ISE-315: Engineering Project Management

Units: 3

Term—Day—Time:

Spring 2021

Days: Tuesdays and Thursday

Time: 9:30 am to 10:50 am

Location: ONLINE, via Zoom

Instructor: Neil Siegel, Ph.D.

The IBM Professor of Engineering Management,
Daniel Epstein Department of Industrial and Systems Engineering; and
Professor of Computer Science Practice;
USC Viterbi School of Engineering

Office: OHE 310D (note: if the course ends up being entirely on-line, I will be holding office hours only via electronic methods)

Office Hours: 11:00 am to 12:00 noon pm Tuesdays
(additional office hours are available by appointment – send me an email)

Contact Info: nsiegel@usc.edu or siegel.neil@gmail.com; 424-373-0720
I usually respond to emails the same day.

Teaching Assistant / Course Producer: Linda Badaracco
Contact info: lbadarac@usc.edu

Course Description

Introduction to managing a project intended to create an engineered system. Methods, processes, tools. Lessons-learned from actual practice on large-scale, complex engineering projects. Case studies from real projects. Presentations by student teams.

This course is designed for engineering undergraduate students interested in learning how to manage engineering projects.

Society today depends on many engineered systems – complex ensembles of capability, interconnected so as to provide some benefit not achievable by the individual components. Examples include air traffic control and scheduling, medical systems that optimize care and cost, the power grid that integrates many sources of energy to provide continuous electric service (even in the presence of disruptions and failures of components), systems that coordinate the supply chain of businesses so as to ensure continuous availability of desired products while also reducing waste, and so forth. It is not an exaggeration to say that society as we know and expect it could not exist without such systems, which provide safety, reliability, and affordability for many critical products and services.

Such systems are among the most complex artifacts ever created by humans. And each such project needs a ***project manager***, someone who will lead the project to a successful conclusion.

Of course, there are also many smaller projects, of varying sizes and degrees of complexity. They all need project managers, too.

This course provides an introduction to the subject of learning to be such a project manager. Drawing upon the experiences of the instructor as a person – who actually was such an engineering project manager in private industry (for projects large and small) before joining the USC engineering faculty – he will share with you a set of guidelines, objectives, techniques, practices, and tools that he believes will help the students understand how to perform the role of an engineering project manager.

This course, however, is ***not*** intended to prepare the student for any particular project management certification exam.

Learning Objectives

By the end of the course, students will:

- Understand the motivation for engineering projects, and the motivation for wanting to learn to become the manager of an engineering project
- Understand the engineering project management value-proposition, understand the difference between projects and other activities, understand the special needs of engineering projects (as contrasted with other types of projects and their management), and understand the contribution of engineering project management to society
- Have learned the complete *system life-cycle* (requirements, design, implementation, test, deployment, operations and maintenance, disposal) used in developing engineering projects, and also learned about key leverage points, and key lessons-learned from actual large projects
- Have been exposed to an introduction and analysis of the major elements of the *engineering project management process*, interspersed with examples (case-studies) drawn from real projects
- Have learned about the methodologies, tools, representations, and analysis methods used in engineering project management, and (through the case studies

from actual projects that are presented in the class) how engineering managers tackle and solve problems. These case studies cover both the technical and social aspects of being an effective engineering project manager, including dealing with our non-technical stake-holders (which might include those who make procurement decisions, those who make funding decisions, those who make applicable laws and regulations, our customers and users, and [increasingly] the general public and the media), as well as our fellow engineers and scientists.

- Have learned and used a computer-based project scheduling tool (Microsoft Project) to create automated representations of a project activity network

Prerequisite(s): ISE 225 and/or ISE 330
Co-Requisite(s): None
Concurrent Enrollment: None

Recommended Preparation:

- Competency in undergraduate level mathematics
- Capable of preparing professional papers and presentations in the English language using proper citations
- Ability to produce documents in Microsoft Word, PowerPoint, and Excel

Course Notes

The course may be taken ***only*** for a conventional letter grade; taking the course on a pass/fail basis is not allowed by the instructor.

