AEROSPACE AND MECHANICAL ENGINEERING
COLLEGE OF ENGINEERING

AERO 4365
Aerospace Systems Engineering
Spring 2025 - Syllabus

Instructor: Sergio Luna, Ph.D.

Course Web Address: Link to Blackboard shell
Course Schedule: Monday & Wednesday (1:30 pm – 2:50 pm MST)
Location: Classroom Building c305
Contact Information: salunafong@utep.edu
Office Hours: Monday 9:00am – 10:30 or by appointment. Feel free to reach out via MS Teams

Course Description

Systems engineering is a multidisciplinary approach to developing complex systems, emphasizing a holistic perspective. In this course, students will gain hands-on experience with systems engineering methods, tools, and processes specific to the aerospace domain. This includes understanding stakeholder needs, design drivers, conducting trade studies, making design decisions, performing risk analysis, and engaging in verification and validation throughout the sustainment and retirement phases. Additionally, the course will incorporate essential project management activities.

This course introduces students to the theory and practice of systems engineering by guiding them through a multidisciplinary group project aimed at addressing a specific stakeholder need. Students will engage with the complete lifecycle stages while producing essential artifacts for project completion. Through the development of an unmanned aerial system, students will apply systems thinking to translate customer needs into system requirements, identify the appropriate system development process, generate potential design solutions, present conceptual architectures, outline the plan for interface integration, discuss proposed testing, verification, and validation strategies, and review planned maintenance and retirement activities.

Student Learning Outcomes

After successful completion of this course, students will be able to:

- Explain the systems engineering process and its application to complex systems.
- Develop and manage system requirements.
- Apply risk management strategies to engineering projects.
- Integrate subsystems into a cohesive system level
- Work effectively in multidisciplinary teams to achieve project objectives.
- Communicate systems engineering concepts and project results effectively.
- Apply systems engineering methods, tools, and processes to the design of complex systems

ABET Student Outcomes

Outcome	Description
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3	An ability to communicate effectively with a range of audiences
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to conclude.

Course Format and Structure

- Our weeks will run from **Monday** to **Wednesday**. I will post all the information (online activities, discussion starters, etc.) on Blackboard for the upcoming week on **Sunday** evening after class so you can begin the new week and submit your deliverables, if any, by the following **Sunday**.
    - Course Web Address: Link to Blackboard shell

- Office hours will be held Monday from 9:00 a.m. - 10:30 p.m. MST or by appointment. Please email me at salunafong@utep.edu to schedule a meeting.
- Assignments are due by 11:59 p.m. MST on the due date listed in the course schedule.
- An assignment file should be appended with the respective assignment number, your Last Name, and your First Name, such as "assignment1_LastName_FirstName.pdf". This makes it easier for me to manage assignment files when downloading to my computer.

Course Materials

- The following materials are **required:**

    1. *NASA Systems Engineering Handbook* (NASA SP-2016-6105 Revision 2)
        - https://www.nasa.gov/sites/default/files/atoms/files/nasa_systems_engineering_handbook_0.pdf

    2. INCOSE Handbook. International Council on Systems Engineering, *Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities*. 4th Edition, Wiley 2015.

       The electronic version of the handbook is included with the INCOSE student and professional membership. It is also available, free of charge, to INCOSE's Corporate Advisory Board (CAB) limited members. Several industry, academia, and government organizations are INCOSE's CAB members. To join INCOSE or confirm that your organization is a CAB member, please visit the following link:

        - Join INCOSE - International Council on Systems Engineering
        - UTEP is a CAB member. Hence, we can access it at no cost.

    3. NoMagic System of Systems Architect for Model-Based Systems Engineering (Software)
        - Download instructions in Blackboard

- The following materials are not mandatory but are **recommended:**

    1. Product Design and Development 6ed (Ulrich, Eppinger) McGraw Hill
        - Link to sample book

    2. Kossiakoff, A., Biemer, S. M., Seymour, S. J., & Flanigan, D. A. (2020). *Systems engineering principles and practice* (2nd ed.). John Wiley & Sons.

    3. Blanchard, B. S., & Fabrycky, W. J. (2010). *Systems engineering and analysis* (5th ed.). Pearson College Division.

    4. Product Design and Development 6ed (Ulrich, Eppinger) McGraw Hill
        i. Link to sample book

    - **Knowledge Repository**

    5. SEBoK Link - SEBoK - Systems Engineering Body of Knowledge

Tentative Course Schedule

The schedule below is subject to change. If I am required to make any amendments, I will inform you via Blackboard, email, and MS Teams.

