



<b>Course Title:</b> Design Decisions: environmental impact intensity of materials and energy flows and processes			
Course Number	EVDS 683-06		
Pre/Co-Requisites	none		
Instructor Name	Getachew Assefa	Instructor Email	gassefa@ucalgary.ca
Office Location	PF3191		
TA Name		TA Email	
Class Dates	Fall 2019, Tuesdays and Thursdays		
Class Times	12:20pm to 1:50pm		
Class Location	PF 4140		

## Course Information / Description of the Course

Design and planning actions have influence on how much and what types of materials and energy and where will be moved/extracted, processed, used and eventually wasted or recovered. The choices made significantly affect the overall life cycle performance of the designed objects. Rating systems, design guidance and increased consumer awareness are increasingly considering life cycle performance and benchmarking of what should be favored for manufacturing, development and purchasing decisions. Two examples of new trends are the growing use of life cycle based environmental product declarations (EPDs) of building/construction materials; and the new ISO standard under development aiming to enable the use of EPDs at construction works using building information modeling (BIM).

This course on LCA in design, offered for senior undergraduate and graduate design students develop the skill of understanding the implications of the decisions they make at different levels of product and service design and development.

The course delivery includes Lectures and studio-project related assignments.

### **i) Lectures**

The lectures will provide a theoretical background of LCA covering, among others, the following:

#### a) Methodological

- Identification and delimitation of the system boundary
- Defining and handling of allocation problems
- Midpoint and endpoint approaches

#### b) Data

- Identification and use of data from LCA databases

- Collection and use of data from other sources

#### c) Results reporting and application

- Contents of an LCA report
- Analysis and interpretation of LCA results

The lectures cover main topic areas of the course briefly outlined below.

#### **Background to LCA**

Reflecting on features of LCA including some brief history of LCA and different phases of LCA.

#### **Goal and scope definition**

The first phase of LCA includes aspects of system boundary, functional units, data quality requirements, etc.

#### **Life cycle inventory analysis**

Based on the information from the Goal and Scope Definition, quantitative dimension of LCA including data collection and modeling of the product or service system under consideration.

#### **Life cycle impact assessment and Interpretations**

The methods and approaches for quantifying the environmental impacts using the data collected; the implication of the choices involved in applying the different methods of aggregating data and weighting.

#### **Data availability and quality in LCA**

Data quality and associated issues will be outlined together with presentation of selected LCA software tools.

#### **Product category rules and Environmental product declarations**

Environmental product declarations as LCA -based labeling of products and services are the practical way of communicating the environmental performance through independently verified documents. How EPDs are developed based on product category rules will be explored and examples from different sectors will be provided.

#### **Streamlined LCA and life cycle sustainability assessment**

How life cycle thinking can be used without necessarily doing detailed quantitative LCA; and the expansion of environmental life cycle assessment to include the economic and social realm as part of a life cycle sustainability assessment will be covered.

#### **ii) Exercises**

Each lecture is followed by exercise questions that cover important parts of the lectures.

#### **iii) Assignments**

The course will build on the projects/assignment in the studio courses and will be based on an effort of exploring connections between the digital design tools used studio projects with a life cycle assessment tool. Students will individually submit written report and make presentations for the following three assignments.

1. Studio project connected life cycle assessment of material aspects
2. Studio project connected life cycle assessment of energy aspects
3. Analysis and interpretation of results of i) and ii)

#### iv) Software tools

Autodesk Revit connected Tally and Athena Impact Estimator will be used for the assignments.

### Learning Resources

#### Required readings, textbooks and learning materials:

There is no specific required textbook for the course. However, the following books are recommended for those interested in doing further readings.

Klöpffer, W. and Grah, B. (2014) Life Cycle Assessment (LCA): A Guide to Best Practice. John Wiley & Sons. (e-book through University of Calgary Library website)  
<http://site.ebrary.com.ezproxy.lib.ucalgary.ca/lib/ucalgary/detail.action?docID=10855742>

Matthews, H. S., Hendrickson, C. T., & Matthews, D. H. (2015). Life cycle assessment: Quantitative approaches for decisions that matter. (e-book available for download for free at: <https://www.lcatextbook.com/>)

The LCA studies that will be used in the two review exercises will also add into the course resources.

