University of Southern California
Viterbi School of Engineering
Syllabus

ENGR 102: Engineering Freshman Academy
Fall 2016

Section: 28534
Day/Time: Wednesday, 10:00 a.m. – 11:50 a.m.
Location: RTH 109

Instructor: Anthony B. Maddox, Ph.D., P.E.

Coaches: Sarah Milkowski <milkowsk@usc.edu>
Adam Seifert <aseifert@usc.edu>

INTRODUCTION
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, 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.

GOALS AND LEARNING 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. 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.

TEXTBOOK AND ASSIGNED READINGS/MATERIALS

There is no textbook for the course, however comprehensive reading, viewings, and other course resources may be available via posts on Blackboard, emailed, the World Wide Web, or Class Time.

Class Requirements, Structure & Grading Policy

This course includes one lecture/discussion per week (Wednesday, 10:00 a.m. – 11:50 a.m.) that will be held in RTH 109. 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 the 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 project 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. Please visit RTH 218 for a list of events. 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**

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

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Due</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation and Attendance</td>
<td>Weekly Class Time</td>
<td>30</td>
</tr>
<tr>
<td>Outside the Class Activities</td>
<td>Dates To Be Determined (TBD)</td>
<td>30</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infographic and Fast Pitch</td>
<td>9/27, the Day <strong>before</strong> Class Time</td>
<td>10</td>
</tr>
<tr>
<td>Interview</td>
<td>10/25, the Day <strong>before</strong> Class Time</td>
<td>10</td>
</tr>
<tr>
<td>Pecha Kucha Video</td>
<td>11/22, the Day <strong>before</strong> Class Time</td>
<td>10</td>
</tr>
<tr>
<td>Class Time Presentation</td>
<td>11/30 Class Time</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

**GRADE SCALE**

The final grade for this course will be awarded using the following point scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>95–100</td>
</tr>
<tr>
<td>A-</td>
<td>90–94</td>
</tr>
<tr>
<td>B</td>
<td>86–89</td>
</tr>
<tr>
<td>B-</td>
<td>80–82</td>
</tr>
<tr>
<td>C+</td>
<td>76–79</td>
</tr>
<tr>
<td>C</td>
<td>73–75</td>
</tr>
<tr>
<td>C-</td>
<td>70–72</td>
</tr>
<tr>
<td>D+</td>
<td>66–69</td>
</tr>
<tr>
<td>D</td>
<td>63–65</td>
</tr>
<tr>
<td>D-</td>
<td>60–62</td>
</tr>
</tbody>
</table>

**STATEMENT FOR STUDENTS WITH DISABILITIES**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to the instructor (or to the Coach) as early in the semester as possible. DSP is located in STU 301 and is open from 8:30 a.m. – 5:00 p.m., Monday through Friday, (213) 740-0776.

**ACADEMIC INTEGRITY**
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others and to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles.

Section 11.00 of SCampus, the USC Student Guidebook, which outlines behaviors that violate the USC Student Conduct Code, can be found here:
https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/

A list of recommended sanctions for a range of academic integrity violations are located in Appendix A of SCampus, which can be found here:

Should there be any suspicion of academic dishonesty, students are referred to the Office of Student Judicial Affairs and Community Standards (SJACS) for further review. The SJACS review process can be found here:
http://www.usc.edu/student-affairs/SJACS/pages/students/academic_integrity.html

The SJACS website provides additional resources that you will find helpful in understanding what is meant by academic integrity, such as the following:

Academic Integrity: A Guide for Graduate Students
http://www.usc.edu/student-affairs/SJACS/forms/GradIntegrity.pdf

Academic Integrity Overview
http://www.usc.edu/student-affairs/SJACS/forms/AcademicIntegrityOverview.pdf

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 as follows (from the USC Catalogue):

Conditions for Removing a Grade of Incomplete: If an IN is assigned as the student’s grade, the instructor will fill out the IN Completion form which will specify to the student and to the department the work remaining to be done, the procedures for its completion, the grade in the course to date, and the weight to be assigned to work remaining to be done when computing the final grade. A student may remove the IN by completing only the work not finished as a result of illness or emergency. Previously graded work may not be repeated for credit. It is not possible to remove an IN by re-registering for the course, even within the designated time.

