

ENGR 102: Engineering Freshman Academy Fall 2024

Sections: 28508 & 28632
Days/Times: 28508. Wednesdays 10:00–11:50AM
28632. Fridays 12:00–1:50PM
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Acknowledgements. This syllabus is modified from a version provided by Dr. Gisele Ragusa. Many teaching materials and presentations are provided by previous instructors of the ENGR 102 “Freshman Engineering Academy.” Specific citations attributing the original authors will be provided in the course materials. Note that weekly topics may change depending on the availability of guest lecturers.

Course Introduction

The primary purpose of Freshman Engineering Academy (ENGR 102) is to introduce first-year students to the “Viterbi Experience.” The faculty in the Viterbi School recognize that entering engineering, computer and materials science students are highly qualified to pursue undergraduate studies at Viterbi; and, that the identity of each student relative to any given major is important. Viterbi is a high-performance and academically demanding environment that will stretch the skill set of most students. Thus, a major focus of the course is to introduce students to subject matter, contexts, skills, experiences, faculty, advanced students, and staff that can assist in the onboarding undergraduate experience that is critical for all students as they are welcomed into the Trojan Family, and thereby situate students for success in Viterbi academic programs. This section of the ENGR 102 course content is positioned around three themes: (1) The multidisciplinary nature of modern engineering knowledge and links to computer science skills, (2) Research, and (3) Career Preparedness. Accordingly, the course topics are divided among these themes.

Course Objectives

The overarching context for exploring various aspects of one’s identity and skills at Viterbi will be the National Academy of Engineering (NAE) Grand Challenges and other contemporary global societal challenges including the UN Sustainable Development Goals, and opportunities and challenges in uses of artificial intelligence (AI). These challenges and opportunities are threaded throughout the course. Upon completion of the Academy, first-year Viterbi students will:

- **Demonstrate a better understanding of their ability to think like an engineer or computer scientist:** Viterbi students are problem-solvers, using multiple skills and strategies to identify and solve problems and address challenges.
- **Identify and systematically address societal and historical contexts for engineering, and computer science research and practice.** Complex disciplines of research and practice are influenced by, and thus not independent from people and organizations that determine their evolutions.
- **Reflect upon and initiate practice of the skills and strategies that shape the thinking and pursuit of a Viterbi undergraduate degree** via an inventory of unique offerings to the Viterbi School and USC including that which shapes students’ character development and career preparedness.
- **Develop, design and create a prototype of a potential solution for an engineering or computer**

science challenge through study and understanding of the NAE Grand Challenges and other contemporary societally relevant global engineering and computer science opportunities and challenges.

Assigned Readings, Materials and Platforms

There is no textbook for the course, however, required readings, viewings, and other course resources are available via web links on this dynamic syllabus, posts on Brightspace, and through USC email. Brightspace will be used for general announcements, for posting of course documents and information. Google docs are used for collaborative student group assignments.

Course Requirements, Structure & Grading Policy

This course includes one ~2-hr in-person class per week. The course also includes readings, videos, team/group or whole class discussions, team activities and projects, and mini lectures and presentations by faculty experts and other guest speakers. The course will be graded according to the following:

(1) Active Participation (10%)

Students are required to complete assigned readings, participate in discussions, respond to email requests, and act as responsible and respectful team members and colleagues with others in the class. Completion of all assigned readings, viewings and in-class assignments is **mandatory**. If you must miss a class or activity, please provide **advance notice** to your course instructor and Coaches. You are responsible for any information covered in a class you do not attend including completing any “in-class” activities prior to the next class session.

(2) Out-of-Class Lectures, Presentations, and Activities (10%)

Students are required to attend 2 *All Academy lectures or presentations*, participate in 1 *mentoring meeting* with the coaches, **and** attend 2 *USC/Viterbi events* from the following list: USC Visions and Voices event; Viterbi Career Connections or USC Career Center event; Viterbi/Department lecture, symposium, colloquium, or showcase; or a similar approved event. There may also be optional out-of-class coach-organized activities to respond to the needs/wants of students in this class. The purpose of these activities is to foster student growth, for students to get to know one another, and to learn more about the campus, student life, and engineering, computer science and materials science. Accordingly, missing these events is highly discouraged.

