UTC-IASE
UNIVERSITY OF CONNECTICUT

UCONN
SCHOOL OF ENGINEERING

SE 5000: Introduction to Systems Engineering, Spring 2018

Course Instructor: Amy E. 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. The Blackboard Discussion Board and Instant Messenger (IM) 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 engineered systems.
(3) Develop and create objectives, requirements, architectures, specifications, verifications, and tests for an engineered system.
(4) Create views of systems using SysML and other diagraming approaches.
(5) Allocate objectives, requirements, and functions to define and create design spaces for an engineered system.
(6) Recognize important systems engineering and systems thinking strategies and practices in examples and cases.

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

Course Outline. The structuring of these five learning modules into 12 lectures of a one semester. 14-week course, along with the topics and references, is described in the following

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

Week 1: Introduction to the field of Systems Engineering

Week 2: Overview of the Systems Engineering Design Process

Week 3: System Modeling and SysML

----------*Module 2: Defining the Design Problem*----------

Week 4: Writing Good Requirements

Week 5: Defining the Design Problem

Week 6: Project Phase I Due

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

Week 7: Functional Architecture Development

Week 8: Physical Architecture Development

Week 9: Allocated Architecture Development

Week 10: Interface Design

Week 11: Project Phase II Due

----------Module 4: System Engineering Technical Processes: Up the Systems Vee----------

Week 12: Integration, Verification, and Qualification

Week 13: Making Design Decisions and Defining Design Spaces

----------Module 5: Systems Thinking and Course Wrap-Up----------

Week 14: Systems Thinking

Week 14: Project Phase III Due

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. Available with membership from INCOSE.

(3) M. Ryan and L. Wheatcraft, Guide for Writing Requirements, INCOSE Technical Product INCOSE-TP-2010-006-02, 1 July 2015. Available with membership from INCOSE.

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. Students 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.

Grading. Student grades will be based upon assignments, quizzes, class participation and a course-long project. Breakdown: Class Participation (20%), Assignments/Quizzes (20%), Phase I Project Submission (20%), Phase II Project Submission (20%), Phase III/Final Submission (20%)

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 developing System Definition Document (SDD) is the major deliverable of the course.

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
Jan 16 - 23	*Week/Lecture 1: Introduction to the field of Systems Engineering*	1	Live Meeting January 16, 5:00pm
Jan 23 - 30	*Week/Lecture 2: Overview of Systems Engineering Design Process*	1	Live Meeting January 23, 5:00pm
Jan 30 – Feb. 6	*Week/Lecture 3: System Modeling and SysML*	1	Live Meeting January 30, 5:00pm
Feb 6 - 13	*Week/Lecture 4: Writing Good Requirements*	2	Live Meeting February 6, 5:00pm
Feb 13 - 20	*Week/Lecture 5: Defining the Design Problem*	2	Live Meeting February 13, 5:00pm
Feb 20 - 27	*Week 6: Phase I Submission Due*	2	Live Meeting February 20, 5:00pm **Phase I Submission Due February 27**
Feb 27– Mar 6	*Week7/Lecture 6: Functional Architecture Development*	3	Live Meeting February 27, 5:00pm

Mar 6 - 13	*Week 8/Lecture 7: Physical Architecture Development*	2	Live Meeting March 6, 5:00pm
Mar 13 - 20	*Spring Break*	3	No Live Meeting March 13
Mar 20 - 27	*Week 9/Lecture 8: Allocated Architecture Development*	3	Live Meeting March 20, 5:00pm
Mar 27– Apr 3	*Week 10/Lecture 9: Interface Design*	3	Live Meeting March 27, 5:00pm
Apr 3 - 10	*Week 11: Project Phase II Due*	3	Live Meeting April 3, 5:00pm **Phase II Submission Due April 10**
Apr 10 - 17	*Week 12/ Lecture 10: Integration, Verification, and Qualification*		Live Meeting April 10, 5:00pm
Apr 17 - 24	*Week 13/Lecture 11: Making Design Decisions and Defining the Design Space*	4	Live Meeting April 17, 5:00pm
Apr 24– May 1	*Week 14/Lecture 12: Systems Thinking and Course Wrap-Up*	4	Live Meetings April 24, 5:00pm May 1, 5:00pm **Phase III Final Submission Due May 1**

* 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 and Wednesday 1:00 – 3:00pm

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/