours.

Lectures: Tuesdays, 4:00 pm to 7:00 pm, University College, UC52

Course Description:

This course introduces the fundamentals of both product and process engineering with an emphasis on life cycle models. A mixture of practical and theoretical topics, methodologies, principles, and techniques are covered such as Life Cycle Analysis, Design For Assembly (DFA), Design For Manufacturing (DFM), Design For Environment (DFE), etc. Students develop an understanding of the performance, cost, quality and environment implications of both product design and manufacture and become capable of translating these into engineering "cradle-to-grave" responsibility requirements, goals, and specifications in order to maximize the values of products and the effectiveness of supply chain management while containing the costs to manufacturer, the user, and the society.

Course Outcomes:

The objective of the Life Cycle Engineering (LCE) course is for students to understand how all they create as engineers affects the environment and how decisions they make can decrease these impacts. Students will complete one LCE based projects, to give the theory some practice. The primary specific learning and training outcomes are:

- To broaden the ideas of students and give them a brief introduction to life cycle engineering.
- To acquire a basic understanding of the concept of life cycles of products and services.
- To acquire both theoretical and practical understanding of parameters within external environment, work environment, resource consumption, and social impacts as key elements in an analysis of the life cycle of products or services systems.



UNIVERSITY OF TORONTO FACULTY OF APPLIED SCIENCE & ENGINEERING

- To become familiar with the application of life cycle assessment as an environment oriented analytical tool/method for decision support in companies or public administration.
- To be able to plan, carry out and evaluate an elementary life cycle assessment.
- To become familiar with many different life cycle tools.
- To be able to use different life cycle tools.

Delivery Mode and Teaching Method:

The class meets once a week for 150 minutes for lectures. The lectures will consist of a series of topics of general interest in life cycle engineering. Lectures are provided to give guidance for completion of the application project. The students should expect to dedicate 2 to 4 hours per week outside the class to this course. A **MID TERM** and **FINAL EXAM** is given in the course.

The online course related communication will be mainly conducted via Portal by the instructor. A portion of the lecture notes will be made available to students in Microsoft Power Point, Microsoft Word, or Adobe Acrobat formats. Students are responsible for checking Portal **REGULARLY** for course information and announcements.

Attendance:

Lecture attendance is not mandatory but is expected. Learning is motivated through active discussion, demonstration, and practices of the topics studied. Even if you are not attending the lectures, you are still responsible to ensure you know what is happening in the class; consult with your fellow classmates before consulting me. Note that some information provided in class may not be available to students who were not in attendance. Missing class is not an excuse for an extension on assignments, as some assignments will be given in class and due at the end of said class.

Preparation:

In order for you to get the most out of this course you are expected to come to class with an open mind and prepared for discussion of the scheduled topic(s). This may include pre-reading the course materials and other suggested reading materials as well as contributing questions and previous experiences to the class dialog. Ask questions as they arise during lectures.

Computer/Software Experience:

Availability and proficiency in using laptop/desktop computers and the use of Blackboard (Portal) in classrooms wired for computer use and internet access, as well as remotely, is assumed. In addition, it is assumed that students are familiar with the use of Microsoft Office, and other programs that they have been exposed to during their course of studies.

Textbook Requirements (Optional):

T. E. Graedel, B. R. Allenby, 2010, *Industrial Ecology and Sustainable Engineering* – Prentice Hall.



UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE & ENGINEERING

References:

G. Boothroyd, P. Dewhurst, W. Knight, *Product Design for Manufacture and Assembly*, CRC Taylor and Francis, Available online and through library.

H. Baumann, A-M. Tillman, 2004, Hitch Hiker's Guide to LCA, Studentlitterature AB., Available in bookstore and/or from prior years' students.

