

ABE 452: Engineering for Disaster Resilience

Spring Semester, Tuesday-Thursday

COURSE DESCRIPTION

This course is a project-based experience designed to engage students in development of resilient food, energy, and water supply chains designs for disaster-prone regions. Students will investigate background factors that provide context for specific disaster-prone regions and viable design solutions. Students will quantify expected engineering reliability to potential solutions. Students will work with local communities, aid organizations, and peer institutions when identifying resilient designs, eventually seeking pathways to implement solutions with partner communities.

During class meetings, independently, and in virtual environments, students will work in teams to resolve design related challenges. Class topics and both recorded and live guest lectures will focus on the design approaches and assessment of resilience for potential technological and social solutions responding to current and anticipated challenges for disaster prone regions. Term projects will document, organize, and store assessments, analyses, and designs, providing prioritized design, testing, education, management, and business plans for collaborating communities and future students enrolled in this class. Participation in the course also offers an optional study tour and an opportunity to repeat the course for deeper training in Disaster Resilience (see Credits below). Grades for all students are calculated after post semester study tours as data collection will occur during travel and will be incorporated into final term projects after students return, pending the submission and grading of assignments upon return.

INSTRUCTORS

Name	Contact Information	Office Hours
Luis F. Rodríguez, Ph.D.	O: +1-217-333-2694 M: +1-832-875-3024 E: lfr@illinois.edu	Accessible to you for reservation via http://my.aces.illinois.edu/advising Open door policy: You may feel free to drop by at any time to room 376C Agricultural Engineering Sciences Building. If my door is open, feel assured that I will make time to talk to you. You should feel free to knock.
Michael James Stablein, M.S.	M: +1-847-987-1282 E: stablei1@illinois.edu	Available by appointment via zoom or in person in my office, **AESB Room 310C.

CREDITS (3)

Students enrolled in ABE 491 earn three undergraduate or graduate credit hours by focusing their efforts on term projects and developing an understanding of theories and approaches to problem solving targeting resilience, reliability, and a solid contextual understanding of the partner communities. To earn graduate credit graduate students will complete additional problem sets and an additional research related project effort.

Some students may choose to repeat this course. Given our ongoing collaborations with actual communities, where project based student challenges are derived in collaboration with community members, an underlying goal of this class experience includes not only generating viable solutions, but also realizing practical implementation within communities. Thus, project related efforts in this class are often carried forward from semester to semester. Because of the nature of the ongoing project efforts, **students may repeat this class up to six hours if term project projects differ**

from term to term. Students should consult with the professor to verify this is the case and acquire permission to repeat the course.

LEARNING OBJECTIVES

This semester we will focus our project efforts on Puerto Rico, where in 2017 Hurricanes Irma and Maria devastated local infrastructures. Thus, course objectives are as follows:

1. Students will demonstrate their understanding of globally relevant issues where problem solving can contribute towards tangible, context sensitive, and resilient solutions
2. Students will demonstrate their understanding of the political, cultural, and social issues preceding recent disaster related events in Puerto Rico, and how they may affect potential solutions
3. Students will document their observations of the current state of Puerto Rico, its citizens, and its infrastructure, identifying current challenges for recovery
4. After seeking stakeholder input, students will assess and prioritize potential viable social and technological solutions responding to current challenges resulting from the aftermath of Hurricane Maria
5. Students will identify potential improvements for disaster resilience to communities under consideration and quantify the potential benefit benefits of design solutions.
6. Students will market viable solutions to developers and funders for the construction of potential solutions

REQUIRED MATERIALS

- This course website.
- Your laptop
- Slack
- Google Drive
- Selected Readings From:
 - Amadei, B. (2014). *Engineering for Sustainable Human Development: A Guide to Successful Small-Scale Community Projects*. Reston, VA: American Society of Civil Engineers. <https://doi.org/10.1061/9780784413531>
 - Ang, A. H.-S., & Tang, W. H. (2006). *Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering* (2 edition). Wiley.
 - Johnson, L. A., & Olshansky, R. B. (2017). *After Great Disasters: An In-Depth Analysis of How Six Countries Managed Community Recovery*. Cambridge, Massachusetts: Lincoln Institute of Land Policy. Retrieved from <https://www.lincolninst.edu/publications/books/after-great-disasters>
 - Mihelcic, J. R., Fry, L. M., Myre, E. A., Phillips, L. D., & Barkdoll, B. D. (Eds.). (2009). *Field Guide to Environmental Engineering for Development Workers: Water, Sanitation, and Indoor Air*. Reston, VA: American Society of Civil Engineers. <https://doi.org/10.1061/9780784409855>

BASIC COURSE POLICIES

Evaluation

In general, we will adhere to a standard grading scale. This course is graded out of approximately 1000 points distributed below as follows.