(3) Challenge Project and Associated Homework (80%)

A group (team) Challenge project and associated homework assignments are required and associated with our semester-long study of the National Academy of Engineering (NAE) Grand Challenges and other societally relevant globally focused opportunities and challenges (see below for components and point distribution of components).

(4) Replacement for ONE Out-of-Class Activity

Students may substitute **ONE Out-of-Class Activity** with participation in or completion of one or more substitute events or activities arranged with your coaches. Generally, it is preferred that *this option be used only in the case of emergencies or unforeseen circumstances*.

Grade Distribution

The final course grade will be computed from the assignments listed in the table below. Late assignments will receive a reduction of 5 points per day past the due date.

<i>Assignment</i>	<i>Due dates</i>	<i>Points</i>
Participation	Weekly	10
All-Academy lectures	TBD/As Scheduled	10
Outside-the-class activities	TBD/As Scheduled	
Challenge Group Project		80
Project Pitch (10 pts)	10/16 or 18/2024	
Project Report (30 pts)	12/04 or 06/2024	

<i>Assignment</i>	<i>Due dates</i>	<i>Points</i>
Final Project Presentation (30 pts) Group / Peer Assessment (10 pts)	Day of scheduled final Day of scheduled final	
TOTAL:		100

Grading Scale

The final grade for this course will be awarded using a typical grading scale.

A 94 -100	B+ 86 - 89	C+ 75-79	D+ 65-60
A- 90- 93	B 83 - 85	C 73-74	D 62- 64
	B- 80 - 82	C- 70-72	D- 61 and below

Assessment of Engaged Participation

Students’ engaged participation in the course will help create a meaningful learning experience for all. Engaged participation enhances learning of new content and skills and will supports success on graded assignments. The following rubric summarizes the behaviors to employ in order to exhibit engaged participation.

	<i>Engaged Participation</i>	<i>Moderate Participation</i>	<i>Limited Participation</i>
Preparation	Exhibits evidence of having completed all readings & activities according to guidelines assigned	Attempts to participate but is inhibited due to partial completion of reading assignments & activities	Exhibits lack of preparation and non-completion of required assignments
Initiative	Initiates discussion & supports points using specific references to readings/materials	Occasionally initiates discussion, however, uses general, unspecific references to readings/materials	Rarely initiates discussion & doesn’t reference required readings/materials
Engagement	Furtheres class discussion & builds on peers ideas; comments & questions reflect deep thought about materials	Occasionally builds on peers’ ideas but includes limited references to materials	Comments do not further class discussion & limit thoughtful reflection on materials

An end-of-project group/peer assessment will ask each student to provide feedback on the function of their team and the engagement and contribution of their team members. The instructors will determine the “group/peer assessment” portion of the project grade using this feedback.

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university’s mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#).(2024) All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication

(e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage. The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Policy on Use of Artificial Intelligence (AI) in this Course

In this course, you **are** permitted to use artificial intelligence (AI)-powered programs to help you with assignments. You MUST explicitly acknowledge when you use AI in course assignments and in your project reports. However:

- (1) You should also be aware that AI text generation tools may present incorrect information, biased responses, and incomplete analyses; thus these tools are not yet sufficiently advanced to produce text that meets the standards of this course. You are responsible for ensuring the accuracy and completeness of any materials that you submit for the course.
- (2) To adhere to our university values, **you must cite any AI-generated material (e.g., text, images, and other content) included or referenced in your work and provide the prompts used to generate the content.** Using an AI tool to generate content without proper attribution will be treated as plagiarism and reported to the Office of Academic Integrity.

Please review the instructions in each assignment for more details on how and when to use AI Generators for your submissions.

Incompletes

An incomplete (IN) is given when work is not completed because of documented illness or some other emergency occurring after 80% of the course has been completed. Arrangements for the IN and its removal should be initiated by the student and agreed to by the instructor prior to the final exam. The University policy on IN is detailed in the USC Catalogue.

Illnesses and Emergencies

In this course, students are expected to attend class in person. Students who miss class due to illness or other emergencies are expected to make up missing classwork; if medical issues arise that preclude meeting the published deadlines, please contact the instructors as soon as possible.

University Emergencies and Course Continuity

During an emergency, USC will post emergency announcements on this website: <https://emergency.usc.edu>. USC Safety has guidelines for emergency preparedness for fire, earthquake or active shooter situations: <https://safety.usc.edu/emergency-preparedness/>.