**Technology requirements (D2L etc.):** D2L will be used as a course platform. For Life Cycle Software, Tally (<https://choosetally.com/>) and Athena Impact Estimator ( <https://calculatelca.com/software/impact-estimator/> ) and for design: Autodesk Revit.

### Course Learning Outcomes

After completing the course, students should be able to:

1. Understand the overall purpose and principles of LCA.
2. Describe the content and explain the purpose of the different steps of LCA.
3. Carry out a complete LCA of a defined system based on the ISO standard for LCA.
4. Write an LCA report complying with guidelines and terminologies of the ISO standard
5. Discuss design applications and limitations of LCA.
6. Understand how a third-party critical review of LCA is done.

Assessment Components			
Assessment Method	Description	Weight	Aligned Course Learning Outcome
Studio project related assignments	Assignment 1	20	All
	Assignment 2	20	All
	Assignment 3	40	All
Quizzes	Quiz 1	10	All
	Quiz 2	10	All

Assessment and Evaluation Information
<p><b>Attendance and Participation Expectations:</b> all students are expected to attend and participate discussions and working on assignments.</p> <p><b>Guidelines for Submitting Assignments:</b> assignment should be submitted before the end of the day (before midnight) of the deadline date through D2L Dropbox.</p> <p><b>Final Examinations:</b> There is no final examination while there will be two quizzes that make up 20% of the overall evaluation of the course.</p> <p><b>Expectations for Writing</b> (<a href="https://www.ucalgary.ca/pubs/calendar/current/e-2.html">https://www.ucalgary.ca/pubs/calendar/current/e-2.html</a>): written submissions should have a clear structure using headings, citation of sources when appropriate, clearly showing the names of group members written in single spaced 12pts times new roman or equivalent .</p> <p><b>Late Assignments:</b> 1 mark per day late will deducted for each late submission of assignment.</p> <p><b>Criteria that must be met to pass:</b> there is no specific component that will be used as a criterial. It is the overall performance that will determine the final score.</p>

Final grades will be reported as letter grades, with correspondence between letter grades and 4-points scale and percent based on the following grading scale.

Grading Scale				
Grade	Grade Point Value	4-Point Range	Percent	Description
A+	4.00	4.00	95-100	Outstanding - evaluated by instructor
A	4.00	3.85-4.00	90-94.99	Excellent - superior performance showing comprehensive understanding of the subject matter
A-	3.70	3.50-3.84	85-89.99	Very good performance
B+	3.30	3.15-3.49	80-84.99	Good performance
B	3.00	2.85-3.14	75-79.99	Satisfactory performance

B-	2.70	2.50-2.84	70-74.99	Minimum pass for students in the Faculty of Graduate Studies
C+	2.30	2.15-2.49	65-69.99	All final grades below B- are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements.
C	2.00	1.85-2.14	60-64.99	
C-	1.70	1.50-1.84	55-59.99	
D+	1.30	1.15-1.49	50-54.99	
D	1.00	0.50-1.14	45-49.99	
F	0.00	0-0.49	0-44.99	

A student who receives a "C+" or lower in any one course will be required to withdraw regardless of their grade point average (GPA) unless the program recommends otherwise. If the program permits the student to retake a failed course, the second grade will replace the initial grade in the calculation of the GPA, and both grades will appear on the transcript.