Time Limit for Removal of an Incomplete: One calendar year is allowed to remove an IN. Individual academic units may have more stringent policies regarding these time limits. If the IN is not removed within the designated time limit, the course is considered “lapsed” and the grade is changed to an IX and it will be calculated into the grade point average as 0 points. Courses
offered on a Credit/No Credit basis or taken on a Pass/No Pass basis for which a mark of IN is assigned will be lapsed with a mark of NC or NP and will not be calculated into the grade point average.

STANDARDS OF APPROPRIATE ONLINE BEHAVIOR
This course involves both in-person and online segments. The protocols defined by the USC Student Conduct Code will be upheld in online classes. Students are not allowed to post inappropriate material, spam to the class, use offensive language, or engage in online flaming. For more information, please visit http://www.usc.edu/student-affairs/SJACS

EMERGENCIES AND COURSE CONTINUITY
In case of emergency, and if travel to campus is difficult, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of 2SC, teleconferencing, and other technologies. Although this course uses the 2SC LMS for online support, an emergency site for the course is also available through 2SC (2SC.usc.edu). For additional information about maintaining classes in an emergency, please access: http://cst.usc.edu/emergency-preparedness/

In the Event of Technical Breakdowns: Students may submit assignments to the instructor via email by the posted due date. Remember to frequently back up your work, post assignments once completed, load files onto a power drive, and keep a hard copy of papers/projects.

ACADEMIC ACCOMMODATIONS
The University of Southern California is committed to full compliance with the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA). As part of the implementation of this law, the University will continue to provide reasonable accommodation for academically qualified candidates with disabilities so that they can participate fully in the University’s educational programs and activities. Although USC is not required by law to change the “fundamental nature or essential curricular components of its programs in order to accommodate the needs of disabled candidates,” the University will provide reasonable academic accommodation. It is the specific responsibility of the University administration and all faculty serving in a teaching capacity to ensure the University’s compliance with this policy.

Any candidate requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. to 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. The email address is ability@usc.edu. The website for DSP has additional information regarding accommodations and requests (www.usc.edu/disability).
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 can be classified as belonging to four categories: sustainability, health, security, and enriching life. The Grand Challenges represent societally relevant engineering issues which, when addressed, will greatly improve global society. Although the Academy will briefly address the 14 Grand Challenges, each course section is primarily focused on one, possibly two, of the Grand Challenges. The course content will be centered on this Challenge to provide you with contemporary contexts.

Assessment of Active Participation

Your active participation will help create a meaningful learning experience for your, 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.

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Active Participation</th>
<th>Moderate Participation</th>
<th>Low Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exhibits evidence of having completed all reading/viewing assignments and activities according to guidelines that were assigned</td>
<td>Attempts to participate but sometimes inhibited due to apparent lack of completion of reading assignments and activities</td>
<td>Exhibits lack of preparation and non-completion of required assignments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Active Participation</th>
<th>Moderate Participation</th>
<th>Low Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initiates discussion and supports points using specific references to</td>
<td>Sometimes initiates discussion but may use more general references</td>
<td>Rarely initiates discussion and unable to reference required</td>
</tr>
</tbody>
</table>
readings or other materials  
readings or other materials  
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.