GRAND CHALLENGES FOR ENGINEERING – BACKGROUND AND CONTEXT

The National Academy of Engineering has identified 14 “Grand Challenges” for engineering in the 21st Century (<http://www.engineeringchallenges.org/>). These Grand Challenges are:

- Make solar energy economical
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure

- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools of scientific discovery

These 14 Grand Challenges are classified as belonging to four categories: sustainability, health, security, and enriching life and represent societally relevant engineering issues which, when addressed, will greatly improve global society.

UN SUSTAINABLE DEVELOPMENT GOALS

The United Nations' Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges that the world faces, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. The 17 Sustainable Development Goals are interconnected, and in order to leave no one behind, it is important that we achieve them all by 2030. <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Goal 1: No Poverty: Donate what you don't use; there are more than 700 million people living in poverty spanning the globe.

Goal 2: Zero Hunger: Waste less food and support local farmers; One third of the world's food is wasted yet 821 million people are undernourished world-wide.

Goal 3: Good Health and Wellbeing: Vaccinate families; vaccinations resulted in an 80% drop in measles related deaths between 2000 and 2017

Goal 4: Quality Education: Help educate children in communities; 617 million children and youth lack proficiency in mathematics and reading world-wide.

Goal 5: Gender Equality: Empower women and girls and ensure their equal rights; one in three women has experienced physical and or sexual violence.

Goal 6: Clean Water and Sanitation: Avoid wasting water; water scarcity impacts more than 40% of the world's population.

Goal 7: Affordable and Clean Energy: Use only energy efficient appliances and bulbs; three billion people world-wide lack clean cooking fuels and technologies.

Goal 8: Decent Work and Economic Growth: Create job opportunities for youth; one fifth of young people across the globe are not in education, employment or training.

Goal 9: Industry, Innovation and Infrastructure: Fund projects that provide basic infrastructure; roads, water and electricity remain scarce in many developing countries.

Goal 10: Reduced Inequalities: Support the marginalized and disadvantaged; the poorest 40% of the population earn less than 25% global income.

Goal 11: Sustainable Cities and Communities: Bike, walk or use public transportation; Nine of ten urban residents world-wide breathe polluted air on a regular basis.

Goal 12: Responsible Consumption and Production: Recycle paper, plastics, glass and aluminum; by 2050 the equivalent of almost three planets may be required to sustain current lifestyles.

Goal 13: Climate Action: Act now to stop global warming; global emissions of carbon dioxide (CO₂) have increased by nearly 50% since 1990.

Goal 14: Life Below Water: Avoid use of plastics to keep the oceans clean; over three billion people depend on marine and coastal biodiversity for their livelihoods.

Goal 15: Life on Land: Plant a tree and help protect the environment; forests are homes to more than 80%

of terrestrial species of animals, plants and insects.

Goal 16: Peace, Justice and Strong Institutions: Stand up for human rights; in 2017 the number of people fleeing war, persecution and conflict exceeded 70 million.

Goal 17: Partnerships for the Sustainable Development Goals (SDGs): Lobby and educate your government to boost development financing; achieving the SDGs could open up \$12 trillion (US) of market opportunities and create 380 million new jobs world-wide by 2030.

DATA SCIENCE/ ARTIFICIAL INTELLIGENCE IMPACT PROJECT

Students may select to engage in a project in which they utilize data science, artificial intelligence and/or machine learning to design and “prototype” a solution to a challenge using applied data science, artificial intelligence or a combination therein.

CHALLENGE TEAM PROJECT DESCRIPTION

This course will have one culminating project, the Challenge Team Project. This project will span most of the semester and class sessions will successively provide students with opportunities to practice key skills that will operationalize development of components of the project. The Challenge project is a group project, composed of ~ 4 students per group. The main focus of the project is to: (a) identify a significant problem within one of the NAE Engineering Grand Challenges, challenges related to application and use of data science, machine learning and/or artificial intelligence, or UN Sustainable Development Goals; (b) develop a plan for an innovative solution to the problem; and (c) create a video or other multimedia presentation to present the group’s ideas and solution to the class. The project should make use of equipment in the Viterbi School’s new Baum Family Maker Space (BFMS) — e.g., 3-D printing, milling machines or lathes, waterjet cutter, etc. or engage with the use of DS or AI— to create a physical or virtual prototype, product or part related to solutions for one of the afore-mentioned challenges developed by the group. Ideally, each group should partner with two other groups who are using different equipment from the BFMS posed as a potential solution to the same selected challenge.