A+ > 98.0% (>980)

B+ 85.0-87.9% (850-879)

C+ 75.0-77.9% (750-779)

D+ 65.0-67.0% (650-679)

F <60.0% (<600)

A 90.0-97.9% (900-979)

B 80.0-84.9% (800-849)

C 70.0-74.9% (700-749)

D 60.0-64.9% (600-649)

A- 88.0-89.9% (880-899)

B- 78.0-79.9% (780-799)

C- 68.0-69.9% (680-699)

However, I will calculate both curved and standard grades and the highest of the two possible scores will be awarded to the student. You will be evaluated based on the following three categories of evaluation.

Participation (15% of total grade; 150 points)

Class participation will be quantitatively assessed for each individual in this class and calculated to the maximum extent possible using the following assessments. Active and sincere participation in this course is essential for its success. You will all engage with stakeholders to our projects directly and some of your classmates will eventually travel as a group to Puerto Rico and in doing so we will collectively represent the Department of Agricultural and Biological Engineering, the College of Agricultural, Consumer, and Environmental Sciences, the College of Engineering, the University of Illinois at Urbana-Champaign, the State of Illinois, and the United States of America. At any time, lack of participation by any of us will reflect negatively on not only on the individual, or our group, but also everything we represent.

Furthermore, we have a long-term commitment in this course to assess potential technological solutions that may be implemented via several follow up projects after this course is ended. Demonstrating engagement in the process early and throughout the process is essential for the general success of the class.

Participation is considered at every class session using participation-based assignments which must be completed during your class session. In case of an emergency that causes you to miss multiple class sessions (often 3 or more is a major concern in any class), please contact the [Student Assistance Center in the Office of the Dean of Students](#). Please read the [University's Revised Student Code of Conduct](#), which considers class attendance closely if you have any concerns.

These participation assignments are designed to ensure that all students can actively reflect on all projects. This provides a structure for students to add their expertise towards these projects in a safe and anonymous manner. Feedback provide during these intervals will be reviewed by project teams, prioritized and acted upon. Students are encouraged to provide their feedback directly to project teams on a regular basis.

Group Peer Review: Several assignments throughout the semester are group assignments (e.g. Technology Concept, Annotated Bibliography, Outlines, Poster, Report). You will be asked to quantitatively review the level of participation of your group team members at several intervals throughout the semester. Your participation in these assessments will be recorded and used to determine your level of participation during group activities.

Homework (15% of total grade, 150 divided across several homework assignments)

Homework packets testing the theory, problems solving, and design of systems where disaster resilience is among the design requirements will be provided and completed by the students. Homework will be completed individually.

Projects (70% of total grade, 700 points in total divided across several parallel projects)

In this course, you will contextually analyze the viability of one of several technological solutions that may alleviate challenges recovering from the aftermath of Hurricane Maria in Puerto Rico.

You will document what you have learned and propose potential solutions for improving the sustainability of these systems. These potential solutions will be prioritized by the class in collaboration with our collaborators. A scaffolded process is utilized here to facilitate the development and review of these potential solutions and information transfer across the various projects. This semester the scaffolded steps of these projects and the point allocations are as follows.

Project Area	Description
Background Research (10% of Project, 15-20 Points)	This assignment is designed to cause you to document what you currently believe is important for disaster recovery and the current project for this course. We will provide some initiation points for your effort through stakeholder engagement and we will rely on some students in the course who are repeating the class for their additional experience. This assignment forms the basis of your process of identifying realistic opportunities for improving the state of affairs, while considering both positive and negative impacts on other sectors, and the constraints inherent with limited access to standard infrastructures and resources. This shall guide subsequent research and problem solving. You might equate this effort to an annotated bibliography that precedes a literature review.
Conceptual Idea and Project Outlines (13-15% of Project, 20-30 Points)	By now you and your team have identified one or more exciting opportunities for addressing the aftermath of Hurricane Maria and you have initiated your research supporting your position. This assignment is designed to outline how you will tell your story in the form of presentations and outlines to your peers and collaborators. These conceptual ideas are developed early in the semester and provide a basis for considering how we may improve our ideas. Ideas continue to evolve from here.
Draft Project Reports (20% of Technology Assessment Project)	You present a draft of your project for instructor evaluation. Templates will be provided.
Near Final Project Reports (30% of Technology Assessment Project)	You will present a near final draft of your project. This is a ‘near final’ draft as some of your classmates will engage directly with our stakeholders during the study tour and they will revise and present the final draft for this term. The purpose of these project plans is to help you communicate your ideas to those who might collaborate with you in the future. These individuals include those are outside this class, but who might help you implement your project, those who might fund your project in the future, and future students in this class who will follow up on your legacy. This document will summarize your work after you have completed a semester of effort on this topic.

Sample Project Point Distribution Across Several Projects

Project	Background research	Conceptual Idea	Draft Review	Final Report	Total
Rainwater Harvesting Prototype	20	30	50	100	200
EPA P3 Proposal	20	30	50	100	200
Marketing Plan	15	20	40	75	150
Education Plan	15	20	40	75	150
Total	70	100	180	350	700

TABLE OF TOPICS AND CLASSROOM ACTIVITIES

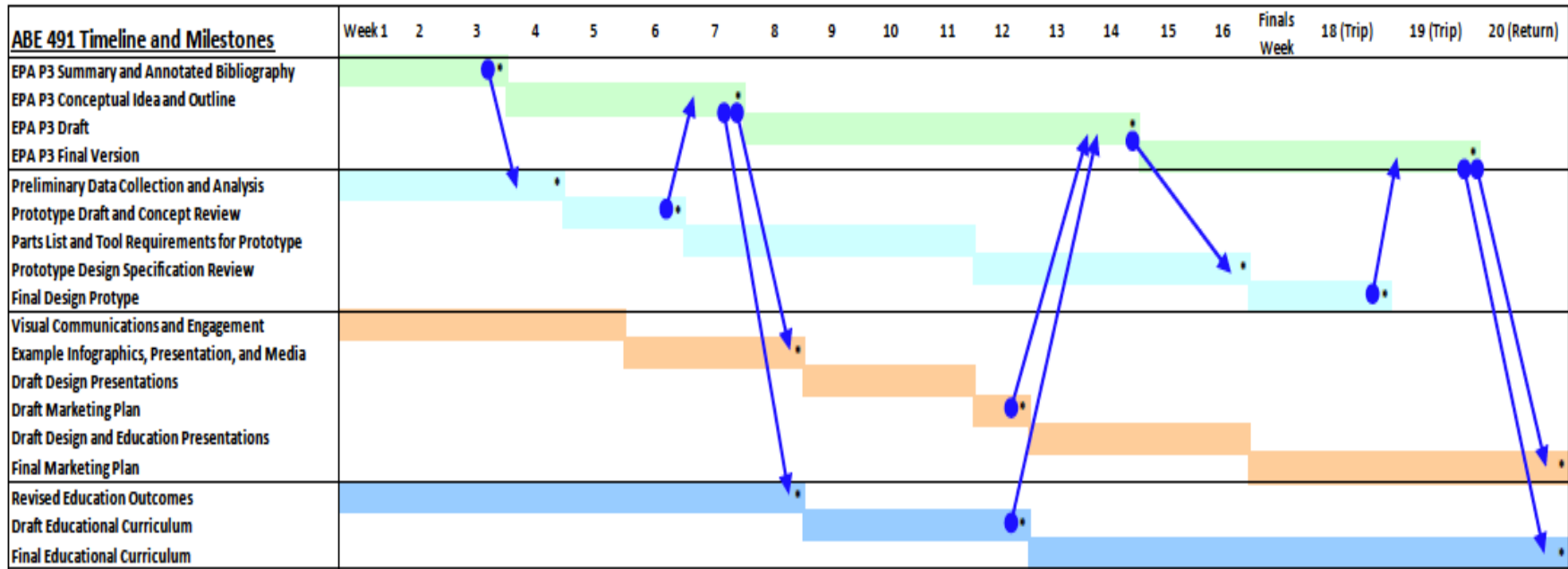
Typically delivered in two weekly class meeting, 80 minutes each

Topic	Contact Hours
Overview, classroom technology orientation	1.5
What is resilience?	1.5
Fundamentals of Probability	1.5
Fundamentals of Reliability	3.0
Sources and Types of Uncertainty	1.5
Quantification of Uncertainty Measures	1.5
Analysis of Uncertainty	3
Redundant and Non-redundant Systems	7.5
Design and Design Criteria in Uncertain Environments	1.5
Statistics of Extremes	4.5
After Great Disasters	1.5
Engineering in Context	1.5
Global Service Learning	1.5
Stakeholder Web Conferences	4.5
In class supervised group work	9
Total	45

SAMPLE COURSE CALENDAR

Week	ABE 491 (3 hrs)	
	Meeting 1 (80 minutes)	Meeting 2 (80 minutes)
1	Overview, classroom technology orientation	What is resilience?
2	Fundamentals of Probability	After Great Disasters
3	Stakeholder Web Conferences	In class supervised group work
4	Fundamentals of Reliability	Fundamentals of Reliability
5	Sources and Types of Uncertainty	Engineering in Context
6	Quantification of Uncertainty Measures	In class supervised group work
7	Analysis of Uncertainty	Analysis of Uncertainty
8	Redundant and Non-redundant Systems	In class supervised group work
9	In class supervised group work	Stakeholder Web Conferences
10	Redundant and Non-redundant Systems	Redundant and Non-redundant Systems
11	Redundant and Non-redundant Systems	Redundant and Non-redundant Systems
12	Statistics of Extremes	Statistics of Extremes
13	Statistics of Extremes	Design and Design Criteria in Uncertain Environments
14	Global Service Learning	In class supervised group work
15	In class supervised group work	Stakeholder Web Conferences

SAMPLE COURSE TIMELINE INCLUDING INTERRELATED TERM PROJECTS



* major assignments are starred

STANDARDS OF PROFESSIONAL BEHAVIOR

- Turn off your cell phone at the start of every class and during key events in Puerto Rico. Any exceptions require instructor approval.
- Critical thinking is expected and discussions reflect individual investment. Keep criticisms issue-based and factual. Personal attacks are not tolerated under any circumstances.
- Energy! We are actively working in each class period. You should arrive ready to work. Get your rest the night before. Stay up to date on your assignments.

ACADEMIC INTEGRITY

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <http://studentcode.illinois.edu/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

SPECIAL CONSIDERATIONS: CARING FOR YOUR HEALTH AND SAFETY

Diversity and Integration Statement

The Instructional Team is committed to the creation of a fully inclusive community that welcomes diversity and encouraged integration along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. We especially recognize that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, food, agriculture, or society writ large, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community. Indeed, the effectiveness of this course is dependent upon each of us fostering the creation of a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (<https://bart.illinois.edu/>). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible. To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should contact Disability Resources and Educational Services (DRES) (<http://www.disability.illinois.edu/>) and see the instructor as soon as possible. If you need

accommodations for any sort of disability, please speak to me after class, or make an appointment to see me, or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail a message to disability@illinois.edu.

Additional Statement on Accessibility during COVID-19

This semester presents new challenges for all of us, and many students may not know right away how COVID-19 requirements and procedures may affect their classroom experience. I am committed to working with you to create a rigorous and flexible space for learning. If at any time you are experiencing difficulty in any aspect of this course due to social distancing and the mandatory wearing of face coverings, you are welcome to share your concerns with me. Please note that you never need to share diagnosis or medical information with me. The staff members with Disability Resources and Educational Services and the Office for Access & Equity are also available to provide guidance and advice if you have questions or concerns related to a visible or invisible disability.

- Disability Resources and Educational Services (disability.illinois.edu)
- Office for Access & Equity (oe.illinois.edu)

Emergency Response Recommendations

Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class: <http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/>.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

Sexual Misconduct Policy and Reporting

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: <http://wecare.illinois.edu>.

Counseling and Personal Concerns

Successfully negotiating the demands of undergraduate classes, work, and life requires consistent attention. It's okay to seek professional help, and you just may acquire skills that will benefit every area of your life. The [University of Illinois Counseling Center](http://www.counselingcenter.illinois.edu) offers comprehensive services ranging from self-help materials to individual and couples counseling and suicide prevention, and features same-day appointments at no cost to you. Take advantage of them at before you get in over your head.