

EEE 560

Sustainable Manufacturing

Fall 2024

Course Information:

Course Number and Title: EEE 560 Sustainable Manufacturing

Class location: WALC 3138

Meeting days and times: Tuesdays: 12:00 – 1:15 PM
Thursdays: 12:00 – 1:15 PM

Instructional Modality: Face-to-face

Course credit hours: 1

Instructors Contact Information

Instructors: Professor Dr. John W Sutherland

Dr. Chandra Nath

Office Location: POTR 364

Office Phone Number: 765-496-9697

Email addresses: jwsuther@purdue.edu; or nathc@purdue.edu

Office hours: by appointment

Course Description:

The outputs and processes associated with sustainable manufacturing are examined, with special emphasis placed on their interaction with ecological systems. The concept of industrial sustainability is explored. The processes used to produce materials and realize products are discussed. The effects of engineering design and manufacturing on the environment are examined. The product life cycle perspective is introduced. Topics to be covered include: materials and manufacturing processes, energy and material flows, renewable energy, supply chain, technoeconomic viability, life cycle issues including management of end-of-life products, and circular economy. The course also introduces students to concept of societal sustainability and corporate social responsibility.

Learning Resources, Technology & Texts:

- Discussed in class
- Brightspace LMS

Learning Outcomes:

1. Recognize how products and materials interact with the environment through energy and material flows at every stage of their life cycle, from raw material extraction to end of life disposal, life cycle thinking, and life cycle analysis is required to design/develop products for improved environmental performance.
2. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
3. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Assignments:

Group project. Deliverables every week

Grading Scale:

Your grade will be based on the quality and timeliness of deliverables related to the project.

Course Schedule:

Lecture	Date	Topic and Readings	Instructor	Assignments
1	09/24	Introduction	JWS	Proj wk #1
2	09/26	<ul style="list-style-type: none"> • Manufacturing • Sustainability • Life Cycle Analysis (LCA) & Circular Economy (CE) • Techno-economic Analysis (TEA) • Course/Module Project Instruction 		
3	10/01	Materials Processing (CN)	CN	Proj wk #2
4	10/03	Manufacturing Processes – I & II	JWS	
	10/08	Fall Break (NO CLASS)		Proj wk #3
5	10/10	Manufacturing Systems - Equipment	JWS	
6	10/15	Supply Chain	JWS	Proj wk #4
7	10/17	End-of-Life (EoL)	CN	
8	10/22	Product Design	CN	Proj wk #5
9	10/24	Course Summary	JWS	

Group Project:

- ◆ Identify a product related to clean energy technologies: Li-ion battery, electric vehicle, rare earth permanent magnet motor, wind turbine, etc.
- ◆ The overall project goal is to identify a promising change to the product life cycle OR the manufacturing ecosystem that will have a positive environmental impact and not jeopardize financial viability.

Project Assignments and Deliverables:

- ◆ Wk #1: Submit short statement describing product and identify 5+ technical papers that describe manufacturing and life cycle of the product including environmental impact
- ◆ Wk #2: Summary of each paper. Identify strengths/weaknesses of each paper.
- ◆ Wk #3: Detailed description (including figures) of the product life cycle; estimate of key environmental impacts across the life cycle; estimate of product cost
- ◆ Wk #4: Identify one thing that could be done (e.g., a product change, process change, or EoU change) that could be done to reduce environmental impact. Estimate environmental measures and product cost for this change.
- ◆ Wk #5: Document all the work that you have done on the project.

Assignments must be emailed to Dr. Nath by 11:59pm on Thursday of each class week.

General Course Policies:

Have a question? Please send one of the instructors an email – we will try to respond quickly.

Attendance Policy:

Students are expected to be present for every class meeting. If you are unable to attend, please inform Dr. Nath of the situation via email as soon as possible.

Academic Guidance in the Event a Student is Sick:

If you must quarantine, isolate, or be absent in class at any point in time during the semester (covid or otherwise), please reach out to the instructors via email. In general, students who experience any type of extended health issue can contact the Academic Success Center for assistance.

Academic Integrity:

The Purdue Honors Pledge reads “As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together—we are Purdue.” The University policy on dishonesty is shown below:

Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, Student Regulations]. Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

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 is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace under University Policies and Statements.

Use of Copyrighted Material:

See the University Policies and Statements section of Brightspace for guidance on Use of Copyrighted Materials. Effective learning environments provide opportunities for students to reflect, explore new ideas, post opinions openly, and have the freedom to change those opinions over time. Students and instructors are the authors of the works they create in the learning environment. As authors, they own the copyright in their works subject only to the university's right to use those works for educational purposes. Presentations, documents, and materials from class presentations and activities are considered derivative works of the speaker's presentations and materials, and so they are also subject to the presenter's copyright. Students may not copy, reproduce, or post to any other outlet (e.g., Chegg, Course Hero, Quizlet, YouTube, Facebook, or other open media sources or websites) any work in which they are not the sole or joint author or have not obtained the permission of the author(s).

Nondiscrimination Statement:

Purdue University is committed to maintaining a community that 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 own 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 and Statements.

Accessibility:

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let the instructors know as soon as possible 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/Wellness:

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 free and can be done on BoilerConnect.

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. The [CAPS website](#) also offers resources specific to situations such as COVID-19.

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. Additional campus resources:

1. [ODOS services and information portal](#) and the [Critical Need Fund](#).

2. [Student of concern reporting](#) (anyone on campus can submit a report if they are unsure where to go or in what way they can help a student - it does not need to be an emergency).
3. The [ACE Campus Food Pantry](#) (open to the entire Purdue community)
4. The [Center for Advocacy, Response & Education \(CARE\)](#) (open to all Purdue students) “provides support and advocacy for survivors of sexual violence, dating violence, and stalking.

Emergency Preparation

While Purdue University is a very safe campus where there is a low probability of a serious incident occurring, we want to emphasize emergency procedures for evacuation and shelter in place in the case of such incidents. Our preparedness will be critical IF an unexpected event occurs! Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the goal of maintaining a safe and secure campus.

- For any emergency call 911.
- If you experience any symptoms of COVID-19 or suspect you may have been exposed to someone with COVID-19 stay home and follow the current Purdue protocol.
- There are nearly 300 Emergency Telephone Systems throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected to the PUPD.
- If you hear a fire alarm, immediately evacuate the building and proceed to your designated evacuation location, wherever you are. Exit via the stairs as per the building evacuation map. Do not use the elevator.
- If you are notified of a Shelter in Place requirement for a tornado warning, shelter in the lowest level of your building away from windows and doors.
- If you are notified of a Shelter in Place requirement for a hazardous material release, shelter wherever you are located, shutting any open doors and windows.
- If you are notified of a Shelter in Place requirement for a civil disturbance such as a shooter, shelter in any room that is securable, preferably without windows, turn off all lights, and hide.

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 instructors' control. Relevant changes to the course can then be obtained by contacting one of the instructors by email or phone. You are expected to read your Purdue email on a frequent basis.