SYLLABUS (tailored for Fall 2025)
SIE 454A-554A
The Systems Engineering Process

Mondays & Wednesdays 3:00 PM – 4:15 PM AZT/MST (UTC-7 year round)
Location AME S212

Description of Course

Process and tools for systems engineering of large-scale, complex systems: requirements, performance measures, concept exploration, multi-criteria tradeoff studies, life cycle models, system modeling, etc. Graduate-level requirements include extensive sensitivity analysis of their final projects.

Course Prerequisites

None

Instructor Contact Information

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SIE Adjunct Lecturer

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SIE Associate Professor

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- **Office Hours**: Talk to Rick first

Course Format and Teaching Methods

This course will be a **flipped learning space**, meaning we will actively utilize both online (via D2L) and face-to-face instruction to support learning, inquiry, and understanding of course concepts. In this course you should expect to watch lectures, read course materials, and/or do other independent learning activities before and after course meeting times. During course meetings we will actively explore ideas and concepts through discussions, activities, and problem-solving. Because there are no lectures during course meetings it is crucial to come to course meetings having reviewed all assigned materials.

This course will also use **outcomes-based grading** rather than a traditional points-based system. This means that instead of receiving points for each assignment and accumulating them to a final letter grade, you are offered a plethora of mechanisms to demonstrate that you have attained the stated learning outcomes. Mechanisms for the demonstration of learning may include course discussions, homework and written assignments, course projects, personal conversations with the instructor, etc. Final grades are calculated as a function of the level of attainment of learning outcomes achieved by the end of the semester.

Expected Learning Outcomes

When students finish this course, they will be able to:

1. Evaluate the concept of system and distinguish system taxonomies as applied to the engineering of systems.
   [Weight: 5]
2. Establish system boundaries and illustrate an abstraction of a system.
   [Weight: 10]
3. Justify the role of systems engineering in engineering projects.
   [Weight: 5]
4. Justify the adequacy of systems engineering roles and engineering teams to successfully engineer a system.
   [Weight: 5]
5. Illustrate the phases of the system life cycle and use them to debate the appropriateness of development strategies.
   [Weight: 5]
6. Assess the potential consequences of engineering decisions throughout the life cycle.
   [Weight: 10]
7. Distinguish between operational need and system solution.
   [Weight: 20]
8. Apply methods to identify the actual needs that lead to the development of a system.
   [Weight: 10]
9. Apply methods to formulate engineering problems in such a way that capture operational needs and development constraints, by developing Concepts of Operations, eliciting stakeholder requirements, and deriving them into system requirements.
   [Weight 15]
10. Evaluate how system acquisition, system integration, and verification and validation influence system architecture decisions.
    [Weight: 15]

Required Texts and Materials

Applied Space Systems Engineering (Space Technology Series)
Edited by: Larson, Kirkpatrick, Sellers, Thomas, and Verma
Published: McGraw-Hill Education (2009)
ISBN: 978-0073408866

Course Assignments

Homework (x11)

You will be required to complete several assignments that are aimed at practicing individual concepts and methods covered in this course.

Course Project (x1)

This course does not have a final exam. Instead, you will conduct a final project that will cover all the content that you have learnt in the course. This time, you will be required to apply all you have learnt in

an integrated manner in a project that will resemble to some extent an actual application of systems engineering concepts and methods.

Grading Scale and Policies

Grading in this course will be based on attaining the learning outcomes of the course. Instead of you receiving points for each assignment and accumulating them later, you are offered a plethora of mechanisms to demonstrate that you have attained the learning outcomes. This has been done to support you in several ways and more fairly reflect learning in the grades:

- What matters is the learning that you attain by the end of the course. Hence, you can work at your own pace to construct such knowledge, without being negatively affected by early assignments.
- Different students perform differently depending on the assignment type. In this way, you will not be penalized by being forced into a type of assignment that you are not comfortable with.

Learning Outcomes and Mechanisms

Mechanisms for demonstrating attainment of learning outcomes include oral discussions in class, conversations with the instructor (by email, zoom, etc.), weekly homework and written assignments.

Four levels of attainment have been established for each learning outcome:

Level of Attainment	**Description**
Excellent Attainment (GPA 4.0)	The student shows correct understanding and use of fundamental systems engineering concepts of a particular learning outcome in the context of creating systems engineering artifacts.
Good Attainment (GPA 3.0)	The student shows correct understanding and use of fundamental systems engineering concepts of a particular learning outcome in the context of evaluating systems engineering artifacts.
Basic Attainment (GPA 2.0)	The student correctly understands fundamental systems engineering concepts of a particular learning outcome but is unable to use them when evaluating or creating Systems Engineering artifacts.
Unattained (GPA 0.0)	The student exhibits substantial misunderstanding in the interpretation and/or use of the fundamental systems engineering concepts of a particular learning outcome.

In general, **class discussions** and **homework assignments** may help you reach a level of *Good Attainment*. The assignments associated with the **final project** can help in reaching up to a level of *Excellent attainment*. Personal conversations, discussions, side assignments, etc. may be used to demonstrate different levels of attainment at the discretion of the instructor.

It is important to note that *assignments are not mutually exclusive*, so you can use them at your convenience to try to achieve the level of attainment that you desire.

Artificial Intelligence (LLM) Policy

Use of LLM's (a.k.a. artificial intelligence) in this class is permitted ... and actually encouraged for discussion posts and homework. When using AI, each student is *required* to:

- Clearly state which LLM was used
- Provide the specific prompt used to generate the response
- Provide a brief analysis of the response, pointing out where you agreed with it and where you disagreed.

Lack of this information may invalidate the assignment submission.

Grade Revision Policy

Grades are non-negotiable; correctness on grading is. This means:

- If you believe that the instructor has made a mistake when grading an assignment, you are strongly encouraged to inform the instructor and ask for a revision. The instructor will review and revise the grading. *Note that a grading revision may result in the same grade, a higher grade, or a lower grade depending on the grading errors that are identified*.
- Requests for grade revisions where no grading error has been made will not be accepted. That is, the assigned level of attainment is decided only by the instructor and is non-negotiable. *Note that a student requesting a change in grade based only on perceived attainment will be considered a sign of unprofessional behavior*.

Final Letter Grade

The final grade will be calculated as a function of the level of attainment of learning outcomes you achieved by the end of the semester. The final grade will be calculated as follows:

1. The level of attainment of each learning outcome is converted to its GPA equivalent (indicated above).
2. Each learning outcome has been allocated a specific weight within the course (indicated above).
3. A total number grade will be determined as the weighted average of all learning outcomes.
4. The number of points will be converted to their letter equivalent using the rounding function in Excel.

See the Grading Guide in D2L Start Here for Grade Simulator; use this to predict your overall grade in the course.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Classroom Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

To ensure the health and safety of others, students are asked to please **not** attend in-person class sessions if they feel ill. In the event of an illness, please contact your instructor via email.

Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

University-wide Policies

Links to the following UA policies are provided here, https://academicaffairs.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement