



School of Engineering

ENGR 102
Engineering Freshman Academy

Units: 2.0
Semester: Fall 2019
Section: 28636
Day: Tuesday
Time: 1:00 – 2:50 p.m.
Location: RTH 115

Instructor: Trina Gregory
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Hours of Service: 8am–5pm M–F
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Course Description

The primary purpose of the USC Viterbi Freshman Engineering Academy is to introduce first-year students to the “Viterbi Experience.” The faculty and staff at the Viterbi School understand that entering engineering, computer science, and materials science students are highly qualified to pursue undergraduate studies at Viterbi. We also understand that the identity of each student relative to any given major is important. Viterbi is an extremely high-performance and demanding environment that will stretch most students. A major focus of the course is to expose each Freshman student to a variety of subject matter content, contexts, skills, experiences, faculty, Academy coaches, and staff that can help the process of “sensemaking” that is so critical for each and every student as she or he is welcomed into the Trojan Family.

Learning Objectives and Outcomes

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. Of the 15 weeks in the Freshman Academy Course, Week 2 will be devoted to the exploration and discussion of these Grand Challenges and their potential impact on society and the Viterbi student. The Challenges will be threaded throughout the remaining weeks of the course. Each instructor may identify one or more Grand Challenges in their section of the Academy and it is expected that other related topics will be introduced to support an understanding of the Challenges. Upon completion of the Academy, first-year Viterbi students should be able to:

1. **Demonstrate a better understanding of their ability to think like an engineer, computer scientist, or material scientist:** Viterbi students are problem-solvers using multiple problem-solving techniques and strategies to identify not only problems and solutions, but also families and spaces of problems and solutions.
2. **Identify the societal and historical context of the research and practice of engineering, computer science, and materials science.** Complex disciplines of research and practice are influenced by, and thus not independent of, people and organizations that determine their evolutions.
3. **Reflect upon the skills and experiences that shape the thinking and pursuit of a Viterbi degree** via an inventory of one’s own palette of unique offerings to the Viterbi School and USC.
4. **Explore the Engineering Habits of Mind** that help frame the study, research, and practice within the domains of study at the Viterbi School.
5. **Demonstrate a general understanding of engineering, computer science, or materials science and its potential by understanding the NAE Grand Challenges** by reinforcing the Grand Challenges Scholars Program Competencies: Research/Creativity, Multidisciplinarity, Business/Entrepreneurship, Multiculturality, Social Consciousness.

Prerequisite(s): none

Course Notes

All course material will be on Blackboard (<http://blackboard.usc.edu>).

Required Readings and Supplementary Materials

There is no textbook for the course, however comprehensive reading, viewings, and other course resources may be available via posts on Blackboard and given in class.

Description and Assessment of Assignments

The course may also include readings, videos, podcasts, team or group and whole class discussions, team activities or projects, and lectures by experts and other guest speakers. The course will be graded according to the following:

(1) Active Participation & Class Attendance (30%)

Students are required to participate in discussions, respond to email requests, and act as responsible and respectful team members and colleagues to others in the class. Completion of all in-class assignments is **mandatory**. If you plan on missing a class meeting 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.

(2) Outside-the-Class Activities (30%)

Students are required to participate in 2 of 3 large (All Academy) lectures and attend 3 of 4 outside-the-class activities planned by Coaches (including a one-on-one meeting with a Coach).

(3) Project(s) (40%)

A limited number of Project assignments will be required, due the day before specific classes via submission on Blackboard or other means as determined by your faculty. Please follow USC's guidelines on academic integrity across the entire content of the class (from homework assignments to exams). Individual and collaborative (i.e. team-oriented) Project assignments will be completed during the semester that is aligned with one of the 14 NAE Grand Challenges. **This projects will be determined by the class/group in discussion with one another and in consultation with the course instructor and the Coaches.**

(4) Replacement for ONE Outside-the-Class Activity

Students may substitute ONE Outside-the-Class Activity with participation in ONE or more career-related events sponsored by the office of Student Engagement and Career Connections. Students will be required to submit a 2-3-page, double-spaced, American Psychological Association (APA)-style reflective paper OR a four-to-six-minute color video describing the career-focused event and have it signed off by the appropriate Career Connections staff. Check with your Coaches for recommendations and the instructor for hints on APA formatting requirements for papers.

Grading Breakdown

The final course grade will be computed from the assignments listed in table below.

Assignment	% of Grade
Participation and Attendance	30
Outside the Class Activities	30
Assignments	40
TOTAL	

Grading Scale

Course final grades will be determined using the following scale:

A 95–100	B+ 86–89	C+ 76–79	D+ 66–69
A- 90–94	B 83–85	C 73–75	D 63–65
	B- 80–82	C- 70–72	D- 60–62

Assignment Submission Policy

Submission due dates will be posted on Blackboard. Late assignments will receive a reduction of 5 points per day past the due date.

Assessment of Active Participation

Your active participation will help create a meaningful learning experience for your peers, and your instructor. Active participation enhances your ability to learn new concepts and to demonstrate your learning in ways that will support your success on graded assignments. The following rubric summarizes the behaviors to employ in order to exhibit active participation.

	<i>Active Participation</i>	<i>Moderate Participation</i>	<i>Low Participation</i>
Preparation	Exhibits evidence of having completed all reading/viewing assignments and activities according to guidelines that were assigned	Attempts to participate but sometimes inhibited due to apparent lack of completion of reading assignments and activities	Exhibits lack of preparation and non-completion of required assignments
Initiative	Initiates discussion and supports points using specific references to readings or other materials	Sometimes initiates discussion but may use more general references to readings	Rarely initiates discussion and unable to reference required readings or other materials
Engagement	Furthers the discussion and builds on the ideas of others; comments and questions reflect having thought deeply about the material	Sometimes builds on the ideas of others but more opinion based and limited references to course materials	Comments do not further the discussion, do not exhibit careful reflection on the material, or have an arbitrary quality

Assessment of Assignment Quality

The following rubric provides a guide as to how the quality of completed assignments will be evaluated.

	<i>Excellent</i>	<i>Acceptable</i>	<i>Unsatisfactory</i>
Depth of thought	Shows evidence of depth of thought in preparation, intellectual curiosity, adequately supported arguments, and clarity of presentation	Evidence that thought and attention given were insufficient; evidence in support of argument may be lacking to make persuasive presentation	Not evident that serious thought went into preparation
Connection to readings	Assignment demonstrates knowledge of concepts course readings and integrates course content in an appropriate manner	Some parts neglect important concepts presented in the course readings or discussion, or the concepts are integrated in an inaccurate manner	Fails to relate to course materials or demonstrate knowledge of course content
Completeness	All parts of the assignment are done completely and according to guidelines provided for the assignment	All parts done completely, however, lacks adherence to guidelines in some areas	Assignment is not entirely complete and/or shows marked lack of adherence to guidelines
Growth	Highly responsive to feedback from peers and instructors. Substantive revisions in content and format demonstrate willingness to rework ideas and presentation.	Modest revisions in content and format, or revisions don't have a substantive impact on the overall communication of ideas in the document.	Little to no evidence of integration of changes in content or format in response to feedback.

Course Schedule: A Weekly Breakdown

	Module	Assignments/Activities (during class)	Assignment Due (the day before class) *
Week 1 Aug 27	Academy Introduction	Course Review & Name Game	
Week 2 Sep 3	NAE Grand Challenges	Discuss GCs	
Week 3 Sep 10	Problem Finding/Solving and Creativity		2-3 GCs of interest
Week 4 Sep 17	Collaboration	Teamwork Exercise	
Week 5 Sep 24	Research and Information Seeking	Library Resources, Resume critique & career fair preparation	Resume Draft
Week 6 Oct 1	Systems Thinking		Articulation of Problem
Week 7 Oct 8	Ethical Considerations		
Week 8 Oct 15	Communication		
Week 9 Oct 22	Thinking Across Disciplines	Oral presentations of Infographics	Infographics
Week 10 Oct 29	Optimism and Design Thinking		
Week 11 Nov 5	Innovation and Entrepreneurship		
Week 12 Nov 12	Innovation and Entrepreneurship		Innovation Pitch
Week 13 Nov 19	Reflection		
Week 14 Nov 26	NO CLASS	Thanksgiving!	
Week 15 Dec 3	Final Presentations	Oral Presentations	

* These are **in addition** to any required readings/viewings listed on the detailed descriptions in this syllabus.

