UTC-IASE
UNIVERSITY OF CONNECTICUT

UCONN
SCHOOL OF ENGINEERING

SE 5000: Introduction to Systems Engineering

Course Instructor: **Amy Thompson, Ph.D.**

Catalog Description. 3 credits. An introduction to the hard and soft skills that are required of good systems engineers. Lectures follow the competency models for systems engineers and include topics such as systems thinking, needs identification, requirements formulation, architecture definition, technical management, design integration, as well as verification and validation of designs. Some of the key systems engineering (SE) standards will be covered and the roles of organizations in enabling engineers to develop systems will be explored. Applications of SE concepts and tools in various settings will be discussed through examples and case studies. Students will learn to apply the SE methodologies in modern complex system development environments such as aerospace and defense, transportation, energy, communications, and modern software-intensive systems.

Pre-Requisites. An undergraduate degree in engineering or science.

Intended Audience. The course is designed for all graduate students in engineering.

Course Delivery Method. The course will be offered online, asynchronously, in small recorded modules according to the course schedule and syllabus. Direct and live communication with the instructor will be available each week, according to the class schedule, for discussion, questions, examples, and quizzes. Attendance at live sessions is required, and you must notify the instructor in advance if you cannot attend. A social networking tool called Slack will be used to communicate with students and the instructor between live sessions.

Course Objectives.

(1) Student obtains a foundational knowledge of systems engineering processes and practices.
(2) Student uses the knowledge and information gained in the course to expand and improve the application of systems engineering in their field.
(3) Student pursues further in-depth education and training in systems engineering.

Anticipated Student Outcomes. By the end of SE 5000, a student will be able to:

(1) Describe processes, methods, and practices of systems engineering.
(2) Apply systems engineering practices and methods to relevant examples.
(3) Develop requirements, architectures, specifications, verifications, and tests.
(4) Analyze systems using systems engineering approaches to increase performance.
(5) Recognize important systems engineering and systems thinking strategies and practices in examples and cases.

Course Organization. The contents and organization of the course follows the INCOSE, Systems Engineering Handbook Version 4, (SEH), which is required material for the course. Buede and Miller's The Engineering Design of Systems, Models and Methods presents more in-depth engineering methods needed to design engineering systems, and we will use content from that text to support the processes described in the SEH.

Course Outline. The structuring of these four learning modules into 13 lectures of a one semester course, along with the topics and references, is described in the following:

----------Module 1: Introduction to Systems Engineering----------

Week 1: Introduction, INCOSE SE Vision 2025, SEH Scope, Systems Engineering Overview

Week 2: SE Life Cycle Stages

Week 3: Decision Making and Risk Assessment in Design and Model-Based System Engineering

---------Module 2: System Engineering Technical Processes: Down the Systems Vee----------

Week 4: Business and Mission Analysis Process

Week 5: Stakeholder Needs and Requirements Definition Process

Week 6: Architecture Definition Process

Week 7: Interface Design and Definition

Week 8: System Definition Process

----------Module 3: System Engineering Technical Processes: Up the Systems Vee----------

Week 9: Design Definition Process

Week 10: System Analysis Process and Implementation Process

Week 11: Integration, Verification, Transition, and Validation Processes

Week 12: Operation, Maintenance, Disposal Process, Tailoring SE Processes

----------Module 4: Systems Thinking and Course Wrap-Up----------

Week 13: Systems Thinking

USEFUL READING.

Texts are available through a local or online bookstore. The UConn Co-op carries many materials that can be shipped via its online Textbooks To Go service. For more information, see Textbooks and Materials on our Enrolled Students page.

Required Text

(1) Buede, Dennis and William D. Miller. The Engineering Design of Systems: Models and Methods, 3rd Edition. Wiley. ISBN: 978-1-119-02790-4.

Required Materials from INCOSE*

(2) INCOSE, Systems Engineering Handbook Version 4.
(3) M. Ryan and L. Wheatcraft, Guide for Writing Requirements, INCOSE Technical Product INCOSE-TP-2010-006-02, 1 July 2015.