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

<table>
<thead>
<tr>
<th>Class Time</th>
<th>Module</th>
<th>Assignment Due (the Day <em>before</em> class)</th>
<th>Assignments/Tasks Due (during class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/24</td>
<td>Academy Introduction</td>
<td>Syllabus Design</td>
<td></td>
</tr>
<tr>
<td>8/31</td>
<td>NAE Grand Challenges</td>
<td></td>
<td>2-3 Grand Challenges</td>
</tr>
<tr>
<td>9/7</td>
<td>Problem Solving</td>
<td></td>
<td>Most Difficult Problem</td>
</tr>
<tr>
<td>9/14</td>
<td>Systems Thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/21</td>
<td>Creativity</td>
<td></td>
<td>Group Activity</td>
</tr>
<tr>
<td>9/26</td>
<td>Optimism</td>
<td>Infographic and Fast Pitch</td>
<td></td>
</tr>
<tr>
<td>10/5</td>
<td>Collaboration</td>
<td></td>
<td>Group Formation</td>
</tr>
<tr>
<td>10/12</td>
<td>Communication</td>
<td></td>
<td>Group Assessment</td>
</tr>
<tr>
<td>10/19</td>
<td>Ethical Considerations</td>
<td></td>
<td>Case Studies</td>
</tr>
<tr>
<td>10/26</td>
<td>Research</td>
<td>Interview</td>
<td></td>
</tr>
<tr>
<td>11/2</td>
<td>Thinking Across Disciplines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/9</td>
<td>Innovation</td>
<td></td>
<td>ANIMATE</td>
</tr>
<tr>
<td>11/16</td>
<td>Design Thinking</td>
<td></td>
<td>ANIMATE</td>
</tr>
<tr>
<td>11/23</td>
<td>Blended Learning</td>
<td>Pecha Kucha Video</td>
<td></td>
</tr>
<tr>
<td>11/30</td>
<td>Reflection</td>
<td></td>
<td>Presentation</td>
</tr>
</tbody>
</table>
INTRODUCTION, GRAND CHALLENGES, AND PROBLEM SOLVING

These three modules serve as an introduction to the Academy, Instructor, and Coaches. The 14 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.

Introduction to the Academy

Purpose
This class will provide an overview of the Academy assignments and activities and an introduction to your instructor, Coaches, and the guest experts you will encounter in the course. This class will also introduce working definitions of science, technology, engineering, and mathematics (STEM).

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, or Browsing

USC Viterbi Undergraduate Handbook
http://viterbi.usc.edu/students/undergrad/handbook.htm

Welcome to Viterbi Voices
https://www.youtube.com/user/viterbistudent

Task(s)
1. Prepare to ask questions and engage in discussion about the assignments and expectations for the course.

The 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 Challenge 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, or Browsing

Grand Challenges for Engineering, National Academy of Engineering

Security, National Academy of Engineering
https://www.youtube.com/watch?time_continue=2&v=ckHdkOR1OHg

NAE Grand Challenges for Engineering, National Academy of Engineering
http://www.engineeringchallenges.org/

Task(s)
1. Compile a list of 2-3 Grand Challenges of interest.

Problem Solving

Purpose
This class will ask students to think deeply about problem solving. The intent is to encourage Academy students to consider problem and solution spaces and finding as important ways to structure the task of problem solving. Problem-based and project-based learning will be introduced to offer additional perspectives on problem solving.

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 spaces, problem finding, and problem solving all help a problem solver expand their understanding of addressing complex situations.

Required Reading, Viewing, or Browsing

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
Task(s)
1. Be able to explain in class how you believe you solve problems and provide an example of the most difficult problem you solved.

ENGINEERING HABITS OF MIND

For these six modules, we will 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.

Systems Thinking

Purpose
This class will introduce and Soft Systems Methodology: 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 Soft Systems Methodology pioneered by Peter Checkland.
   ● Apply the concept of systems thinking to study at Viterbi.

Required Reading, Viewing, or Browsing

An Overview of the Soft Systems Methodology, Stuart Burge

Soft Systems Methodology, Dhana Lakshmi
https://www.youtube.com/watch?v=JpsmGzuDBp0

Task(s)
1. Familiarize yourself with the one-page Processes for Organizational Meaning Model (POM) of SSM (See Appendix).

Creativity

Purpose
In this class we will investigate what it means to be creative. There are some studies that suggest that creativity may be learned. Creativity also is not solely restricted to the arts: creatively lives and 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)
By the end of the class, Academy students should be able to:

- Acknowledge with relative certainty that creativity may be demonstrated ALL Viterbi students in various assignments and projects in the Viterbi School.
- Build strategies to detect when creativity may be called upon to solve problems.

