ME EN 5160/6160 - Fundamentals of Systems Engineering
Section 030: Contract | **Section 090**: Main Campus | **Section 290**: UOnline

Department of Mechanical Engineering
The University of Utah | **Fall 2023**

Prerequisites:
5160: senior standing / instructor approval
6160: graduate standing

In Fundamentals of Systems Engineering, students are introduced to the discipline of Systems Engineering, especially the methods and tools used to define, develop, and deploy small to complex and large-scale systems. The course takes advantage of integrated examples, analysis and discussion of case studies, projects, and team exercises that enable a thorough understanding of the larger context wherein requirements for a system are realized and then translated into an operational concept.

COURSE CONTACTS

Instructor:
Pedro Huebner
pedro.huebner@utah.edu
Office: 1346 MEK
OH: Mondays | 1:30 PM - 3:30 PM
Wednesdays | at MEK 1346 or Zoom

Department Liaison:
Todd Easton, Program Director
todd.easton@utah.edu

WEBSITE
https://mech.utah.edu

LEARNING OUTCOMES

Upon successful completion of this course, students shall be able to:

o Understand and define the discipline of Systems Engineering, the stages of a system life cycle, and the interrelationships between Systems Engineering and other fields of knowledge.
o Demonstrate familiarity with the methods and tools of Systems Engineering and their respective roles within the stages of the system life cycle.
o Identify and describe the four process groups that support Systems Engineering.
o Examine the requirements of a system and their relevance in the early stages of system development.
o Implement functional analysis, decomposition, and requirement allocation tools and describe their relevance in the later stages of systems development.
o Demonstrate familiarity with technical management processes and how they are used to establish and execute plans at any stage of the system life cycle.

COURSE STRUCTURE

The course is structured in the form of weekly activities assigned according to a semester-specific schedule. The contents of each week may include recorded lectures, demonstrations, discussion forums, knowledge checks, review sessions, Q&As, quizzes, exams, *etc*. It is the responsibility of each student to stay on schedule and complete course activities as they are assigned in observation of their due dates and times. Regular announcements sent via Canvas will include reminders of important deadlines and activities with a significant impact on the course grade. The instructor will make every effort to give students the opportunity to follow the course at a steady and balanced pace.

Sections 030, 090, and 290 follow an entirely online and (somewhat) asynchronous format. There are no scheduled course meetings and students are welcome to watch lectures and complete assigned activities according to their own availability. The course is paced to balance the release of new content evenly throughout the semester as a means of achieving high levels of student enjoyment without the strain of overwhelming amounts of work.

Lecture videos cover a collection of different perspectives and materials on each course subject. Videos are short and about 5minutes long. They cannot be fast forwarded but can be played at a faster speed. An autogenerated transcript of spoken content is available. Several videos incorporate **knowledge checks**, which will require students to interact with the player and answer one or more questions to continue. Lengthier activities that fall outside of the scope of a simple knowledge check will be hosted and completed on Canvas. These will be referenced in the videos when they become relevant and will not interrupt the playback.

At the end of most weeks, **discussion forums** are open to all students and the instructor to engage in a conversation relevant to the materials covered up to that point in the course. Participation is highly expected and graded as an incentive. These discussions are organic, meant to clarify any points of confusion or uncertainty and to give everyone the opportunity to share their personal experiences with a given subject, or to simply to engage with their peers in the fantastic world of Systems Engineering.

Homework assignments must be submitted individually, but collaborative work is encouraged. In other words, students are free to work together when formulating problems and coming up with creative solutions but are required to submit their own work and not that of their colleagues. All assignments will require the submission of electronic materials through Canvas. Pay attention to specific instructions for each activity provided in video recordings and/or in written form.

Short **quizzes** will be assigned at the end of each module and should take about 45 minutes to be completed. They are graded activities that cover subjects recently covered in the course. Quizzes are taken individually on Gradescope, are closed-book/notes, and are meant to reinforce important topics by means of a critical assessment of relevant problems.

One **midterm exam** and one **final exam**, also completed on Gradescope, will contain a variety of multiple choice, essay, and engineering-type questions. Exams are open-book/notes unless otherwise specified. They are designed to be typically completed within a 1-hour interval but will remain open for completion for about 24 hours. You can use a calculator to solve math problems. Exams are individual assignments, so please refrain from discussing their contents with course colleagues before the due date and time.

A **group project** is assigned later in the semester and is designed to encourage students to display creativity and demonstrate that they have mastered the concepts illustrated in the course. All team members are expected to contribute equally to the completion of the project report. A peer evaluation will be conducted after the submission date where students will be rated by their teammates based on individual contributions. The outcome of the peer evaluation will be taken into consideration in the grading process.

CODE OF CONDUCT

As the course is designed to be interactive in many ways, all students and instructional staff are expected to follow proper "classroom behavior and etiquette" and treat others with civility and respect. Despite the rather informal environment encouraged by the instructor, if one's actions or behavior become offensive, disruptive, utterly off-topic, or inappropriate in any way, the instructor reserves the right to block that student's access to shared online resources and report them to departmental leadership for further disciplinary action.