Obtaining INCOSE Materials

Each student will be required to access the INCOSE (www.incose.org) site to download course materials. Students will be able to download their own personal copy of the INCOSE, Systems Engineering Handbook Version 4, along with other support material, which are important resources for the course. Employees and students of an INCOSE CAB Organization, who are not already INCOSE individual members, are able to sign up for a CAB Limited access account for no fee. For a list of INCOSE CAB Organizations, click here: http://www.incose.org/ChaptersGroups/CAB. UCONN is a CAB organization, so you can indicate UCONN as your CAB Organization. UTC is also a CAB organization, and if you are an employee of a UTC division, you can indicate UTC as your CAB organization.

Other Useful Reading and Materials

(1) INCOSE Materials

- INCOSE-TP-2003-002-04, 2015.
- BKCASE Editorial Board. 2015. The Guide to the Systems Engineering Body of Knowledge (SEBoK), v. 1.5., R.D. Adcock (EIC). Hoboken, NJ: The Trustees of the Stevens Institute of Technology. www.sebokwiki.org.
- INCOSE, Journal of the International Council on Systems Engineering, Seattle, W.A.: International Council on Systems Engineering.
- See also the INCOSE web site: http://www.incose.org/ for other useful products and resources.

(2) Relevant Standards

- ANSI/EIA-632-1998, EIA Standard—Processes for Engineering a System, Arlington, V.A.: Electronic Industries Association, 1999.
- IEEE-STD-1220-2005, IEEE Standard for Application and Management of the Systems Engineering Process, New York: IEEE Computer Society, 2005.
- MIL-STD-498, Military Standard: Software Development and Documentation, Washington D.C.: United States of America Department of Defense, 1994.
- MIL-STD-499B, Military Standard—Systems Engineering—Draft, Washington D.C.: United States of America Department of Defense, 1994.
- ISO/IEC 15288-2015, Systems and Software Engineering—System Life Cycle Processes, 2015.
- ISO/IEC, ISO/IEC 29148, FDIS, Systems and Software Engineering—Life Cycle Processes—Requirements Engineering, 2011.
- International Institute for Business Analysis, A Guide to the Business Analysis Body of Knowledge® (BABOK® Guide), Version 2, 2009.

- ANSI/AIAA G-043A-2012, Guide for the Preparation of Operational Concept Descriptions, American National Standards Institute, American Institute of Aeronautics and Astronautics (sponsor), 2012.

Copyright. Copyrighted materials within the course are only for the use of students enrolled in the course for purposes associated with this course and may not be retained or further disseminated.

Grading. Student grades will be based upon assignments, quizzes, class participation (50%) and a course-long project (50%).

Grade	Letter Grade	GPA
93-100	A	4.0
90-92	A-	3.7
87-89	B+	3.3
83-86	B	3.0
80-82	B-	2.7
77-79	C+	2.3
73-76	C	2.0
70-72	C-	1.7
67-69	D+	1.3
63-66	D	1.0
60-62	D-	0.7
<60	F	0.0

Due Dates and Late Policy. All due dates will be identified in blackboard when the work is posted. Deadlines are based on Eastern Standard Time; if you are in a different time zone, please adjust your submittal times accordingly. The instructor reserves the right to change dates accordingly as the semester progresses. All changes will be communicated in an appropriate manner.

Course Project. A project is to be developed by each student, which is expected to evolve during the entirety of the semester. The project will entail applying system engineering principles and methods to a product or system of your choosing, that meets certain minimum

criterion. A separate rubric with the details of the project will be provided to the students on HuskyCT. A mid-term and final report are the main deliverables of this project, and are the basis for the project grade.

Student Conduct. http://www.dosa.uconn.edu/student_code.html. Students are responsible for adherence to the University of Connecticut student code of conduct. Pay attention to the section on Student Academic Misconduct, "Academic misconduct is dishonest or unethical academic behavior that includes, but is not limited, to misrepresenting mastery in an academic area (e.g., cheating), intentionally or knowingly failing to properly credit information, research or ideas to their rightful originators or representing such information, research or ideas as your own (e.g., plagiarism)." Examples of academic misconduct in this class include, but are not limited to: copying solutions from the solutions manual, using solutions from students who have taken this course in previous years, copying your friend's homework, looking at another student's paper during an exam, lying to the professor or TA and incorrectly filling out the student workbook.