Lecture, 80 minutes, twice per week. Some of the class sessions will be facilitated lab sessions.

Outside study and homework includes reading assignments, short written summaries of those readings, individual study to master the lecture materials, and completion of projects started during the weekly facilitated lab sessions.

The professor will hold a minimum of 2 hours of scheduled office hours per week for students of this class, will also offer specifically-scheduled one-on-one or group meetings, and will also be available for consultation via email and telephone.

Lecture slides will be posted on Blackboard.

Technological Proficiency and Hardware/Software Required

The course lectures will be available in Microsoft PowerPoint or Adobe Acrobat Reader format. Registered USC students can obtain copies of Microsoft PowerPoint at:

http://itservices.usc.edu/officestudents/

Adobe Acrobat Reader is available for free from the Adobe web site.

Some of the in-class work and some of the homework will be done in Microsoft ® Project. Copies of Microsoft ® Project are available free of charge to current USC students and faculty.

You may also download Microsoft ® Visio from the USC software repository. Visio can be used to draw a picture of the Work Breakdown Structure in a hierarchical format, and other similar useful tasks. Visio is not, however, required for the class or the homework.

Microsoft ® Project and Visio are also available to students registered in this class via the Viterbi "MyDesktop". A version of the Viterbi MyDesktop is available for both Windows and Apple MacIntosh computers, and thereby provides a way to run both Microsoft ® Project and Visio on an Apple computer. Instructions for gaining access to MyDesktop will be provided via BlackBoard prior to the start of the class.

We will be ***using Microsoft ® Project starting during the 7th week of class***, so please get this software installed onto your laptop computer, and bring that computer with you to class.

Required textbook

There will be one required textbook for this course: "Engineering Project Management", Neil Siegel, Wiley, ISBN-13: 978-1119525769. This text is available via the USC bookstore, and also via on-line sources such as Amazon.com.

Additional reference materials will be provided via Blackboard by the professor.

Description and Assessment of Assignments

Homework will be assigned during the course, and will figure as a part of your grade (see the section below, "Grading Breakdown"). Six of the homework assignments consist of written summaries of your readings from the textbook (20 points each; 120 points total). Instructions regarding this portion of the homework will be contained in the class lecture slides, and is summarized in the matrix below ("Course Schedule: A weekly breakdown"), which shows both dates of assignments and assignment due-dates.

During the facilitated lab work, there will be work assigned to you involving the use of the Microsoft ® Project software (50 points), some of which will be accomplished during the lab sessions themselves; you will likely also need to spend some time outside of the classroom hours in order to finish these assignments. Your products from these assignments will be counted towards your grade.

There will also be a team project; the TA will form you into small teams. We will work in some of the facilitated lab sessions on elements of the team project, which will allow me to ensure that everyone understands each aspect of the team assignment and is keeping up with the flow of work, but you should expect that you will need to work with your team outside of classroom hours in order to complete the team project.

Elements of the team assignment (230 points) are indicated in the matrix, below, and summarized here:

- Introduction to your project, including a description of the problem, and your proposed solution
- The customer's coordinate system of value. Operational Performance Metrics and Technical Performance Metrics.
- Proposals, proposal-creation guidance (such as the "Heilmeier questions"), win themes
- Risk management
- Project start-up
- The social aspects of the engineering project management role
- Summary, conclusions, and recommendations

A more detailed description of the team project paper and presentation charts will be provided via BlackBoard.

The specific homework assignments, their due-dates, and their point-value towards your grade for this course are summarized in the matrix provided in the section "Course Schedule: A Weekly Breakdown", below. All assignments should be turned in through Blackboard. Only one person from each team should turn in the team assignment; each team will need to coordinate in advance with the TA regarding the name of that person.

Examinations

There will be two written examinations as a part of the course:

> Mid-term examination – during the 1st class session for week 8 (300 points)
>
> Final examination – during finals week; you will be notified of the specific date, time, and location well in advance of the examination (300 points).

