Engineering Faculty Document No. 49-23
November 29, 2022

TO: The Faculty of the College of Engineering
FROM: The Division of Environmental and Ecological Engineering
SUBJECT: New Undergraduate Course, EEE 23000, Engineering Economics and Environment

The Faculty of the Division of Environmental and Ecological Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

EEE 23000: Engineering Economics and Environment
Sem. 1, Lecture 3, Credits 3
Corequisites: Undergraduate level CHM 11200 Minimum Grade of D- or Undergraduate level CHM 11600 Minimum Grade of D- or Undergraduate level CHM 13600 Minimum Grade of D- or Undergraduate level CHM 12600 Minimum Grade of D- or Undergraduate level CHM 12400 Minimum Grade of D- or Undergraduate level CHM 12901 Minimum Grade of D- or (Undergraduate level CHEM C1220 Minimum Grade of D- and Undergraduate level CHEM C1020 Minimum Grade of D-) or (Undergraduate level CHEM C1060 Minimum Grade of D- and Undergraduate level CHEM C1260 Minimum Grade of D-).

Course description:
This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impact societies and environments at both local and global scales.

The learning objectives for this course are:

1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles.
    a. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA.
    b. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems.
    c. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal.
    d. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle.
2. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues
    a. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions
    b. Develop an equitable engineering design proposal

This course has been taught as EEE 43000 in Spring 2022 and EEE 29500 in Fall 2022.

Reasons: The EEE curriculum is being updated and this new course was created as part of that.

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John W. Sutherland, Professor and Fehsenfeld Family Head
Division of Environmental and Ecological Engineering

EEE 23000: Engineering Economics and Environment

Level: Undergraduate

Course Instructor: Rebecca Ciez, John Howarter, and Caitlin Proctor

Course Description
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Learning Outcomes & Learning Objectives

1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles.
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    b. Develop an equitable engineering design proposal

Previous Teaching:
This course has been taught as EEE 43000 in Spring 2022 and EEE 29500 in Fall 2022.

Enrollment Spring 2022 = 97
Enrollment Fall 2022 = 65

The syllabus for Fall 2022 follows.

EEE 295: Engineering Econ & Environment

Course Information

Semester: Fall 2022, 3 credit

Meeting times & location*: 9:30-10:20 MWF --- WALC 3087

**All classes will be face-to-face, but please check your email/Brightspace in advance of each class for modality updates as we may need to switch to synchronous online for various reasons. Synchronous online Zoom link:* https://purdue-edu.zoom.us/j/91269889702?pwd=dXhqZzNJK09VVGgrUUdVa3RuMDJGQT09

295 Instructors Email: eee295@purdue.edu (to all instructors, preferred for fastest communication: with descriptive subject i.e. "EEE 295")

Instructor: Dr. Rebecca Ciez Email: rciez@purdue.edu
Office Hours (zoom): Thursday 11:00 AM – 12:00 PM

Instructor: Dr. John Howarter Email: howarter@purdue.edu
Office Hours (zoom): Friday 1:00 – 2:00 PM

Instructor: Dr. Caitlin Proctor Email: proctoc@purdue.edu
Office Hours: scheduled project meetings

Graduate TA: Kaustubh Bawankule Email: kbawanku@purdue.edu
Office Hours: Thursday – 9:00 – 10:00 AM in-person Potter 227

Office hour zoom link (same as above):
https://purdue-edu.zoom.us/j/91269889702?pwd=dXhqZzNJK09VVGgrUUdVa3RuMDJGQT09

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Prerequisites

Completed first year engineering or equivalent first-year STEM curriculum.