Furthermore, all items in the University of Utah's Policy 6-400: Student Rights and Responsibilities apply herein. To learn more about the broad requirements related to student behavior and behavior violations, check the policy's full text at https://regulations.utah.edu/academics/6-400.php.

REFERENCE TEXTS

This course will adopt a pair of books as primary reference texts. Students should have access to an electronic copy of both at no additional cost using the J. Willard Marriott Library's website. While on campus or logged in for off-campus access, use the search tool to find the references below and download individual chapters or view the entire book using your browser or third-party software. Additional materials and other relevant references will be shared throughout the semester at no cost to regular students.

o INCOSE. INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities (4th version). John Wiley & Sons, 2015. Print ISBN: 9781118999400, eBook ISBN: 9781118999417.

– *Note that INCOSE published a 5th version of the handbook in July 2023. Specific mention to content exclusive to this new version may be made in activities throughout the semester. However, the 4th version was primarily used to develop the course in its current form. For more information about the 5th version of the handbook, check https://www.incose.org/products-and-publications/se-handbook.*

o Kossiakoff A, *et al*. Systems Engineering: Principles and Practice (3rd edition). John Wiley & Sons, 2020. Print ISBN: 9781119516668, eBook ISBN: 9781119516699.

GRADING

	Weight	Details
Knowledge Checks	0%	see note below
Course Intro	5%	quiz/self intro
Weekly Forums	10%	9 forums
Homework	20%	4 assignments
Practicums	10%	4 case study sets
Quizzes	10%	5 short quizzes
Group Project	15%	1 written report
Midterm Exam	12%	open-book/notes
Final Exam	18%	open-book/notes

This course follows the letter grading scheme below:

$95 \le$ **A** ≤ 100 $90 \le$ **A-** < 95	$87 \le$ **B+** < 90 $83 \le$ **B** < 87 $80 \le$ **B-** < 83	$77 \le$ **C+** < 80 $73 \le$ **C** < 77 $70 \le$ **C-** < 73	$67 \le$ **D+** < 70 $63 \le$ **D** < 67 $60 \le$ **D-** < 63 $0 \le$ **E** < 60

The option to curve the overall grade distribution is at the sole discretion of the instructor and will never be in disadvantage of any student.

Note regarding the **knowledge checks**: individually, knowledge checks are not graded and failing to complete them will not affect one's grade negatively. However, every student with a knowledge check completion rate of 80% or more will have their numeric (decimal) grade rounded up to the nearest integer before conversion into a letter grade.

Regrade and grade correction requests must be made directly to the instructor no later than one week after the grade or work in question has been returned. Please monitor your grades posted in Canvas continuously as it holds the course's official gradebook preceding the assignment of letter grades that go on a student's transcript.

LATE ASSIGNMENTS AND MAKEUP WORK

The grade for an assignment submitted up to one day following the original deadline will have a 50% penalty applied to it. Assignments submitted more than one day after the original deadline will not be accepted or graded. Legitimate excuses must be supported with appropriate documentation. Makeup work, when authorized by the instructor, will be discussed on a case-by-case basis.

PARTICIPATION

Watching every lecture and completing activities on time is highly recommended and encouraged. A low participation record may be detrimental to your success on the course. Excuses to the timely completion of exams and other scheduled graded activities can be granted if reasonably justified and supported by appropriate documentation. It is at the discretion of the instructor to accept excuses, which will be analyzed on a case-by-case basis in accordance to the University of Utah's policies on instruction and evaluation, available at: https://regulations.utah.edu/academics/6-100.php.

ACCOMMODATIONS FOR DISABILITIES

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this course, reasonable prior notice needs to be given to the Center for Disability & Access (CDA), 162 Union Building, (801) 581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability & Access.

In addition to the standard process above, please inform the instructor if you are aware of any other personal challenges that may prevent you from fully demonstrating your abilities so that accommodations can be made to ensure your full participation in the course and safeguard your educational opportunities at the University of Utah.

NON-DISCRIMINATION POLICY

The University of Utah guarantees equality of opportunity in education and strives to provide an academic environment that is free from any form of discrimination. Therefore, discrimination or harassment of any person based on race, color, religion, creed, gender, national origin, age, disability, veteran status, sexual orientation, or gender identity is a violation of state and federal laws and/or The U's policies and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. Be advised that all students, faculty, and staff are required to

report instances of sexual harassment, sexual assault, or discrimination to the appropriate offices within the university. Information regarding non-discrimination policies and reporting guidelines can be found at https://oeo.utah.edu.

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, (801) 581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, (801) 581-7776. To report to the police, contact the Department of Public Safety, (801) 585-2677(COPS).