The two written examinations will cover materials presented in the *course lecture slides*. The course lecture slides indicate which materials that might be included on the exams by a large red asterisk ("*"). If this asterisk appears on the slide's title line, everything on that slide might be included on one of the exams. If this asterisk appears next to an item on that slide, that item ***and all of its indented sub-items*** might be included on one of the exams.

Two additional PowerPoint files will be made available by the professor:

> One will summarize the key aspects of the lectures up until the mid-term examination; this file will be made available about a week before the mid-term examination.
>
> The second will summarize key aspects of the lectures for the entire course; this file will be made available about two weeks before the final examination.

The date for the final examination is prescribed by the University, and cannot be changed by the professor; the final examination can be offered on another date only under the most extraordinary circumstances (I once had a student who was getting married that day – we did arrange for that student to take the test the day before!). The following describes the written examinations:

- The questions will all be "essay" questions, e.g., the professor will describe a situation, and ask you to discuss it in light of what you have learned from the class. Expect that all the questions will draw *only* from material presented in the course lecture slides. Of course, this material is also discussed in the textbook, but *every* item on both exams will be presented on one of the course lecture slides.
- ***VERY IMPORTANT: You may bring 1 letter-sized piece of paper*** (8½" x 11" – with text &/or drawings on both sides – hand-written or typed, at your discretion) ***of notes to use during each examination.***
- You may use a stand-alone calculator (e.g., no memory or internet connectivity) during the examinations. The mid-term examination will require some numeric calculations.
- Bring pencils, erasers, and a pencil sharpener to the examinations!
- Bring some scratch paper, too.
- No computers, phones, iPads / tablets, Dick-Tracy wrist watches, etc. – nothing with computing, storage, or internet connectivity will be allowed during the examinations.

Grading Breakdown

All homework and examinations will be graded by the professor.

- Homework assignments – 40%
- Mid-term examination – 30%
- Final examination – 30%

The grading scale for the course is as follows:

A 941-1,000	A- 900-940	B+ 880-899	B 841-879	B- 800-840	C+ 766-799
C 733-765	C- 700-732	D+ 666-699	D 633-665	D- 600-632	F Below 600

The total for all point-scoring opportunities is 1,000; the mid-term examination is 300 points (e.g., 30% of your grade); final examination is 300 points (e.g., 30% of your grade); and the homework assignments (including the presentations by the student teams) are 400 points (e.g., 40% of your grade). Your grade will be based on your total point score, using the table above. During the conduct of the course, all of your examination and homework scores will be posted on Blackboard (usually within a couple of days), to which you can gain access anytime by logging in with your USC login information.

Course Schedule: A Weekly Breakdown

Date of the 1st class session that week	Lectures (Tuesdays)	Lectures / facilitated lab work (Thursdays)	Homework assigned	Homework due (*before* the start of the Tuesday class session)
Week 1 (1-19-2021)	• Motivation • Introduction to the topic • Course overview, expectations, texts	• Exercises about motivations for engineering projects, and their contribution to the world • ***NOTE: This week's lecture material will NOT be included on the final examination***	• Read chapter 1; write a 1-page summary of your key learnings	• (no homework due this week)
Week 2 (1-26-2021)	• The project development cycle – how do engineering projects get built? (part 1 of 2)	• The project development cycle – how do engineering projects get built? (part 1 of 2, continued)	• Read chapter 2; write a 1-page summary of your key learnings	• HW 1: 1-page written summary of key points learned from chapter 1 (20 points) • Short bio (include this in the same file as the 1-page written summary of chapter 1)
Week 3 (2-2-2021)	• The project development cycle – how do engineering	• The project development cycle – how do engineering projects get built? (part 4 of 4)	• Read chapter 3; write a 1-page summary of	• HW 2: 1-page written summary of key points learned from chapter 2 (20 points)

