

## **ESM 273: Life Cycle Assessment**

Winter 2024

Tuesdays and Thursdays, 12:30-1:45pm

Bren Hall 3035 (GIS Lab)

### **INSTRUCTORS**

Professor Eric Masanet (Bren 3510)

- Office hours: Tuesdays, 10am-12pm
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Dr. Enze Jin (Bren 3045)

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### **TEACHING ASSISTANT**

Jaenna Wessling (Bren 3016)

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### **COURSE OVERVIEW**

Life Cycle Assessment (LCA) is a scientific methodology to quantify the environmental impacts of a product or process across its entire life cycle, from raw materials extraction to manufacturing and operation to end-of-life waste management. An LCA provides decision makers with greater visibility into the different environmental impacts associated with their decisions, which enables evidence-based choices that can minimize environmental impacts by design. LCA is increasingly being used across sectors to align decisions with corporate and societal sustainability goals.

In this course, you'll learn how to construct and execute an ISO 14044 compliant LCA for a product system, including goal and scope definition, life-cycle inventory data collection, environmental impact characterization, results generation and interpretation, and reporting. You'll learn the process in a highly hands-on way by building an LCA model using state-of-the-art commercial LCA software. At the end of the course, your

results will enable you to compare the environmental performance of your product to potential alternatives.

Class time will be devoted to a mixture of lectures on LCA theory and applications, LCA software training, and hands-on course project work.

## **ASSIGNMENTS AND GRADING**

The final course grade will be based on:

- six homework assignments (5% each for 30% of the final grade)
- the course project (60% of the final grade)
- participation (10% of the final grade).

There is no final exam.

The final course project grade will be based on in-class project "report outs," the final project presentation, modeling deliverables, the final report, and peer assessments. To receive a high project grade you'll need to show steady progress on your projects and evidence of engagement and effort within both the class and project team environments. Further information on the project can be found on the "[Course Project](#)" page.

Project "report outs" will be brief updates provided by each team to the class on project milestones, which are important for sharing of information and data between project teams.

Students are expected to attend each lecture and to actively participate. To receive a full participation grade you'll need to engage in the in-class discussions, which will often include responding to ad hoc questions and actively participating in in-class exercises.

## CLASS SCHEDULE AND DEADLINES

Week	Class	Date	Topics	HW*	Project team report out
1	1	1/9	Introduction and overview		
	2	1/11	Understanding unit processes		
2	3	1/16	Aggregated unit process inventories		
	4	1/18	Goal and scope definition: functional units	HW1 due	
3	5	1/23	Goal and scope definition: system boundaries		
	6	1/25	Life cycle inventories and data requirements	HW2 due	
4	7	1/30	Multi-functionality and allocation, part I		BOM and system boundaries
	8	2/1	LCA software tutorial session	HW3 due	
5	9	2/6	Multi-functionality and allocation, part II		Goal and scope definition
	10	2/8	LCA software tutorial session	HW4 due	
6	11	2/13	Data quality assessment, sensitivity analysis		
	12	2/15	LCA software tutorial session	HW5 due	
7	13	2/20	Life cycle impact assessment, part I		Initial LCI results
	14	2/22	LCA software tutorial session	HW6 due	
8	15	2/27	Life cycle impact assessment, part II		Initial LCIA results
	16	2/29	LCA software tutorial session		
9	17	3/5	Interpretation		Sensitivity results
	18	3/7	Advanced topics: consequential and input-output LCA		
10	19	3/12	Team project presentations		
	20	3/14	Team project presentations		

\* all HW is due by 12:30pm Pacific time on the indicated day, to be uploaded on Canvas

## **TEXTBOOK/READINGS**

There is no course textbook. Selected readings are included as part of homework assignments. Additionally, each project team will have to identify and utilize numerous papers and reports on their own to understand product systems and identify data and assumptions to support their modeling projects.

## **OFFICE HOURS**

Instructor and TA office hours will be held in “open door” fashion, meaning any ESM 273 student can join the discussion at any time. This format will enable students to learn from each other’s questions and facilitate cross-project learning on common modeling and analysis issues. Students who wish to discuss course questions or issues privately should email the instructor or TA to set up an appointment outside of office hours.

## **ACCOMMODATION OF SPECIAL CIRCUMSTANCES**

Please see the instructor for accommodation of religious beliefs, disabilities, and other special circumstances.

## **COMMUNICATIONS**

Instructor announcements and other course communications will occur on Canvas.

## **ABSENCES AND EXTENSIONS**

Students are expected to attend each lecture and to attend meetings organized by project teams. Students are encouraged to notify the instructor in advance of any foreseen absences so that accommodations can be made as needed.

If you are feeling sick and/or suspect that you may have a contagious illness such as COVID, please stay home. If you are feeling up to attending lecture remotely, a Zoom link can be provided.

If you suspect that you have, or if you have been diagnosed with, COVID, please adhere to UCSB's COVID protocols:

<https://www.ucsb.edu/COVID-19-information/campus-updates>Links to an external site.

If you must miss a due date for an assignment, the instructor will consider granting an extension. Your case will be helped if you have supporting evidence (i.e., doctor’s notice). Do not assume that extensions will be granted automatically.

## **COURSE MATERIAL USE POLICY**

All course materials (class lectures and discussions, handouts, assessments, web materials) and the intellectual content of the course itself are protected by United States Federal Copyright Law, the California Civil Code. UC Policy 102.23 expressly prohibits students (and all other persons) from recording lectures or discussions and from distributing or selling any course materials without the prior written permission of the instructor. See [policy.ucop.edu/doc/2710530/PACAOS-100](https://policy.ucop.edu/doc/2710530/PACAOS-100)Links to an external site.. Students are permitted to make notes solely for their own private educational use. Exceptions to accommodate students with disabilities may be granted with appropriate documentation. To be clear, in this class students are forbidden from completing study guides and selling them to any person or organization. This text has been approved by UC General Counsel.