ENGR 102: TENTATIVE WEEKLY COURSE SCHEDULE

Note. Due to University holidays or scheduling of Guest Lecturers, this schedule may be modified during the semester. Changes to the schedule will be posted on Brightspace as early as possible.

Week	Instructor Lead	Topic/Module	Assignment Due	In-Class Activity	Coaches Activity (to be adjusted per coaches)
1 (8/28 or 30)	JMai	1. Course Introduction / NAE Grand Challenges. Differences between Engineering and Science.		Introduce Your Colleagues Discuss GCs etc.	Get-to-know-you Activity
2 (9/4 or 6)	JMai	2. Problem Solving, Innovation & Design Processes	2–3 Challenges of Interest	Brainstorm of Innovation/ Design for challenges	Icebreakers and Survival Skills
3 (9/11 or 13)	Guests: Dr. Trina Gregory & USC Marshall students	Part 1. Entrepreneurship Education (VSEE)		Overview of entrepreneurial education	VSEE
4 (9/18 or 20)	Guests: Dr. Trina Gregory & USC Marshall students	Part 2. Entrepreneurship Education (VSEE) Part 2	Draft plan business / marketing / customer discovery		VSEE
5 (9/25 or 27)	BFMS Staff/Faculty-In Maker Space	Viterbi Maker Space Part 1	Team Project Group Selection	Tour of Maker Space	Maker Space Safety Training
6 (10/2 or 4)	BFMS Staff: In Maker Space	Maker Space Part 2: 3-D Printing	Team Assessment Part 1	“Maker” Training and Practice	Group Work in BFMS
7 (10/9 or 11)	JMai	Lecture. Little things can have a big impact in engineering.	TBD. Video links posted on Brightspace	Discussion linking the various engineering majors together.	TBD
8 (10/16 or 18)	JMai	Collaboration & Teamwork (aka Pirates vs. the Royal Navy)		Team Project Pitches	Hands on team building
9 (10/23 or 25)	JMai	Systems Thinking. Engineering Examples	Multimedia Project Pitch	Ask me anything about engineering (e.g. feedback on your pitches)	10:00 AM: Study and Productivity Tips 1:00 PM: Midterms + Sophomore year 101 (housing, etc.)
10 (10/30 or 11/1)	Ragusa	Ethics for Engineers & Computer Scientists		Case-based Ethics Team Study	Coaches work with case study teams

11 (11/6 or 8)	Science & Engineering Librarians/ TBD	Research & Library Resources		Tour & Practice: Library Resources	Coaches help with library resources
12 (11/13 or 15)	JMai	Can you identify a good idea? Stories about technology pivots.		Discussion about unknowns and knowledge gaps (for your projects).	10:00 AM: Class registration for spring + clubs for next semester 1:00 PM: Viterbi Student Panel
13 (11/20 or 22)	JMai	Can you identify the winner? Examples from life.			10:00 AM: Ask me anything 1:00 PM: DISC personality assessment & activity
14 (11/27 or 29)	JMai	Life after engineering school.			10:00 AM: Paper airplane competition 1:00 PM: Engineering show & tell
15 (12/4 or 6)	JMai	14. Student selected topic(s)	Project Report		10:00 AM: Housing + other university experiences 1:00 PM: Jeopardy about coaches, Viterbi & general trivia
Final	JMai	Final Presentations TBD Wednesday 11AM section: ???? Friday Noon section: ???? Team Assessment Part 2			

Assignments are *in addition* to any required readings/viewings listed on the detailed outline below.

Statement on Academic Conduct and Support Systems

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osas-frontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

<https://sites.usc.edu/counselingandmentalhealth/>

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

988lifeline.org

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call

<https://sites.usc.edu/clientservices/>

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

eotix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

osas.usc.edu

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu

chan.usc.edu/patient-care/faculty-practice

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

COURSE CONTENT & MODULES: WORKING DESCRIPTIONS

Introduction to the Academy, NAE Grand Challenges, Heroic & Humanitarian Engineering

Purpose

This introductory module provides an overview of the Academy, course assignments and activities, an introduction to the course instructors, coaches, and an overview of course tenets including the challenge team projects, Grand Challenges and heroic engineering. In particular, this module contains an overview of the Challenge Team project and therefore introduces Academy students to the NAE Grand Challenges, the UN Sustainable Development Goals, Opportunities and Challenges with Entrepreneurship and Artificial Intelligence (AI). It prompts a discussion of how the Challenges were determined and societal relevance to engineering and computer science. Each Academy student will identify 1-3 challenges and briefly share why these challenges have been selected and why they are important to you. Students will be grouped (with self-selection) from this idea share.