	projects get built? (part 3 of 4)		your key learnings	
Week 4 (2-9-2021)	• Your users and your other stakeholders	• Team exercise: the customer's coordinate system of value, OPMs, TPMs	• Read chapter 4; no written summary is required	• HW 3: 1-page written summary of key points learned from chapter 3 (20 points)
Week 5 (2-16-2021)	• Where do engineering projects come from? Creating winning proposals.	• Team exercise: proposals, the Heilmeier questions, win themes	• Read chapter 5; no written summary is required	• (no homework due this week)
Week 6 (2-23-2021)	• Work breakdown structure, organizing a project, planning	• Team exercise: work-breakdown structure	• Read chapter 6; write a 1-page summary of your key learnings	• (no homework due this week)
Week 7 (3-2-2021)	• The activity network: creating credible predictions for schedule and cost	• Introduction to the concept of an *activity network* as the primary schedule-management artifact • Individual exercises using the Microsoft © Project software: basics of the activity network (will become a part of HW MSP) • A review of the course-to-date by the professor (for use by the students in advance of the mid-term exam) is available on BlackBoard	• Read chapter 7; no written summary is required	• HW 4: 1-page written summary of key points learned from chapter 6 (20 points)
Week 8 (3-9-2021)	• Using statistics to reach valid conclusions	• **Mid-term examination**	• Read chapter 8; no written summary is required	• (no homework due this week)
Week 9 (3-16-2021)	• Risk and opportunity management	• Feedback from the mid-term examination • Team exercise: risk	• Read chapter 9; write a 1-page	• (no homework due this week)

		management	summary of your key learnings	
	(no spring break this semester)			
Week 10 (3-23-2021)	• ***WELLNESS DAY; no class today, and no homework due today***	• Assessing earned value • Individual homework assigned: earned value and variance calculations (will become a part of HW MSP)	• Read chapter 10; the written summary of your key learnings will be combined with that for chapter 11	• HW 5: 1-page written summary of key points learned from chapter 9 (20 points)
Week 11 (3-30-2021)	• The monthly management cycle	• Individual homework: additional exercises with the Microsoft © Project software: 3-point estimates (will become a part of HW MSP)	• Read chapter 11; write a 1-page summary of your key learnings	• (no homework due this week)
Week 12 (4-6-2021)	• Special topics: (a) launching your project (b) projects with lots of software (c) agile projects	• Team exercise: launching your project	• Read chapter 12; no written summary is required	• HW MSP: Your outputs from the Microsoft Project session will be turned in as homework, together with your answers to the earned-value and variance calculation assignment (50 points). • HW 6: 1-page written summary of key points learned from chapters 10 and 11 (20 points)
Week 13 (4-13-2021)	• Social aspects of the engineering project-management role: dealing with people, providing leadership, building effective teams	• Social aspects of the engineering project-management role (part II) • Team exercise: the social aspects of engineering project management	• Read chapter 13; no written summary is required	• (no homework due this week)
Week 14 (4-20-2021)	• Achieving *quality* on an engineering project	• ***WELLNESS DAY; no class session or lab on this Thursday, and no***	• Read chapter 14; no written summary is	• (no homework due this week)

		homework due today	required	
Week 15 (4-27-2021)	• Team presentations	• Team presentations	• Read chapter 15; No written summary is required	• Team reports are due this week • Presentation charts for each team are also due this week (230 points for the team project)
Finals week	• **Final examination**	• (no lab this week)	The final is probably on **5-11-2021**	

Additional Policies

Late homework assignments will usually be marked down for every day late; in general, ***no*** homework assignments will be accepted more than ***3 days after the due date***. The professor will try to make accommodation for legitimate personal crises. The professor, however, has no obligation to do so; such accommodation is at his discretion.

The professor will always endeavor to treat his students with respect and dignity; he expects that you will do the same, both to him, and to the other students in the class. He invites questions and discussion, but reserves the right to structure the course and the class time as he sees fit, including the right to request that a student take a line of discussion "off-line" to office hours if the professor believes that this line of discussion is not of general interest to the class, or not contributing to the established teaching objectives for this course.

To quote from a USC guidebook: "Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior, and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem, and may be reported to the Office of Student Judicial Affairs for disciplinary action."

