EXPANDED COURSE DESCRIPTION
MECHANICAL ENGINEERING
Lassonde School of Engineering
Mechanical Engineering
LE / MECH 4504 3.0 SECTION M
LIFE-CYCLE ANALYSIS AND SUSTAINABILITY
FALL 2018 / WINTER 2019

Last Modified Date: 12/18/2018

COURSE CALENDAR DESCRIPTION

This course discusses the notion of "triple bottom-line" or triple-E (energy, environment, economics), life Cycle inventory, computational structure of LC inventory, case studies and execution of a mini-LCA, as well as strengths, weaknesses and appropriate uses of LCA. Prerequisites: ES/ENVS 2150 3.00 or LE/ESSE 2210 3.00. Corequisite: LE/MECH 4401 3.00.

INSTRUCTOR(S)

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<tr>
<th>Name</th>
<th>Section / Format / Term</th>
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<tr>
<td>O'Brien, Paul G.</td>
<td>Sec. M / LECT / W</td>
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ADDITIONAL INFORMATION

TOPICS AND CONCEPTS

*Sustainability from the “triple bottom line” view point*
The importance of environmental, economic and societal factors and stakeholder engagement in making sustainable decisions. The importance of aligning corporate codes of conduct with sustainable decision making from the “triple bottom line” perspective. Measuring and reporting your progress, creating a culture of sustainability

*Introduction, Environmental Life Cycle Assessment (LCA): Background and Perspective*
Basic concepts, historical roots of LCA, environmental life cycle concept, an overview of the LCA method-past, present, and future.

*Life Cycle Inventory (LCI) Modeling*
Introduction, study goal, scope, methodology issues, evolution of LCA practice and associated issues.

*Life Cycle Impact Assessment (LCIA)*
Life cycle impact assessment (ISO14040-44 requirements), Principles and framework of LCIA.

*Sourcing Life Cycle Inventory Data*
Types of LCI data, private, public, and dedicated LCI databases.

*Software for Life Cycle Assessment*
LCA software, “OpenLCA” professional life cycle assessment, sample case studies.

*Life Cycle Assessment in Product Innovation*
The importance of research and development (R&D), Idea generation and assessment, concept development, business planning and execution, design for environmental compliance.

*How to Approach the Assessment?*
Assessment methods, comparison of assessment methods, guidance for assessment.

*Life Cycle Sustainability Analysis (LCSA)*
Life cycle assessment and sustainability questions, A framework for life cycle sustainability analysis

*Life Cycle Knowledge Informs Greener Products*

Situation analysis, Diagnostics and interpretation, main strengths and weaknesses of LCA, Applications of LCA to a variety of systems (offshore wind, bio-fuels, electric vehicles, etc.) in varying industries and locations.

**LIST OF LEARNING OUTCOMES AND EXAMPLES OF COURSE LEARNING OBJECTIVES**

Upon successful completion of this course the student will be able to:

- Demonstrate a fundamental understanding of life cycle thinking in the analysis and management of technological systems.
- Develop a mini life cycle assessment of a product or a technological system.
- Use LCA software (e.g., “openLCA”) to model a product life cycle assessment.
- Explain the life cycle assessment parameters which describe the impacts on society, environment, and resources.
- Explain some examples of the most important industrial and regulatory applications of LCA.
- Explain the role of LCA concepts in sustainability from the “triple bottom line” perspective (Environmental, Economic, and Societal aspects)

**GRADED ASSESSMENT**

**Proposed Grading Scheme:**
- Regular Assignments - 20%
- Mini LCA Project - 20%
- Quizzes - 20%
- Final Exam - 40%

**ADDITIONAL INFORMATION**

**Required Textbook:** A course pack that consists of selected chapters in the following textbooks:

  1. Scott Matthews, Chris T. Hendrickson, Deanna H. Matthews, Creative Commons, 2015
  Freely available on-line: <www.lcatextbook.com>

- The Triple Bottom Line: How Today's Best-Run Companies Are Achieving Economic, Social and Environmental Success, 1/E
  ISBN: 9781118330371 (ePub), 9781118333174 (ePDF)

- Professional Life Cycle Assessment (OpenLCA) [http://www.openlca.org/home](http://www.openlca.org/home)
  “OpenLCA” is a free, professional Life Cycle Assessment (LCA)

- The International Reference Life Cycle Data System (ILCD) Handbook

**LAND ACKNOWLEDGEMENT**

We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the
Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current
treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One
Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
• The Indigenous Framework for York University: A Guide to Action can be found here:
  http://indigenous.info.yorku.ca/
• Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

ACADEMIC INTEGRITY LINKS
• Senate Policy on Academic Honesty -
  http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
• Academic Integrity - http://lassonde.yorku.ca/academic-integrity

STUDENT LINKS
• Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
• Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
• Academic Accommodation for Students with Disabilities -
  http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/
• Counselling and Disability Services - http://cds.info.yorku.ca/
• York University Racism Policy and Procedures -
  http://secretariat-policies.info.yorku.ca/policies/racism-policy-and-procedures/
• York University’s Policies on Sexual Violence -
  http://secretariat-policies.info.yorku.ca/policies/sexual-violence-policy-on/
• York University’s Policies on Gender/LGBTQ*/Positive Space - http://rights.info.yorku.ca/lgbtq/

Many courses utilize Moodle, York University’s course website system. If your course is using Moodle,
click here to access it.
Moodle @ York University