Objectives

Upon completion of this module, Academy students will:

- Understand the guidelines and expectations for all assignments.
- Reflect on and communicate in interests in engineering, materials science, and computer science prior to entering the Viterbi School.
- Meet other first-year Viterbi students and engage in activities that foster engagement and shared understandings with classmates.
- Demonstrate familiarity with the NAE Grand Challenges, UN Sustainable Development Goals, data science and artificial intelligence opportunities and challenges, and identify one to three Challenges of interest, explaining what piques that interest.
- Establish a prioritized list of challenges and associate a time frame for meeting a challenge.
- Begin to select group members with whom they will work on their team challenge project.

Required Reading, Viewing

USC Viterbi Undergraduate Handbook

<https://online.flippingbook.com/view/948459/>

NAE Grand Challenges for Engineering: <http://www.engineeringchallenges.org/>

UN Sustainable Development Goals: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Tasks

1. Ask questions and engage in discussion about course requirements, assignments and expectations.
2. Engage in conversation about career objectives and other key characteristics of course peers.
3. Compile a list of 2-3 Grand Challenges, UN Sustainable Development Goals of interest or a DS/AI related opportunity or challenge.
4. Brainstorm on potential solutions for selected challenges.

Problem Solving, Innovation and Design Processes

Purpose

This module requires students to engage in engineering and computer science problem identification, iterative design processes and employ the use of innovation and solution planning. The intent is to encourage Academy students to consider problem, innovation, and solution spaces as important mechanisms for structuring design for engineering and computer science solutions. Problem-based and project-based learning will be reinforced to offer perspectives on paths and places in a search space. Design thinking and innovation are essential components of societally relevant problem solving processes and the character

development of a practicing engineer or computer scientist.

Objectives

Upon completion of this module, Academy students will:

- Understand and articulate a variety of problem solving strategies
- Explore and practice problem solving and associated iterative design processes.
- Compare and contrast design models, innovation and problem solving
- Explain why iterative design & innovation help a problem solver to expand their understanding of addressing complex situations.
- Explain how human/citizen centric design assists engineers and computer scientists in professional character development

Required Reading, Viewing

Purdue University EPICS Design Process (community focused with humanitarian engineering design)- Please read and review the content at the weblink below:

<https://engineering.purdue.edu/EPICS/k12/epics-k12/epics-design-cycle>

Please review the engineering problem solving and design cycle models at the link below. Be prepared to compare their similarities and differences.

(see Brightspace link and course content tab)

Please review the NAE Grand Challenges and the UN Sustainable Development Goals (under the course assignment button)

Tasks

1. Compare design processes, innovation and problem solving
2. Begin the iterative process of problem identification.
3. Initiate a “first try” (preliminary) problem identification brainstorm.
4. Explore and meet with other groups addressing the same chosen Challenge to begin to identify and plan for group membership, project synergies and solution connections.

Maker Spaces and Designing for Solutions

Purpose

These two modules are associated with Viterbi’s new Baum Family Maker Space (BFMS). The Academy students will receive a tour of BFMS and will learn how to use and practice computer assisted design software to create a prototype of a potential solution (or portion of) for their Challenge project. Students will work in groups (teams) to iteratively design and then 3D print their prototype (with BFMS staff assistance) and or work to incorporate DS and AI into a prototype.

Objectives

Upon completion of these two modules, Academy students will:

- Design, create and print (with assistance) a 3- dimensional prototype of the potential solution for their Challenge project OR
- Design and create a virtual prototype that demonstrates a solution to a data science or artificial intelligence related human /societal opportunity or challenge.
- Effectively use Fusion 360 software to prototype their solution for their group Challenge project (unless teams select DS/AI project).

