

TO: The Faculty of the College of Engineering  
FROM: The Division of Environmental and Ecological Engineering  
SUBJECT: New undergraduate Course, EEE 36002

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 36002:** Environmental Sustainability for Industry, Laboratory  
*Sem. 2, Lecture 1, Laboratory 3, Credits 3*

Prerequisite: (Undergraduate level EEE 38000 Minimum Grade of D- [may be taken concurrently] or Undergraduate level CE 21101 Minimum Grade of D- [may be taken concurrently] or Undergraduate level CHE 21100 Minimum Grade of D- [may be taken concurrently] or Undergraduate level ME 20000 Minimum Grade of D- [may be taken concurrently]) and (Undergraduate level MA 26100 Minimum Grade of D- or Undergraduate level MATH 26100 Minimum Grade of D- or Undergraduate level MA 26300 Minimum Grade of D-)

**Course description:**

This lab course provides an opportunity for students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include: experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and environmental assessment of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products. Students are encouraged to complete their statistics requirement. The learning outcomes for this course are:

1. Develop a hypothesis and design experiments to test the hypothesis
2. Conduct/interpret statistical analysis of experimental results
3. Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer
4. Propose energy efficiency solutions and evaluate their economic and environmental consequences
5. Design and measure the material and environmental impacts of a product's life cycle, including production, waste-handling, and end-of-life scenarios
6. Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience

This course has been offered for approximately five years under permanent course EEE 36000, which is a variable title, variable credit course. The new course, EEE 36002 is a permanent title, three-credit course Spring semester course.

**Reasons:** As the EEE program has grown it has become necessary to clearly differentiate between the Fall and Spring versions of EEE 36000. In addition, the Registrar will not permit students to repeat and replace failing grades of a variable title, variable credit course.



---

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

Enrollment for the previous five years:

2023 – 18 (averaged over the three 5 week modules)

2022 – 16 (averaged over the three 5 week modules)

2021 – 24 (averaged over the three 5 week modules)

2020 – 10 (averaged over the three 5 week modules)

2019 – 12 (averaged over the three 5 week modules)

Syllabus for Spring 2023 follows.

# EEE 360 Environmental & Ecological Engineering Laboratory

## *Industrial Sustainability*

### Course Information

Semester: Spring 2023

Lecture: Tuesdays, 10:30 AM - 11:45 AM / WALC 3121

Lab: Thursdays, 10:30 AM - 1:20 PM / POTR 254-256

Modules: 1. Design of Experiments for EEE / CRN: 14155 (Lec), 13886 (Lab)  
2. Power and Energy Efficiency / CRN: 15188 (Lec), 15187 (Lab)  
3. Product End-of-Life Management / CRN: 15191 (Lec), 15192 (Lab)

### Teaching Team

Instructor: Prof. John Mulrow, [jmulrow@purdue.edu](mailto:jmulrow@purdue.edu)  
OH: Tuesdays, 12:00-2:00 PM / Thursdays, 2:00-4:00 PM / POTR 364-i  
(book an in-person or virtual office hours meeting at: [calendly.com/jmulrow/oh](https://calendly.com/jmulrow/oh))

Peer TA: Aaron Harp, [amharp@purdue.edu](mailto:amharp@purdue.edu)  
OH: Mondays, 12:00-2:00 PM / POTR 227

### Course Overview

This lab course provides an opportunity for EEE students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include: experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and evaluation of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products.

You will be challenged to apply the scientific and ecological principles you have already learned in your EEE curriculum. In every module, we will consider the relationship between technologies – such as electricity generation systems, electronic devices, and household appliances – and the global ecological phenomena that are impacted – such as climate change, land use, and material flows. Some of the skills you will gain include the ability to:

- Develop a hypothesis and design experiments to test the hypothesis
- Conduct/interpret statistical analysis of experimental results
- Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer
- Propose energy efficiency solutions and evaluate their economic consequences
- Design and measure the material impacts of a product's life cycle, including production, waste-handling, and end-of-life scenarios
- Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience

**Course Outline** (subject to change depending on weather/logistics)

<b>Wk</b>	<b>Module</b>	<b>Tue</b>	<b>Lecture: WALC 3121</b>	<b>Thu</b>	<b>Lab: POTR 254, except tour days (bolded)</b>
<b>1</b>	DoX	10-Jan	Intro to DoX, stats review, hypothesis testing	12-Jan	1-1. wind speed
<b>2</b>	DoX	17-Jan	Planning factors, independent t-test	19-Jan	1-2. indoor air quality
<b>3</b>	DoX	24-Jan	Paired t-test	26-Jan	1-3. home appliance power consumption
<b>4</b>	DoX	31-Jan	Factorial design 1	2-Feb	1-4. design: traffic emissions experiment
<b>5</b>	DoX	7-Feb	Factorial design 2	9-Feb	analysis: traffic emissions experiment
<b>6</b>	P&E	14-Feb	Intro to P&E, combustion and heat transfer	16-Feb	2-1. combustion, heat conduction/convection
<b>7</b>	P&E	21-Feb	Electricity I, DC circuit components/analysis	23-Feb	2-2. breadboards, building resistor circuits
<b>8</b>	P&E	28-Feb	Electricity II, AC circuit components/analysis	2-Mar	2-3. function generator, oscilloscope, RLC circuits
<b>9</b>	P&E	7-Mar	Renewable energy	9-Mar	2-4. <b>Knoy Hall solar array tour and data analysis</b>
<b>Break</b>		<i>14-Mar</i>		<i>16-Mar</i>	
<b>10</b>	P&E	21-Mar	Power, energy, efficiency, & sustainability	23-Mar	<b>Wade Utility Plant tour</b>
<b>11</b>	EoL	28-Mar	Intro to EoL, product life cycles and impacts	30-Mar	3-1. product disassembly, bill of materials
<b>12</b>	EoL	4-Apr	Electronics, economic analysis	6-Apr	3-2. component recovery and economic analysis
<b>13</b>	EoL	11-Apr	Plastics and metals	13-Apr	3-3. <b>Purdue Surplus facility tour</b>
<b>14</b>	EoL	18-Apr	Organic waste	20-Apr	3-4. identification/separation of plastics and metals
<b>15</b>	EoL	25-Apr	Materials, energy, and sustainability	27-Apr	course conclusion/evaluation
<b>Finals</b>		<i>2-May</i>		<i>4-May</i>	<i>NO FINAL</i>