Course Evaluation:

The course evaluation is made up of one large group project, two cumulative knowledge tests and a series of small assignments. Details of the project and research paper are listed below:

1) In-Class Exercises	20%
2) Midterm Test	20%
3) Final Test	30%
4) Group Project (including presentation)	30%

Streamlined Life Cycle Assessment (Group Project)

Each student group (number of students per group TBD) completes a life cycle analysis. Instructor will choose a product/process. Groups will apply life cycle analysis and industrial ecology principles and tools to assess the environmental impact of the product and identify opportunities for improvement. The expected team product will include, but not limited to, a technical report of no less than 15 pages and no more than 30 pages. Groups will present their analysis as part of the final mark for the project.

In-Class Exercises

Exercises will be given to supplement students understanding of class materials.

Mid Term and Final Exam

The tests are designed to test the students' cumulative knowledge of life cycle engineering. This had typically been scheduled in class.

Course Topics

1. What is Life Cycle Engineering
2. Life Cycle Assessment
3. Streamlined Life Cycle Assessment
4. How to design products
5. Life Cycle Design:
 - a. Design for Environment
 - b. Design for Recycling
 - c. Design for Manufacturing
 - d. Design for Assembly
 - e. Design for Disassembly
6. Student Life Cycle Projects
 - a. Student LCA



UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE & ENGINEERING

Reports, Assignments and Other Submissions

In-Class exercises will **ONLY** be accepted during the lecture. Late papers will have a penalty of 5/30 for the first day, 10/30 for the second day and 30/30 if hand in later than 2 days. See marking rubrics for more details.

Other Information and Important Notes

- Reports of projects and assignments are to be submitted through Portal or hand in the class on the specific dates or through direct e-mail to the instructor.
- Ask questions as they arise during the lectures, project, etc.
- Notifications of changes to information in the course outline and this document will only be made after proper consultation and will be announced in class via Blackboard (Portal) prior to being implemented. Deadlines will never move forward but at times, may be moved later to give everyone more time.
- No recycling of work is allowed. It includes work submitted for research papers, an assignment, and group project. This is also part of University of Toronto academic misconduct policy.
- It is responsibility of the groups to ensure that the work submitted conforms to academic conduct requirements. The professor is not responsible to investigate whether individuals within the group or the whole group committed the academic misconduct. It is up to the individual students to prove their innocence otherwise the group will be treated as whole.
- All reports will have an originality statement signed by the individual(s), stating the work is their own, and all work that is not theirs has been properly acknowledged and referenced.
- If student groups exceed the specified number, marks will be proportionally reduced based on the increasing size of the group.

Important Dates

Week	Date (tentative)	Deliverables	%
1	Tuesday, September 12	Lecture 1	
2	Tuesday, September 19	Lecture 2	
3	Tuesday, September 26	Lecture 3	
4	Tuesday, October 3	Lecture 4	
5	Tuesday, October 10	Lecture 5	
6	Tuesday, October 17	Lecture 6	
7	Tuesday, October 24	Mid-Term Exam	20
8	Tuesday, October 31	Lecture 7	
9	Tuesday, November 7	Lecture 8	
10	Tuesday, November 14	Lecture 9	
11	Tuesday, November 21	Lecture 10	
12	Tuesday, November 28	Lecture 11	
13	Tuesday, December 5	Lecture 12, Group Project	30
14	Tuesday, December 12	Final Exam	30



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Course Content Breakdown (CEAB Categories):

Mathematics:	10%
Basic Science:	10%
Engineering Science:	30%
Engineering Design:	20%
Complementary Studies:	30%
Total:	100%

Note: The instructor is responsible to copy 2 highest marked, 2 intermediate marked, and 2 lowest marked for each of the deliverables and submit these to the department for CEAB purposes.

Academic Integrity and Conduct:

University of Toronto is committed to the fundamental values of preserving academic integrity as defined in policies and contained in the Calendar. Students should familiarize themselves with university's policies and statements in this area. Acts of academic dishonesty, including plagiarism, cheating, aiding others in cheating, and examination impersonation, will be dealt with severely as they threaten the integrity of the academic system and are not acceptable. For details refer to:

- <http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjul012002.pdf>
- <http://www.mie.utoronto.ca/graduate/info/#medical>