Required Reading, Viewing

- BFMS virtual tour videos

- Fusion 360 software (free) download: <https://www.autodesk.com/campaigns/education/fusion-360>
- Basic Fusion 360 tutorial 1: <https://academy.autodesk.com/course/129267/introduction-cad-learn-fusion-360-90-minutes>
- Basic Fusion 360 tutorial 2: <https://academy.autodesk.com/course/126271/introduction-3d-modeling>
- In-depth CAD/CAM intro: <https://academy.autodesk.com/course/132727/fusion-360-introduction-cadcam>
- SolidWorks Tutorial (see Viterbi PDF on Brightspace using the Viterbi Virtual Desktop Interface)

NOTE: All students will be required to learn and use Fusion 360 or SolidWorks software regardless of the nature of their challenge project.

Tasks

1. Review the CAD/CAM intro.
2. Review all Maker Space virtual tours.
3. Complete the tutorials for the Fusion 360 or SolidWorks software.
4. Collaboratively design and develop the Challenge prototype using Fusion 360 or SolidWorks.
5. Work with the Maker Space staff to print the prototype in 3-D OR
6. Design and create your AI/AI Challenge solution
7. Work with other groups to merge Challenge project solution parts for a more comprehensive solution.

OPTIONAL: Data Science and Artificial Intelligence Part 1

Purpose

In computer science and engineering practice, there are significant opportunities and challenges in the use of data and artificial intelligence. Data science (DS) and artificial intelligence (AI) can be very helpful in both computer science and engineering in creation of solutions to every day human related challenges, however challenges often emerge from such efforts. This module focuses on an introduction and overview of data science and artificial intelligence in the world and provides an introduction to conceptual understanding of DS and AI.

Objectives

Upon completion this module, Academy students will:

- Identify and explain key concepts in Data Science (DS) and Artificial Intelligence (AI)
- Identify some of the societal opportunities and challenges with the use of AI and DS
- Apply AI and DS to a challenge that is evident in contemporary society

Required Reading, Viewing, or Browsing

[https://urldefense.com/v3/https://youtu.be/G4A73Ht6l6U_!!Lr3w8kk_Xxm!tOkqEewpv4D3Y8QlgQddh4-qfrfUI8-9caoMAt0KZQyPUcckRi0bcw2tjY9YhEun3_OcUyb\\$](https://urldefense.com/v3/https://youtu.be/G4A73Ht6l6U_!!Lr3w8kk_Xxm!tOkqEewpv4D3Y8QlgQddh4-qfrfUI8-9caoMAt0KZQyPUcckRi0bcw2tjY9YhEun3_OcUyb$)

Tasks

1. Explore how AI and DS is implemented in solving real engineering problems.
2. Practice identifying the strengths, opportunities, and challenges of using AI and DS in addressing societal issues.

Undergraduate Research and Use of Library Resources

Purpose

This module enables Academy students to initiate research using USC's electronic library resources with a focus on the Challenge project for the course. A guest library faculty expert will introduce and facilitate practice of using library resources that have been specifically curated for the ENGR 102 course and focused on the Challenge project.

Objectives

Upon completion of this module, Academy students will:

- Explore and examine science and engineering library resources with foci on the group Challenge project.
- Use the library resources as a means of supporting their design and prototyping of their Challenge solution.

Required Reading, Viewing

ENGR Freshman Academy Research Guide: <https://libguides.usc.edu/ENGRACAD>

Tasks

1. Explore the ENGR 102 library e-resources (and beyond).
2. Identify and research resources appropriate for the Challenge group project.

Collaboration/Team Building

Purpose

This module explores and provides guided practice on effective ways to collaborate with others to achieve engineering and computer science solutions. As engineers and scientists, we should recognize that the amount of content, skill, and experience needed to address complex problems and challenges often requires more than any one individual may offer. Thus, a better result is often achieved through group collaboration. Moreover, such group processes affords engineers and computer scientists with opportunities to engage in professional character development as practitioners and researchers.

Objectives

Upon completion of this module, Academy students will:

- Practice opportunities to leverage group dynamics and learning to achieve a result with focus on team challenge project.
- Reflect on what facilitates optimal productive group collaboration (and what limits such production).
- Determine which collaborative practices will best meet their challenge team's needs

Required Reading, Viewing, or Browsing

Group Challenge Presentation Specifics Document
(see Brightspace link and course content tab)

Tasks

1. Engage in a collaboration exercise as a means to understand the elements necessary to be a productive team/group member.
2. Meet with challenge project groups and assess how well the group functions so far in the course. Engage in respectful, constructive, and collaborative practices!
3. Allocate project tasks within your group and discuss the degree of cooperation between team members in performance of these tasks.