Learning Outcomes

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Learning Resources, Technology & Texts

- **Software/web resources**: This course will require the use of software including Excel, Zoom, Brightspace. Students will need to have a free registered zoom account. Purdue licenses Office 365 (including Excel) to be free to all students.
- **Brightspace**: This course will use Brightspace to post all relevant course materials including readings, assignments, and other files. Grades and feedback will also be posted to Brightspace. Students are responsible for checking Brightspace regularly, and turning on notifications for the class. Instructors may post announcements without a separate e-mail, and it is the student's responsibility to get this information in a timely manner.
- **Gradescope**: Most assignments and projects will be submitted and graded via a linked Gradescope page. Assignment feedback will be available on Gradescope.
- **Reading materials**: There is no required textbook for this course. Reading materials will be provided on the course Brightspace.
  Recommended reference text: Materials and the Environment: Eco-Informed Material Choice ISBN: 9780128215210
  Digital Copy Available free from Purdue library.

Course Assessments

A. Homework assignments – 30%
B. Tests – 40%
C. Project – 30%

Homework: Homework questions will be posted on Brightspace and a linked Gradescope page. Assignments will be submitted via Gradescope, and feedback will be provided via Gradescope. Assignments are due at 11:59 PM ET on the date listed in the course schedule. On occasion, Brightspace quizzes may be used as an open-book homework question. These quizzes will be completed within Brightspace and will be due as indicated on the page. *Your 3 lowest homework grades will be dropped.*

Tests: There will be 4 in-class tests over the course of the semester (refer to the course schedule for exact dates). All tests will be held in person.

Project: A semester-long group project will be assigned in week 1, with final presentations in-person in the final week of classes. Complete details on the group project are available on Brightspace. Deliverables will be required periodically throughout the semester, and will include homework assignments, group reports, group meetings outside of class with instructors, and a final presentation.

General Course Policies

Communication: Do not hesitate to ask for assistance. **Professional communication is critical in this course**. Dropping in to any of the zoom office hours is encouraged as a best first step. For the quickest reply please email: eee295@purdue.edu

Class Expectations & Participation: Class sessions will entail group work, open discussion, and lectures. Respect and courtesy for others is expected. Advance preparation and documented in-class participation will be required frequently. Specific guidance on pre-read assignments will be available on Brightspace.

Assignment Submissions: Assignment submission details and due dates will be provided on Brightspace and discussed in class. Additionally, a schedule for the course is provided on Brightspace. Late assignments will not be accepted at all.

Attendance [normal class sessions]: We strongly encourage in-person attendance because you will keep up with the content most effectively with regular attendance. If you are unable to attend a NORMAL class session you can do NOT need to email instructors or gain prior approval. Access to recorded lectures can be requested via a qualtrics form (available via brightspace). Access to recorded lectures is not guaranteed.

[tests, project presentations]: Prior communication (about illness, etc.) is ONLY expected if you cannot attend a test or your in-class presentation. Please email eee295@purdue.edu with subject line "Absence:Date" as early as possible. In cases falling under excused absence regulations, the student or the student's representative should contact or go to the Office of the Dean of Students website to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted for cases of grief/bereavement, military service, jury duty, and parenting leave. For details, see the Academic Regulations & Student Conduct section of the University Catalog website. Academic Regulations & Student Conduct section of the University Catalog website.

***Grading*:**

Course grading will not be more stringent than the scale listed below. Grade break scores may vary from straight-scale, and may be curved at the instructors' discretion. Regrading requests must be submitted **via email** (to eee295@purdue.edu) within one week of the date the graded document was made available. Regraded items may result in a score that is higher, lower, or the same as compared to the original score

Grade	Numerical Score (%)
A	≥93
A-	≥90
B+	≥87
B	≥83
B-	≥80
C+	≥77
C	≥73
C-	≥70
D+	≥67
D	≥63
D-	≥60
F	Below 60

University Policies

Classroom Guidance Regarding Protect Purdue
Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

Academic Integrity
Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

The Purdue Honor Pledge (https://www.purdue.edu/odos/osrr/honor-pledge/about.html):
"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

Students are expected, within the context of the Regulations Governing Student Conduct and other applicable University policies, to act responsibly and ethically by applying the appropriate exception under the Copyright Act to the use of copyrighted works in their activities and studies. University Regulations on copyright policies.

Diversity and Inclusion
Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with instructors, confidentially if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

Grief Absence Policy
Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the death of a member of the student's family. See the University's website for additional information.