Topic Areas & Detailed Class Schedule		
Course Schedule Date	Topic	Assignments/Due Dates
September 09	Lecture 1: LCA – Quantitative LCA	
<b>September 11</b>	Project Activity	
September 16	Lecture 2: Goals and Scope Definition	
<b>September 18</b>	Project Activity	
September 23	Lecture 3: Interpretation	
<b>September 25</b>	Project Activity	
September 30	Lecture 4: Data and Methodological aspects	
<b>October 02</b>	Project Activity	
October 07	Lecture 5: Product Category rules and Environmental Product Declarations	
<b>October 09</b>	Project Activity	
<b>October 14</b>	No classes Thanksgiving	
<b>October 16</b>	Project Activity	
<b>October 21</b>	No classes SAPL Block week	
<b>October 23</b>	classes SAPL Block week	
October 28	<b>Quiz 1</b>	
<b>October 30</b>	Project Activity	

November 04	Lecture 6: Streamlined LCA and Life cycle sustainability assessment	Assignment one Submission
<b>November 06</b>	<b>Presentation</b>	Assignment one Presentation
November 11	No classes – term break	
November 13	No classes – term break	
November 18	Project Activity	Assignment two Submission
November 20	<b>Presentation</b>	Assignment two Presentation
November 25	Quiz 2	
<b>November 27</b>	Project Activity	
December 02	Project Activity	Assignment three Submission
<b>December 04</b>	<b>Presentation</b>	Assignment three Presentation

## Media and Recording in Learning Environments

### Part 1

University Calendar: <https://www.ucalgary.ca/pubs/calendar/current/e-6.html>

Recording of lectures (other than audio recordings that are pre-arranged as part of an authorized accommodation) is not permitted.

Students may not record any portion of a lecture, class discussion or course-related learning activity without the prior and explicit written permission of the course instructor or authorization from Student Accessibility Services. For any other use, whether by duplication, transcription, publication, sale or transfer of recordings, written approval must be obtained from the instructor for the specific use proposed. Any use other than that described above constitutes academic misconduct and may result in suspension or expulsion.

### Part 2

The instructor may use media recordings to capture the delivery of a lecture.

The instructor will notify all students and guests in the class that the event is being recorded. If a student or guest wants to take steps to protect privacy, and does not want to be recorded, the instructor will provide the individual (s) with an alternative means of participating and asking questions (e.g., passing written notes with questions). Students cannot be penalized for choosing not to be recorded in situations where participation is part of the course. Students must be offered other ways of earning participation credit that do not involve recording.

Any video-recording would be intended to only capture the instructor and the front of the classroom. Students/other participants would not necessarily be visible on video recordings.

## University of Calgary Policies and Supports

### **ACADEMIC ACCOMMODATION**

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit [www.ucalgary.ca/access/](http://www.ucalgary.ca/access/). Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at <http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf>.

### **ACADEMIC MISCONDUCT**

Plagiarism involves submitting or presenting work in a course as if it were the student's own work done expressly for that particular course when, in fact, it is not. Most commonly plagiarism exists when: (a) the work submitted or presented was done, in whole or in part, by an individual other than the one submitting or presenting the work, (b) parts of the work are taken from another source without reference to the original author, (c) the whole work (e.g., an essay) is copied from another source, and/or, (d) a student submits or presents work in one course which has also been submitted in another course (although it may be completely original with that student) without the knowledge of or prior agreement of the instructor involved. While it is recognized that scholarly work often involves reference to the ideas, data and conclusions of other scholars, intellectual honesty requires that such references be explicitly and clearly noted. Plagiarism is an extremely serious academic offence. Any suspicion of plagiarism will be reported to the Dean, and dealt with as per the regulations in the University of Calgary Graduate Calendar.

For information on academic misconduct and its consequences, please see the University of Calgary Calendar at <http://www.ucalgary.ca/pubs/calendar/current/k.html>

### **COPYRIGHT LEGISLATION:**

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright ([www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright.pdf](http://www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright.pdf)) and requirements of the copyright act (<https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy.

### **FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY**

Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary.

**UNIVERSITY STUDENT APPEALS OFFICE:** If a student has a concern about the course, academic matter, or a grade that they have been assigned, they must first communicate this concern with the instructor. If the concern cannot be resolved with the instructor, the

student can proceed with an academic appeal, which normally begins with the Faculty.

<https://ucalgary.ca/student-appeals/>

**More student support and resources (e.g. safety and wellness) can be found here:**

<https://www.ucalgary.ca/registrar/registration/course-outlines>