Required Reading, Viewing, or Browsing

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. Participate in a group problem solving activity.

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.

Collaboration

Purpose
In this class we will explore ways to collaborate with others to achieve a result. To some degree, this involves the realization that the amount of content, skill, and experience to address complex issues requires more that any one individual may offer. We will borrow from a
paradigm called Mediated Learning Experiences and focus on what is called Sharing Behavior that supports learning and doing by working together.

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, Adapted from Johns Hopkins University
https://www.cmu.edu/teaching/designteach/design/instructionalstrategies/groupprojects/tools/PeerEvaluations/PeerEval-GroupWork-formsample1.docx.

Task(s)
1. Form Grand Challenge Groups, name the Group, and assign roles for every Group member.

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.

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 your group has 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_abIeQ&feature=plcp

Task(s)
1. Meet with in your groups and assess how well your group functions so far in the course. Be prepared to be respectful, critical, and collegial.
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. Connections will be made with the Grand Challenges at a macro (global or national) level while also looking at these same perspectives from a mezzo level (groups and organizations) and micro level (individuals).

Objective(s)
At the end of the class, Academy students should be able to:

- Acknowledge that human and societal issues are 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(s)

1. Identify one case where the attention to ethical considerations was questionable.

ESSENTIAL SKILLS FOR VITERBI STUDENTS

For these modules, the Academy 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.

Research

Purpose
This class looks at the practice of research with a special emphasis on scientific methodology and rigor. 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?

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://viterbi.usc.edu/students/undergrad/research/

**Task(s)**

1. Come to class prepared to share your research progress on the Grand Challenges in a 3-minute pitch.

**Thinking Across Disciplines**

**Purpose**
This class is designed to introduce the idea of disciplinarity 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.

**Innovation**

**Purpose**
This class 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.

**Objective(s)**
At the end of the class, Academy students should be able to:
● Become familiar with the stages and types of innovation
● Consider how you may demonstrate a basic level of innovation here at the Viterbi School.

Required Reading, Viewing, or Browsing

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

Science Unscrambled: Disruptive Innovation, The National Academies of Science, Engineering, and Medicine
https://www.youtube.com/watch?v=iTMTqxdg1Nk

Incubate USC
incubate.usc.edu

Task(s)
1. Come to class prepared to discuss how Viterbi students may embrace innovation as a way to get the best our of their Viterbi education.

Design Thinking

Purpose
Class 13 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

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?
Blended Learning

Purpose
This class looks at the trends in blended learning. Increasingly, Academy students are expected to go beyond course assignments to discover content that is not presented in the syllabus. Learning may be less formal and increasingly informal or even nonformal. How committed are you to going beyond the course requirements to facilitate your own learning?

Objective(s)
At the end of the class, Academy students should be able to:
- Use Blackboard to participate in a Blended ENGR 102 class.
- Know the difference between blended, hybrid, flipped, and inverted learning

Required Reading, Viewing, or Browsing

Hybrid, Blended, Flipped, and Inverted: Defining Terms in a Two Dimensional Taxonomy, Margulieux, L.E., Bujak, K.R., McCracken, W.M., and Majerich, D.
http://c21u.gatech.edu/sites/default/files/HICE%20Conference%20Proceedings_1556_with%20citation%5B4%5D.pdf

What is Blended Learning, Training in the 21st Century
https://www.youtube.com/watch?v=-B3fGX3he8I

Task(s)
1. Come to class prepared to discuss how learning involves new and different combinations of technology-mediated, instructor-mediated, and student mediated learning.

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
http://www.supervisionandcoaching.com/pdf/What%20is%20Reflective%20Practice%20(Amuly
The Purpose of Reflective Practice, Toby Adams
https://www.youtube.com/watch?v=1AfHPV-YBdI

Task(s)

1. Come to class prepared to reflect on ENGR 102 and your exploration of the NAE Grand Challenges.
APPENDIX

Processes for Organizational Meaning (POM) Model

Source: Adapted from Checkland and Holwell (1998)