Assignments are due by 11:59 p.m. MST on the day specified in the "Assignment" column seen below.

Module	Date	Topic(s)	Assignment Quizzes: Every Wednesday Project Updates
Week 01	Jan 20th – 26th, 2025	Orientation & Introduction to Systems Engineering	Student Introductions
Week 02	Jan 27th – Feb 2nd	Systems Engineering Foundations Systems Engineering Principles	INCOSE SE Handbook: Ch. 1, 2 NASA SE Handbook: Ch. 1, 2 **Quiz #1: SE Principles**
Week 03	Feb 3rd – Feb 9th	Systems Engineering Processes and Life Cycles	INCOSE SE Handbook: Ch. 3 NASA SE Handbook: Ch. 3 **Quiz #2: SE Processes**
Week 04	Feb 10th – 16th	Mission and Business Analysis Stakeholders and CONOPS	INCOSE Handbook: Ch. 4.1 - 4.2 NASA SE Handbook: Ch. 4.1 **Quiz #3: Mission and Business Analysis**
Week 05	Feb 17th – 23rd	System Requirements Elicitation	INCOSE Handbook: Ch. 4.3 NASA SE Handbook: Ch. 4.2, 6.2, App. C **Quiz 4#: Requirements Elicitation** **Project Update #1: Project Description**
Week 06	Feb 24th – March 2nd	System Requirements Management	INCOSE Handbook: Ch. 9.3 NASA SE Handbook: Ch. 4.3 **Quiz #5: Requirements Management**
Week 07	March 3rd – 9th	Functional Analysis	**INCOSE Handbook: Ch. 4.4 – 4.5** **NASA SE Handbook: Ch. 4.4** **Quiz #6: Functional Analysis**
Week 08	March 10th – 16th	Architecture Definition	INCOSE Handbook: Ch. 4.6, 5.2 – 5.7 and 9.1 NASA SE Handbook: Ch. 6.3 – _6.7, App. L **Quiz #7: Architecture Definition**
Week 09	**March 17th – 23rd**	**System Analysis**	**Mid Term due: 3/25**
Week 10	March 24th – 30th	Implementation and Integration	INCOSE Handbook: Ch. 4.7, 4.8, 4.10, 5.8, 9.6-9.7 NASA SE Handbook: Ch. 5.1 – _5.2, 5.5, App H **Quiz #8: Implementation and Integration** **Project Update #2: Project Implementation**
Week 11	March 31st – April 6th	Testing, Verification, Validation, Quality	INCOSE Handbook: Ch. 4.9, 4.11 NASA SE Handbook: Ch. 5.3-5.4, App D, E, I **Quiz 9#: Testing, V&V**
Week 12	April 7th – 13th	Specialty Engineering	INCOSE Handbook: Ch. 5.3, 10 NASA SE Handbook: Ch. 6.8 **Quiz #10: Specialty Engineering**

Week 13	April 14th – 20th	Model-Based Systems Engineering (MBSE) & Operation	INCOSE Handbook: Ch. 4.12 – 4.14, 9.1- 9.2 NASA SE Handbook: Ch. 6.8 **Project Update #3: Project Implementation**
Week 14	April 21st – 27th	Maintenance and Disposal	**Quiz #11: Maintenance and Disposal**
Week 15	**May 9th**	**Final Project – MBSE Model**	**Final Project Presentations** **Final Project Report**

Course Requirements

- **Assignments**

  The following breakdown describes class assignments:

  - (20%) – Quizzes
  - (20%) – Project Updates
  - (25%) – Mid-term project – Lectures 2 to 8
  - (25%) – Final Project
  - (10%) – Team Presentation

- **Team Project – Development of System Description Architecture using model-based engineering – Unmanned Autonomous System Physical and Simulation**

  - Students will work in multidisciplinary teams to develop a Systems Engineering Management Plan (SEMP). This document describes the technical project planning and control, systems engineering process, and engineering specialty integration and sets the foundation for establishing how a system will come to life.
  - Each team member will be asked to assess each other's contribution to the team's contribution.

Grading Procedures

Grades will be based on the following weights:

Quizzes	20%
Project Updates	25%
Midterm project	25%
Final Report	25%
Team Presentation	10%

The final grading rubric will be as follows:

A	90 - 100
B	80-89
C	70 - 79
D	60 – 69
F	< 60

Learning Accommodations

The Center for Accommodations and Support Services (CASS) aspires to provide students with disabilities accommodations and support services to help them pursue their academic, graduation, and career goals. For more information concerning services for students with disabilities, please contact the Center for Accommodations and Support Services at https://www.utep.edu/student-affairs/cass/