Systems Thinking

Purpose

Very often in engineering practice, the true cause of a problem, or the approach to solve it, are not readily apparent. This module will introduce Academy students to the *Soft Systems Methodology* (SSM): an action research process for engaging different individuals and groups in making sense of problem solving and design.

Objectives

Upon completion this module, Academy students will:

- Identify and explain the seven aspects of the SSM, pioneered by Peter Checkland.
- Apply the concept of systems thinking and theory to study at Viterbi and to their Challenge project.

Required Reading, Viewing, or Browsing

An Overview of the Soft Systems Methodology, Stuart Burge
(see Brightspace link and course content tab)

Tasks

1. Explore how SSM can be implemented in solving real engineering problems.
2. Practice use of SSM with group members.

Dr. Ragusa. Engineering and Computer Science Ethics

Purpose

This module is intended to explore various dimensions of engineering and computer science ethics with foci on moral, rational, and legal perspectives using a case study approach. Various multi-dimensional engineering and computer science case studies involving ethical dilemmas will be explored and resolutions will be developed.

Objectives

Upon completion of this module, Academy students will:

- Recognize that human and societal issues influence the manner in which temporal, financial, intellectual, social, and political assets are allocated to engineering and computer science projects.
- Identify the ethical issues in contemporary case studies that impact multiple stakeholder groups.
- Articulate the influence that role morality, professional systems, one's character and personal experience play in ethical decision making.
- Propose potential solutions for ethical dilemmas in engineering and computer science cases that consider national engineering standards, as well as multiple professional and societal perspectives and stakeholder groups.

Required Reading, Viewing, or Browsing

National Society of Professional Engineers Code of Ethics

<https://www.nspe.org/resources/ethics/code-ethics>

Online Ethics Center for Science and Engineering: <http://www.onlineethics.org/>

Tasks:

1. Identify/discuss a case(s) where the attention to ethical considerations was questionable.
2. Engage in group case study analyses with group role play.

3. Propose potential solutions for ethical dilemmas from multiple perspectives and with accountancy for stakeholder groups.

(VSEE) Entrepreneurship in Engineering and Computer Science Contexts

Purpose

These two modules are intended to provide Academy students with a general understanding and practice of entrepreneurship. The first class provides an introduction to entrepreneurship education and the second session provides students with business planning practice. USC's Marshall School of Business MBA students co-facilitate these sessions.

Objectives

Upon completion of these two sessions, Academy students will:

- Identify and explain key components of entrepreneurship.
- Pitch an (work in progress) idea for the Challenge project.
- Draft a business plan associated with the Challenge project.

Required Reading, Viewing

Key components of a business plan (see handout on Brightspace)

Tasks

1. Practice pitch protocols with VSEE guidance.
2. Draft a mini business plan for the Challenge project.

OPTIONAL. Viterbi Merit Programs-Research Opportunities, GCS, Honors

Purpose

This module provides information about key merit focused opportunities available to Viterbi undergraduate students. Expert faculty will present/discuss the NAE Grand Challenges Scholars Program, the Viterbi Honors Program, and Viterbi's Undergraduate research opportunities.

Objectives

Upon completion of this module, Academy students will:

- Understand the requirements to participate in the Viterbi special merit programs.
- Make informed choices about what future Viterbi programs that they may be interested in participating with.

Required Reading, Viewing, or Browsing

The Viterbi undergraduate website: viterbiundergrad.usc.edu/

Tasks

1. Explore the Viterbi website with special attention to the undergraduate merit programs
2. Prepare questions about programs of interest.
3. Make a plan for achieving the requirements for participating in the Viterbi merit based program of choice.

Group Project. Student Topic(s) of Choice

Purpose

This module provides information about topics that are of student choice. These topic(s) will be selected

by students in the beginning weeks of the semester and will be addressed either by the instructors or guest experts (depending on student choices).

Objectives

Upon completion of this module, Academy students will:

- Have a general understanding of the topics that students have selected.

Required Reading, Viewing, or Browsing

TBD (depending on topics of choice)

Tasks

1. Students will select topics early in the semester.
2. Topics will be chosen for presentation based on majority student selection.