The following is the USC Viterbi School honor code:

Engineering enables and empowers our ambitions and is integral to our identities. In the Viterbi community, accountability is reflected in all our endeavors.

Engineering+ Integrity.
Engineering+ Responsibility.
Engineering+ Community.
Think good. Do better. Be great.

These are the pillars we stand upon as we address the challenges of society and enrich lives.

This honor code was developed by Viterbi students.

In your written homework, please be sure to cite any referenced sources appropriately. We will not look kindly on plagiarism or cheating; we will hold you to the highest standards in this regard, and you will receive a grade of zero for the assignment if you are caught cheating or plagiarizing, which will result in a lowered or failing grade for the class. You

will also be reported to the appropriate University office for plagiarizing, which could result in further sanctions, including suspension or expulsion from school. Don't do it.

The same, of course, applies to the examinations; you are expected to do your own work during the examination. The only legitimate sources of information about what to expect on the examinations are the professor and the TA currently assigned to the course.

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" https://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, http://policy.usc.edu/scientific-misconduct.

Support Systems:
Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org

Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. https://engemannshc.usc.edu/rsvp/

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

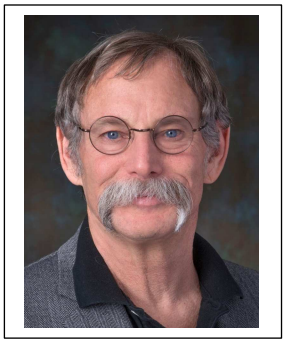
Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

Student Support & Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

Diversity at USC – https://diversity.usc.edu/
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students

About the professor



Neil Siegel, Ph.D. is the IBM Professor of Engineering Management, in the Daniel Epstein Department of Industrial and Systems Engineering, at the Viterbi School of Engineering at USC. He was for many years the sector vice-president & chief technology officer at Northrop Grumman, at times responsible for as many as 12,000 engineers and scientists. Dr. Siegel has been responsible for a large number of successful military, Government, and commercial systems, including the Army's Blue-Force Tracking system, the Army's first unmanned aerial vehicle, the Counter-Rocket-Artillery-and-Mortar system, and many others.

These systems have repeatedly been cited as model programs and important National capabilities. He also led work for the steel industry, the movie industry, and other commercial enterprises. He has a large number of inventions that have been implemented into fielded U.S. Government products and systems (and also in commercial products by companies like Garman and Apple), and holds more than 20 issued patents. Several elements of these patents have been widely adopted, and are used in a billion devices around the world, such as smart-phones, GPS receivers, tablet computers, and so forth.

His expertise is recognized by the U.S. Government, as indicated by past membership on the Defense Science Board, the Army Science Board, and other senior government advisory panels.

His many honors include:

- Election to the U.S. National Academy of Engineering
- Fellow and Member of the U.S. National Academy of Inventors
- Election as a Fellow of the IEEE
- Selection as a member of the National Academy of Inventors
- The IEEE Simon Ramo Medal for systems engineering and systems science
- The Army's Order of Saint Barbara
- The iCMG award for system architecture
- The Northern Virginia Technology Council CTO-of-the-year award
- His (former) company's Chairman's Award for Innovation (three times)

Programs that he has led have also won many honors, including the inaugural Crosstalk award as the best-ran software program in the entire U.S. government, the IDGA award as the "Most Innovative U.S. Government Program", and the Federal 100 Monticello Award.

His personal research contributions have centered around how to implement large, mobile, ad-hoc radio networks over relatively low data-rate carriers, focusing on what he calls "infrastructureless" networks (e.g., wireless radio-frequency networks that have no fixed infrastructure, such as cell-phone towers, repeaters, etc.) and techniques for achieving acceptable dynamics through what he calls "force-structure-aware" networks. He has been a pioneer in large-scale deployments of GPS-enabled applications (like the Blue-Force Tracking system). Much of his recent research has made contributions in the field of improving development methodology for large-scale systems, through the identification of novel root-causes of system-development failures, new methods to correct those root-causes, and application of those new techniques to problem domains such as health, energy, and Government information systems.