SAE 541: Systems Engineering Theory & Practice

Class Session: Wednesdays, 3:30 pm – 6:40 pm, Location Online via DEN or RTH 115 On-Campus

Class Section: 32311R (DEN/Off-campus) and 32341D (On Campus)

Contact Information:

Instructor: Kenneth Cureton	Teaching Assistant: Tyler Presser
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Course Description

Systems engineering is an essential part of achieving success for system products, services, and processes in important domains such as Aerospace & Defense, Transportation, Medical, and Energy Management. As such systems become increasingly complicated and complex, fundamental concepts and rigor become increasingly important throughout the system life cycle: from concept evaluation through retirement. This class provides both theoretical and practical knowledge needed for conceptualizing, designing, supporting, and evaluating todays and tomorrow's systems.

Course Learning Objectives:

- Introduce students to Systems Engineering support of design processes, architecture concepts, operations concepts, systems integration, and life-cycle support concepts
- Explore means for performing trade studies and evaluating risk
- Introduce system Verification, Validation, Quality, Test, Specialty Engineering, Security, and Mission Assurance concepts
- Familiarize students with various standard Systems Engineering Handbooks and Guides and related International Standards Organization (ISO) documents
- Discuss representative systems that highlight course concepts

Prerequisite(s): None

Technological Proficiency and Hardware/Software Required

Must have access to (and be proficient in the use of) a web browser in order to access course materials, view lectures, submit assignments, and interact with the instructor.

THIS IS AN EXPERIENTIAL COURSE!

This class is not a "one-way" lecture: student participation is strongly encouraged! You can choose to work as individuals or in groups or teams for discussions. Just as in the real world, interaction with the instructor and each other can be (but does not have to be) face-to-face. Interaction can be in class or real-time via the DEN tools (e.g., Webex) or even asynchronously via the DEN Discussion boards regardless of Time Zone differences and regardless of time-of-day.

Starting with the second lecture, several video segments presenting the lecture slides will be available on the DEN. Students are required to view each week's lecture videos and accomplish required readings in advance—the scheduled class periods are for student interaction with the instructor and other students in real-time to discuss the presented concepts and to ask questions. All such interaction is recorded and available to all enrolled students. You can also document your questions and observations on the DEN discussion boards so that others may respond at any time. You should use the latter capability if you cannot participate in real-time during the scheduled class periods. This way, there is a record of all discussions, questions-and-answers, etc.

Hint: your class participation and homework assignments are not graded, HOWEVER, accomplishing the homework assignments and participation in the related discussion sessions (on-line via Webex or asynchronously via the discussion boards) will serve to better prepare you for the exams.

Readings:

- Representative (INCOSE, DoD, NASA, and FAA) Systems Engineering Handbooks, Guides, and ISO Standards posted on the DEN/D2L system as downloadable PDF files.
- No textbooks are required for purchase in this class.

Class Assignments:

- All deliverables for the course must be submitted via the DEN/D2L system.

Homework Assignments:

Ten assignments for discussion purposes, but not graded.

Midterm Exam

The Midterm Exam will cover lecture topics presented in Lectures 1 through 6. The exam will be an individual effort, take-home exam with open book and notes. The exam will be downloadable from the DEN starting on Wednesday June 21st, 2023 at 6:40 PM Pacific Time. Responses must be submitted to the DEN before 3:30 PM Pacific Time on Wednesday June 28th, 2023.

FORMAT: Microsoft WORD (.DOC or .DOCX) or equivalent (no PDF files, please).

GRADING: The Midterm will be graded on a scale of zero-to-50. I'll grade and comment on Midterm Exams as soon as possible after the due date. All late or missing submissions will receive a score of zero. Collaboration on the Midterm is forbidden. Violators will receive an automatic score of zero.

Final Exam

The Final Exam will cover lecture topics presented in Lectures 7 through 12. The exam will be an individual effort, take-home exam with open book and notes. The exam will be downloadable from the DEN starting on Wednesday August 2rd 2023 at 6:40 PM Pacific Time. Responses must be submitted to the DEN by Midnight Pacific Time on TUESDAY August 8th, 2023.

FORMAT: Microsoft WORD (.DOC or .DOCX) or equivalent (no PDF files, please).

GRADING: The Midterm will be graded on a scale of zero-to-50. I'll grade and comment on Final Exams as soon as possible after the due date. All late or missing submissions will receive a score of zero. Collaboration on the Final Exam is forbidden. Violators will receive an automatic score of zero.

Grades:

Your class grade is based on the take-home midterm exam (50% of your class grade) and the take-home final exam (50% of your class grade).

Your class grade is computed as follows:

The Take-Home Midterm score (a maximum of 50 points) plus the Take-Home Final Exam score (a maximum of 50 points) forms a grand total (a maximum of 100 points). The grand total of points is divided by 25 (to scale your total to a range of four-to-zero):

Class Score = (Midterm Exam Score + Final Exam Score) / 25

This class score is converted into a letter grade for the class:

A   4.0 to above 3.7
A-   3.7 to above 3.3
B+   3.3 to above 3.0
B   3.0 to above 2.7
B-   2.7 to above 2.3
C+   2.3 to above 2.0
C   2.0 to above 1.7
C-   1.7 to above 1.5
D+   1.5 to above 1.0
D   1.0 to above 0.7
D-   0.7 to above 0.5
F   0.5 or below.

This letter grade is reported to USC as your class grade.

I must turn in the class grades shortly after the end of the Semester (after Final Exams Week), so I'll inform you via e-mail regarding your final paper grade (as well as your overall grade) no later than two weeks after the paper is due.

Schedule of Class Sessions:

The exact schedule and topics are subject to change. Changes will be announced in class.

Date	Planned topics
5/17	**Lecture #1: Introduction to Systems Engineering Concepts / Value of SE** *Personal Introduction assigned*
5/24	**Lecture #2: Systems Engineering Processes Overview & Life Cycles** *Personal Introduction due*
5/31	**Lecture #3: Mission & Business Analysis / Stakeholders, Needs, Scope, and CONOPS**
6/7	**Lecture #4: Requirements Analysis and Development**
6/14	**Lecture #5: Functional Analysis and Allocation**
6/21	**Lecture #6: Architecture Definition / Design Definition** *Take-Home Midterm Exam assigned (Lecture #1-6 content)*
6/28	**Lecture #7: Trade study Analysis** *Take-Home Midterm Exam Due*
7/5	**Lecture #8: Systems Analysis & Control: Risk Analysis & Management; Other Processes**
7/12	**Lecture #9: Implementation, Integration, & Transition, Interface Analysis**
7/19	**Lecture #10: Verification, Validation, Quality, Test**
7/26	**Lecture #11: Specialty Engineering, Safety, Cybersecurity**
8/2	**Lecture #12: Operation, Maintenance, Logistics & Sustainment, Disposal** *Take-Home Final Exam assigned (Lecture #7-12 content)*
8/8	**(Tuesday) No Lecture** *Take-Home Final Exam Due*

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:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.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) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, 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 Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
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.