Course Content & Modules: Detailed Descriptions

The National Academy of Engineering (NAE) Grand Challenges will be discussed and Academy students will be asked to identify Challenges that are most interesting. Problem solving will be addressed with a focus on the need to examine and articulate problem-solving techniques. Through this course, the Grand Challenges will be used to explore the many disciplines in engineering, material science, and computer science.

We will also discuss the Engineering Habits of Mind: Systems Thinking, Creativity, Optimism, Collaboration, Communication, and Ethical Considerations. We ask Academy students to adopt the role and mindset of a professional materials scientist, computer scientist, or engineer. Thinking and sharing ideas about the professional side of Viterbi studies will better prepare Academy students for future job, internship, and research opportunities.

The Viterbi school has identified several skills and experiences that Academy students may develop and employ in their studies, practice, and investigations. Increasingly Viterbi students all need advanced skills and experiences to add value to the more traditional engineering, computer science, and materials science skills. We will focus on research and information seeking, thinking across disciplines, innovation and entrepreneurship, design thinking, and reflection.

Academy Introduction

Purpose

This class will provide an overview of the Academy, assignments and activities and an introduction to your instructor, Coaches, and guest experts you will encounter in the course.

Objective(s)

Upon completion of this class, Academy students should be able to:

- Understand the guidelines and expectations for all assignments.
- Reflect on interests in STEM prior to entering the Viterbi School
- Meet other first-year Viterbi students and engage in activities that foster interactions among classmates.

Required Reading, Viewing

USC Viterbi Undergraduate Handbook

<http://viterbiadmission.usc.edu/wp-content/uploads/2019/06/Viterbi-Undergraduate-Handbook-2019.pdf>

Task(s)

1. Ask questions and engage in discussion about course assignments and expectations.
2. Engage in conversation about what it means to be an engineer and what skills/traits are important to be a successful engineering student and practitioner.

The National Academy of Engineering (NAE) Grand Challenges

Purpose

This class will introduce Academy students to the NAE Grand Challenges and prompt a discussion of how the Challenges were determined. Each Academy student will identify 1-3 Challenges and briefly share why these Challenges have been selected and why they are important to you.

Objective(s)

After completing this class, Academy students should be able to:

- Demonstrate familiarity with the NAE Grand Challenges and identify one to three Challenges of interest and explain what piques that interest.
- Attempt to establish a prioritized list of Challenges and associate a time horizon for meeting those Challenges. How long will be required to make substantial progress on these challenges?

Required Reading, Viewing

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

Task(s)

1. Compile a list of 2-3 Grand Challenges of interest.

Problem Finding / Solving and Creativity

Purpose

This class will ask students to think deeply about problem finding and solving. The intent is to encourage Academy students to consider problem and solution spaces as important ways to structure the task of searching for problem and solutions. Problem-based and project-based learning will be reinforced to offer additional perspectives on paths and places in a search space. Creativity is an essential part of the problem solving process. Creativity abounds in ALL of the disciplines of computer science, materials science, and engineering. How may creativity be evoked to allow us to explore various problem and solution spaces using science, mathematics, computation, and technology?

Objective(s)

After completing this class, Academy students should be able to:

- Understand a variety of problem solving strategies: e.g. Visualization, Means Ends Analysis, Hill Climbing, Forward and Backward Chaining.
- Explain why problem solving & creativity help a problem solver creatively expand their understanding of addressing complex situations, and how to harness creativity to augment the problem solving process.
- Acknowledge that creativity may be demonstrated by ALL Viterbi students, and discuss ways to gain or regain creative confidence

Required Reading, Viewing

Polya's Problem Solving Techniques, G. Melvin: <https://math.berkeley.edu/~gmelvin/polya.pdf>

Creativity and Problem Solving, Eric Hoke: <https://www.youtube.com/watch?v=IKuX-sLqtNk>

How to Build Your Creative Confidence, David Kelley

http://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence?language=en

Task(s)

1. Be able to explain how you believe you solve problems and provide an example of a difficult problem you addressed.

Collaboration

Purpose

This class will explore ways to collaborate with others to achieve a result. As engineers, we should realize that the amount of content, skill, and experience needed to address complex issues often requires more than any one individual may offer. Thus, a better result is often achieved through collaboration.