Pregnancy/Childbirth: Should you need modifications or adjustments to your course requirements because of pregnancy- or childbirth-related events, please contact your instructor to discuss an accommodation plan. Congratulations and enjoy the many sleepless nights to come!

Religious Observance: Students may be given additional time to complete activities that fall on days of religious observance or religious holidays, without penalty. Please communicate potential conflicts promptly.

LGBTQ+ Individuals *and Beyond*: The course instructor advocates in favor of equality for all individuals, regardless of their perceived or actual sexual orientation, gender identity, or choice of gender expression. Regardless of your status as a member of the LGBTQ+ community, please inform the instructor if you have a chosen pronoun and/or name that you would like to be addressed by.

ACADEMIC INTEGRITY AND STUDENT CONDUCT

Students are required to comply with all university-level policies on academic integrity as published in the Code of Student Rights and Responsibilities. All cases of academic misconduct will be reported to the Office of the Dean of Students. Please review your rights and responsibilities available at https://regulations.utah.edu/academics/6-400.php.

Additionally, academic misconduct policies specific to the Department of Mechanical Engineering will also apply. These policies are available at https://www.mech.utah.edu/academics/me-academic-misconduct-policy. By continuing your enrollment in this course, you acknowledge to be familiar with these policies and commit to abide by them.

Integrity Pledge: Your signature (digital or otherwise) on any test or assignment implies the following integrity pledge: *"On my honor, I affirm that I have neither given nor received inappropriate aid in the completion of this exercise."*

UNIVERSITY SAFETY

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit https://safeu.utah.edu.

Please review The U's Emergency Response Guide available at https://alert.utah.edu/emergency-response-guide and be familiar with the official procedures in the events of earthquakes, utility failures, fires, medical assistance in case of injury or illness, environmental quality concerns, active shooters and acts of violence, bomb threats, severe weather, bio/chem/RAD spills, secure in place and shelter in place orders, and evacuation orders.

COURSE DELIVERY

Sections 030, 090, and 290 of ME EN 5160/6160 will be delivered entirely online and remotely. There are no in person activities nor regularly scheduled course meetings. Lecture recordings and their associated assignments are made available every Saturday at 12:00 AM when classes take place during the week that follows. The course is considered asynchronous as each student is free to organize their week as they please based on the release of new materials and the due dates and times of graded activities. However, a standard pace will be set according to the release of each week's materials as defined by the detailed schedule that follows.

COURSE SCHEDULE AND IMPORTANT DEADLINES

See pages 5 and 6 below.

WEEKLY CALENDAR

Week	Dates	Topics
MODULE 0 - COURSE INTRODUCTION		
1	08/21 - 08/25	Course Introduction
MODULE 1 - INTRODUCTION TO SYSTEMS ENGINEERING		
2	08/28 - 09/01	Overview of Systems Engineering
3	09/04 - 09/08	Systems Life Cycle
4	09/11 - 09/15	Module #1 Practicum
MODULE 2 - TECHNICAL PROCESSES		
5	09/18 - 09/22	Business and Stakeholder Needs
6	09/25 - 09/29	System Requirements
7	10/02 - 10/06	System Architecture and Design
8	10/09 - 10/13	Fall Break
9	10/16 - 10/20	System Verification and Validation | Module #2 Practicum
10	10/23 - 10/27	Midterm Exam | Group Project Assigned
MODULE 3 - HIGHER LEVEL SYSTEMS ENGINEERING PROCESSES		
11	10/30 - 11/03	Risk Management
12	11/06 - 11/10	Quality and Measurement
13	11/13 - 11/17	Human Resource Management
14	11/20 - 11/22	Module #3 Practicum
MODULE 4 - SYSTEMS ENGINEERING APPLICATION		
15	11/27 - 12/01	Tailoring Process + Systems Thinking
16	12/04 - 12/07	Module #4 Practicum
17	12/11 - 12/15	Final Exam

Version 0 (21-Aug-23)

HOMEWORK DUE DATES

HW	Due	Topics
1	09/15	Module 1 | Weeks 2-4
2	10/27	Module 2 | Weeks 5-10
3	11/22	Module 3 | Weeks 11-14
4	12/07	Module 4 | Weeks 15-16

All submissions are due at 11:55 PM on Canvas

SCHEDULE AND DUE DATES ARE SUBJECT TO CHANGE

Canvas will always have the most up-to-date version of this schedule.

All changes will be communicated!

QUIZ DATES

Quiz	Due	Topics
1	09/15	Module 1 | Weeks 2-4
2	10/20	Module 2 | Weeks 5-10
3	11/22	Module 3 | Weeks 11-14
4	12/07	All Modules | All Weeks

All quizzes are completed on Gradescope

PROJECT DATES

Date	Event
10/23	Assignment and Formation of Groups
12/07	Final Report
12/08	Peer Evaluations

Do not hesitate to send any questions you may have to pedro.huebner@utah.edu. I am here to help you succeed! 😊
I also appreciate feedback. Let me know if things are going well for you. We will work together to resolve any issues.