Attendance. Students should make every effort to attend the live sessions and to talk with students in the Slack chat forum to get help and assistance from others. It is practically impossible to follow the class if classes are missed.

Absences. Make-up of missed exams requires permission from the Dean of Students, see "Academic Regulations." Midterm-exams are treated the same as Final Examinations. Students involved in official University activities that conflict with class time must inform the instructor in writing prior to the anticipated absence and take the initiative to make up missed work in a timely fashion. In addition, students who will miss class for a religious observance must "inform their instructor in writing within the first three weeks of the semester, and prior to the anticipated absence, and should take the initiative to work out with the instructor a schedule for making up missed work."

Adding or Dropping a Course. If you should decide to add or drop a course, there are official procedures to follow:

- Matriculated students should add or drop a course through the Student Administration System.
- Non-degree students should refer to Non-Degree Add/Drop Information located on the registrar's website.

You must officially drop a course to avoid receiving an "F" on your permanent transcript. Simply discontinuing class or informing the instructor you want to drop does not constitute an official drop of the course. For more information, refer to the online Graduate Catalog,

Academic Calendar. The University's Academic Calendar contains important semester dates.

Students with Disabilities. Students needing special accommodations should work with the University's Center for Students with Disabilities (CSD). You may contact CSD by calling (860) 486-2020 or by emailing csd@uconn.edu. If your request for accommodation is approved, CSD will send an accommodation letter directly to your instructor(s) so that special arrangements can be made. (Note: Student requests for accommodation must be filed each semester.)

Course Schedule*

Date[1]	Topic	Module No	Details
Aug 30-Sept 5	*Lecture 1: Introduction, SE Vision 2025, SEH Scope, Systems Engineering Overview*	1	Live Meeting August 30th 5:00pm
Sept 6-12	*Lecture 2: Life Cycle Stages*	1	Live Meeting on Sept 6th Holiday
Sept 13-19	*Lecture 3: Decision Making and Risk Assessment in Design and Model-Based System Engineering*	1	Live Meeting Sept 13th
Sept 20-26	*Lecture 4: Business and Mission Analysis Process*	2	Live Meeting Sept 20th **Project Proposal Due**
Sept 27-Oct 3	*Lecture 5: Stakeholder Needs and Requirements Definition Process*	2	Live Meeting Sept 27th
Oct 4-10	*Lecture 6: Architecture Definition Process*	2	Live Meeting Oct 4th
Oct 11-17	*Lecture 7: Interface Design and Definition*	2	Live Meeting Oct 11th
Oct 18-24	*Lecture 8: System Definition Process*	2	Live Meeting Oct 18th **Project Mid-Term Report Due Oct. 24th**
Oct 25-31	*Lecture 9: Design Definition Process*	3	Live Meeting Oct 25th
Nov 1–7	*Lecture 10: System Analysis Process and Implementation Process*	3	Live Meeting Nov 1st
Nov 8-14	*Lecture 11: Integration, Verification, Transition, and Validation Processes*	3	Live Meeting Nov 8th
Nov 15-21	*Lecture 12: Operation, Maintenance, Disposal Process and Tailoring SE Processes*	3	Live Meeting Nov 15th
Nov 22-28	*Thanksgiving Recess*		No Live Meeting on Nov. 22nd Holiday
Nov 29-Dec 5	*Week 13 Systems Thinking*	4	Live Meeting Nov 29th **Project Final Report Due Dec 5th**
Dec. 6	*Course Wrap-Up*	4	Live Meeting Dec 6th

* Schedule is tentative and may change

[1] First Date indicates release of lecture modules

Instructor's Contact Information:

- Amy Thompson: amy.2.thompson@uconn.edu Phone: (860)486-8462
- Office Hours: Tuesday 1:00 – 3:00pm and Wednesday 10:00am – Noon

Helpful Links:

- Virtual Computer Lab at UConn: http://skybox.uconn.edu/
- Course Material: https://lms.uconn.edu
- Institute for Advanced Systems Engineering: http://www.utc-iase.uconn.edu/