Objective(s)

At the end of the class, Academy students should be able to:

- Work in groups to better create opportunities to leverage group dynamics and learning to achieve a result.

Required Reading, Viewing, or Browsing

Peer Evaluation Form for Group Work: <https://info.catme.org/catme-tools/peer-evaluation>

Task(s)

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

Research and Information Seeking

Purpose

This class looks at the practice of research with a special emphasis on scientific methodology, rigor, and information seeking. One of the cornerstones of research is the aggregation of intellectual resources from primary and secondary sources. What does it mean to collect data and design experiments? What is information seeking behavior?

Objective(s)

At the end of the class, Academy students should be able to:

- Describe why research is a fundamental skill to apply throughout your Viterbi career.
- Demonstrate knowledge of setting up the preconditions to conduct rudimentary research for the Grand Challenge.

Required Reading, Viewing, or Browsing

USC Viterbi - Research

<http://viterbiundergrad.usc.edu/research/>

Task(s)

1. Come to class prepared to share your research progress on the Grand Challenges.

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 class will introduce the *Soft Systems Methodology* (SSM): an action research process for engaging different individuals and groups in making sense of problem solving and design.

Objective(s)

After completing this class, Academy students should be able to:

- 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.

Required Reading, Viewing, or Browsing

An Overview of the Soft Systems Methodology, Stuart Burge

<http://www.burgehugheswalsh.co.uk/Uploaded/1/Documents/Soft-Systems-Methodology.pdf>

Task(s)

1. Explore how SSM can be implemented in solving real engineering problems.

Ethical Considerations

Purpose

In this class we will explore various dimensions of STEM work starting with ethics, and also discussion moral, rational, and legal perspectives of STEM.

Objective(s)

At the end of the class, Academy students should be able to:

- Acknowledge that human and societal issues often influence the manner in which temporal, financial, intellectual, social, and political assets are allocated to STEM projects.
- Identify a STEM situation where the outcomes were directly determined by attention to or some degree of ignorance or misunderstanding of social or human factors.

Required Reading, Viewing, or Browsing

Code of Ethics, National Society of Professional Engineers

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

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

Task: Identify/discuss a case(s) where the attention to ethical considerations was questionable.

Communication

Purpose

In this class we will consider the importance of sharing ideas with others for a variety of purposes. One inherent difficulty in the STEM disciplines is that the granularity of detail of STEM methods and techniques do not easily or readily map into natural languages of expression. Emerging media literacies allow the complexity of STEM to be represented as images, video, audio, or animation. Multimedia and New Media Literacies can help others understand what material scientists, computer scientists, and engineers think and do. In addition, we will also explore “best practices” for presenting technical information to technical audiences.

Objective(s)

At the end of the class, Academy students should be able to:

- Use creativity to identify mediums for communication that may improve opportunities for others to understand the details of STEM work.

- Create an image, video, podcast, or animation to signal the progress made so far in the ENGR 102 course.

Required Reading, Viewing, or Browsing

Why We Can't Trust Our Intuitions: Communication as a Science, Arthur Lupia

https://www.youtube.com/watch?v=UsYFa_ableQ&feature=plcp

Task(s)

1. Discuss how research on your particular GC may be advanced amidst political, social, economic pressures and resistance.

Thinking Across Disciplines

Purpose

This class is designed to introduce the idea of disciplinary and how various disciplines may be considered to help solve problems.

Objective(s)

At the end of the class, Academy students should be able to:

- Describe ways to distinguish the terms intradisciplinary, multidisciplinary, cross-disciplinary, interdisciplinary, and transdisciplinary.