Medically Excused Absence Policy
In February 2022 the University Senate added the **Medically Excused Absence Policy (MEAPS)** to the university regulations on class attendance. MEAPS joins Grief/Bereavement, Military Service, Jury Duty and Parenting Leave as specific situations with university-defined procedures and instructor/student expectations.

"A student can contact the Office of the Dean of Students (ODOS) to request that a notice of the leave be sent to instructors when a situation involving **hospitalization, emergency department or urgent care visits emerges**. The student can then provide documentation of hospitalization, emergency department or urgent care as proof of legitimate absence to the ODOS as soon as these documents are available."

Accessibility and Accommodations
Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: **drc@purdue.edu** or by phone: 765-494-1247.

Mental Health Statement
If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Violent Behavior Policy
Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. See the University's website for additional information.

Basic Needs Security
Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund

Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Disclaimer

This syllabus is subject to change. Changes will be shared and announced via Brightspace and email, as well as in class sessions.

EEE 295 Engineering Economy & Environment

Class Number	Date	Topics (tentative brainstorm)
1	8/22/2022	Syllabus, LCA defined, Project topics, Assign groups
2	8/24/2022	Systems, Boundaries, Inputs/Outputs
3	8/26/2022	LCA overview -comparative/consequential types, steps, analyses methods
4	8/29/2022	Goal/scope in depth
5	8/31/2022	Product functional unit
6	9/2/2022	Attributional vs Consequential LCA
X	9/5/2022	**LABOR DAY**
7	9/7/2022	Defining and Measuring Inputs/Outputs
8	9/9/2022	Measurement Uncertainty
9	9/12/2022	Revist Project and Challenging topics
10	9/14/2022	Test 1
11	9/16/2022	Discussion - What makes a problem important? - Who defines the stakeholders?
12	9/19/2022	Inputs/Outputs Over Long Time Horizon
13	9/21/2022	Material End of Life / Conventional Recycling
14	9/23/2022	Net Present Value
15	9/26/2022	Net Present Value Continued
16	9/28/2022	Environmental Damage & costs
17	9/30/2022	Fate & Transport, Environmental Damage, Risk
18	10/3/2022	Revist Project and Challenging topics
19	10/5/2022	Test 2
20	10/7/2022	Discussion - History & risk, lab uncertainty, ability to measure a problem
X	10/10/2022	**FALL BREAK**
21	10/12/2022	Environmental Indicators vs. Impacts (GWP example)
22	10/14/2022	Uncertainty Part 2
23	10/17/2022	Risk Analysis
24	10/19/2022	Space / Time / Risk Profile / Dissimilar Impacts
25	10/21/2022	Quantifying &Comparing Dissimilar Impacts
26	10/24/2022	Weighting Factors / Eco-indicator Scores
27	10/26/2022	Stakeholder Perspectives / Eco-indicators
28	10/28/2022	Environmental Justice Screening tool (EPA)
29	10/31/2022	Revist Project and Challenging topics
30	11/2/2022	Test 3
31	11/4/2022	Discussion - Weighting of Impact Categories, Stakeholder Viewpoints, Bias
32	11/7/2022	Geographical Variation in Impacts and Needs (water scarcity example)
33	11/9/2022	Interpretation- Identifying Low Quality, Outdated LCA
34	11/11/2022	Matching Scope to Stakeholders
35	11/14/2022	Economical Recycling vs. Alternatives (EOL)
36	11/16/2022	Innovations in Sustainable Design
37	11/18/2022	Policy Inputs for Industry & Consumer Decisions
38	11/21/2022	Revisiting Functional Units and Sustainable Design
X	11/23/2022	**THANKSGIVING**
X	11/25/2022	**THANKSGIVING**
39	11/28/2022	Revist Project and Challenging topics -- Notes on strong vs weak presentations
40	11/30/2022	Test 4
41	12/2/2022	Discussion - Decision Making as a Complex Process
42	12/5/2022	4 groups present
43	12/7/2022	4 groups present
44	12/9/2022	4 groups present