**Reference Text** (Recommended, not required)

Montgomery, Douglas C. *Design and Analysis of Experiments*. Eighth edition. Hoboken, NJ: John Wiley & Sons, Inc., 2013.

Available online via Purdue Library: [https://purdue.primo.exlibrisgroup.com/permalink/01PURDUE\\_PUWL/ufs51j/alma99145072500001081](https://purdue.primo.exlibrisgroup.com/permalink/01PURDUE_PUWL/ufs51j/alma99145072500001081)

## Assignments & Grading

Each module consists of five lectures, five lab sessions, and four lab assignments:

Lab	Points	Due at <b>Midnight Eastern time on:</b>
Lab 1	20	Wednesday 1 week after lab
Lab 2	20	
Lab 3	20	
Lab 4	30	Wednesday 2 weeks after lab
On-time submission*	2.5 pts per lab	
<b>Total</b>	<b>100</b>	

\* Labs will be submitted via Brightspace. Request for extension due to illness or unforeseen circumstances should be sent via email to both [jmulrow@purdue.edu](mailto:jmulrow@purdue.edu) and [amharp@purdue.edu](mailto:amharp@purdue.edu).

Each module is graded as an individual course, based on the following point scale:

Grading Scale	
Grade	Numerical Score
A	≥90
B+	≥87
B	≥83
B-	≥80
C+	≥77
C	≥73
C-	≥70
D+	≥67
D	≥63
D-	≥60
F	Below 60

## Course Policies

### **Course updates**

Relevant changes to this course will be posted via Brightspace, and urgent notices may be sent directly via email. You are expected to read your @purdue.edu email on a frequent basis.

### **Lab Safety**

This course has several aspects that require everyone's attention to safety: for yourself and everyone around you. These include the use of electricity generation and testing equipment, electrical appliances, combustible fuels, and product disassembly tools. Several activities will also occur outside, requiring you to dress properly for weather conditions. We will discuss safety considerations specific to each lab.

### **Lab Teams**

For each module, you will be randomly assigned to a 3-4 person lab team to work with on lab activities and data collection. Everyone must complete and submit each lab assignment individually.

### **Lab Equipment**

For assignments where equipment must be taken out of the lab, we will sign out the equipment to each lab team to keep accountability.

### **Attendance**

This course follows the Academic Regulations: Attendance and Office of the Dean of Students: Class Absences posted in Brightspace under “University Policies and Statements.” The policies state that students are expected to be present for every meeting of the classes in which they are enrolled. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, you should inform the instruction team of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification is not possible, contact me as soon as possible by email or phone. For cases that fall under excused absence regulations, you or your representative should contact or go to the Office of the Dean of Students (ODOS) website to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted by ODOS for cases of grief/bereavement, military service, jury duty, parenting leave, or emergent medical care. In cases related to COVID-19, please follow the [Protect Purdue Updates for the Spring 2023 Semester](#).

### **Academic Integrity**

All students are expected to act in an honest and ethical manner consistent with Purdue University regulations. We will apply the Purdue Honor Pledge as our standard: “As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.” It is your responsibility to read "[Academic Integrity: A Guide for Students](#)."

### **Accessibility**

Purdue University strives to make learning experiences accessible to all participants. 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](mailto:drc@purdue.edu) or by phone at 765-494-1247.

### **Nondiscrimination**

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 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.

### **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. Students may submit requests for emergency assistance from the [Critical Need Fund](#).

### **Emergency Preparation**

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.

We will review the following Building Emergency Plans together in class:

**WALC:** <https://www.purdue.edu/ehps/emergency-preparedness/emergency-plans/bep/building-beps/walc-bep.html>

**POTTER:** <https://www.purdue.edu/ehps/emergency-preparedness/emergency-plans/bep/building-beps/potr-bep.html>

### **Land Acknowledgement**

Purdue University is built upon the traditional homelands of the Bodéwadmik (Potawatomi), Lenape (Delaware), Myaamia (Miami), and Shawnee People. We acknowledge these Indigenous groups as the original caretakers of our environment. To learn more about the Indigenous nations represented at Purdue University and their activities, visit the [Native American Educational and Cultural Center](#).