Required Reading, Viewing, or Browsing

Multidisciplinary, Interdisciplinary and Transdisciplinary; intd lakehead

<https://www.youtube.com/watch?v=y7cN8NW0ZEs>

On Disciplinarity, Interdisciplinarity and Transdisciplinarity, The Alliance for the Arts in Research Universities

<https://www.youtube.com/watch?v=Ux9jVmEczs8>

Task(s)

1. Select a discipline other than your own major or anticipated major that you may be able to combine with your major to investigate the Grand Challenge.

Optimism

Purpose

As STEM thinkers, we should be able to articulate the optimism we have in our thinking, methods, and results. What is the source of this optimism besides ego? What data or evidence may we collect that increases the chance that our work will meet the intended outcomes?

Objective(s)

By the end of the class, Academy students should be able to:

- Discuss past **successes** and **failures** and how they have influenced our thinking.
- Identify strategies for managing success and failure professionally and academically.

Required Reading, Viewing, or Browsing

The History of Ideas – Failure, The School of Life:

<https://www.youtube.com/watch?v=6IUj6jyoTl0>

Task(s)

1. Engage in a discussion of failure from *6 different perspectives: cheap, fast, often, safe, smart, and graceful.*

Design Thinking

Purpose

This class guides you in the exploration of design thinking and its application in engineering, materials science, and computer science. Viterbi disciplines are creative disciplines and marshaling science, technology, engineering, and mathematics to solve problems is nontrivial. How can you adopt new perspectives on your coursework by using design thinking?

Objective(s)

At the end of the class, Academy students should be able to:

- Know the 5 steps of design thinking.
- Apply design thinking to your Viterbi coursework including ENGR 102.

Required Reading, Viewing, or Browsing

Design Thinking, Tim Brown

https://www.ideo.com/images/uploads/thoughts/IDEO_HBR_Design_Thinking.pdf

Design Thinking – Bootcamp, Jan Schmiedgen

<http://www.slideshare.net/janschmiedgen/design-thinkingbootcamp>

Task(s)

1. Select a past assignment from your first-term studies and apply design thinking to the process of completing that assignment. How would the assignment be different?

Innovation and Entrepreneurship

Purpose

This module introduces you to basic principles of innovation. Somewhere in your career you will likely be expected to design and create an innovation of a product, service, or experience. You may want to be an entrepreneur and create a startup.

Objective(s)

At the end of the class, Academy students should be able to:

- Become familiar with the stages and types of innovation.
- Be able to articulate the difference between a startup and a company.
- Be aware of all of the opportunities for innovation and entrepreneurship at Viterbi.

Required Reading, Viewing, or Browsing

Educating Engineers to Drive the Innovation Economy, The Royal Academy of Engineering

<http://www.raeng.org.uk/publications/reports/innovation-economy-2012>

Science Unscrambled: Disruptive Innovation, The National Academies of Science, Engineering, and Medicine

<https://www.youtube.com/watch?v=iTMTqxdg1Nk>

Viterbi Innovation

viterbiinnovation.usc.edu

Task(s)

1. Come to class prepared to discuss how Viterbi students may embrace innovation as a way to get the best out of their Viterbi education.

Reflection**Purpose**

This class looks at the benefits of reflective practice in academic and professional situations. It is the process of sense making and a way to learn from your experiences. What do you find valuable (or of less value) from your ENGR 102 experience?

Objective(s)

At the end of the class, Academy students should be able to:

- Determine the value-added of reflection in academic settings here at the Viterbi School.
- Demonstrate that you know the difference between competence and the feeling of competence.

Required Reading, Viewing, or Browsing

What is Reflective Practice, Joy Amulya

<https://www.communityscience.com/images/file/What%20is%20Reflective%20Practice.pdf>

The Purpose of Reflective Practice, Toby Adams

<https://www.youtube.com/watch?v=1AfHPV-YBdI>

On Critical Reflection

<https://natashakenny.wordpress.com/2012/05/10/on-critical-reflection/>

Task(s)

1. On your own, reflect on ENGR 102, your exploration of the NAE Grand Challenges, and your selection of a Viterbi major and perhaps, minor.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling

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

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/ssu

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

Diversity at USC - (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

dps.usc.edu, 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) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.