

AE6393 Introduction to System of Systems Engineering Principles Fall 2020 Syllabus

Course Instructor

Prof. Dimitri Mavris

`dimitri.mavris@aerospace.gatech.edu`

Office Hours: by appointment

Office: Weber 301A

This document provides basic information regarding the Introduction to System of Systems Engineering Principles (SoSE Principles) class for the Fall 2020 academic term. The course is listed as AE6393 for 3 credit hours in the course catalogue of the Georgia Institute of Technology. Lectures take place between TBD times in the TBD building in TBD lecture room unless otherwise specified by the instructor or the assistants.

1 Introduction & Objective

Introduction to System of Systems Engineering Principles is a 3-credit course covering methods related to the study, development, analysis, and design of complex systems and systems of systems. Lectures will cover each method by introducing its theoretical formulation, application criteria, and some example applications. The goal of the course is not to provide comprehensive coverage of each method, but to provide sufficient fundamental coverage of it to allow for the practical use of the methods on the group project. Another goal is to get students initiated with the methods to ease future self-learning.

The main objective of this course is to provide the student with fundamental understanding of complex systems and system of systems engineering. The unique challenges of system of systems development will be discussed. Supporting this objective, cross-cutting view of current and relevant complex systems and system of systems analysis and design methods will be introduced. The course is designed to balance breadth and depth by addressing a variety of methods with sufficient detail to make students knowledgeable in the area. Students will learn concepts and theories such as complexity, mathematical modeling, computer simulation, and emergent behavior and apply them to a group project.

SoSE Principles will also expose students to real world problems through team design projects called Grand Challenges. The focus is on the application of design methods, approaches, concepts and tools in a group setting using material presented and other academic material background as a knowledge basis. Projects include engineering problems of interest to industry and government organizations and the students will form interdisciplinary and interdepartmental teams to tackle them.

During AE6393 the projects will be integrated into the lectures. Students will form teams and select their system of systems project among the options offered. Roughly a review is planned per month to track progress. AE6393 serves as the architecting phase of the group project. The semester culminates in a systems engineering report with a detailed execution plan for the Spring semester. The follow-on course AE6394 includes laboratory sessions during which teams will work on their models, produce results, and prepare documentation in the form of a final report and presentation.

2 Class Projects and Assignments

Project teams will be determined early in the semester. Students will work together through both Fall(AE6393) and Spring(AE6394) semesters. The projects will provide the students to apply their newly-gained knowledge to a practical engineering problem. Progress on these projects will be assessed by progress reports and in-class presentations by the team to the instructor and assistants. Dates for deliverables and presentations will be provided through the course website.

There are three projects the teams will work on. Each project incrementally builds skill and knowledge towards a single goal of executing the Grand Challenge project; however, each project will be graded separately and timely for the students to keep track of their performance throughout the semester. The three projects are defined as follows.

Problem Formulation & Literature Review Establishing the objectives, getting up to speed with the technical background, and defining a solution approach (also known as "the SWARMING Project")

Systems Engineering & Architecting Requirements definition and management approach, system of systems decomposition, and architecting the decision points for the project

Modeling Selection & Analysis Plan Selection of a modeling paradigm for the rest of the project, the plan forward, and the execution of a canonical case using an early-version of the model

3 Grade Breakdown

Grades will be mainly based on project presentation and reports. Participation in lectures and occasional homeworks will also contribute to student grades. Participation will be graded

based on attendance and lecture engagement such as in-class exercises. The breakdown is given in Table 1.

Week	Grade Ratio	Title
6	15%	Problem Formulation & Literature Review Report
7	10%	Problem Formulation & Literature Review Presentation
10	25%	Systems Engineering & Architecting Report
11	10%	Systems Engineering & Architecting Presentation
15	20%	Modeling Selection & Analysis Plan Report
15	10%	Modeling Selection & Analysis Plan Presentation
—	10%	Class Participation & Homeworks

Table 1: Grade Breakdown

4 Class Website

The official SoSE Principles class website is on Canvas at <https://canvas.gatech.edu/>. This website is intended to provide all official lecture material, handouts, presentations, notices and relevant information. Note that the website will be constantly updated and must be checked on a regular basis. All announcements are automatically emailed to your GT student account. It is the student's responsibility to maintain access to this account and address email filtering issues.

To log in use your GT account username (usually your first name initial followed by your last name and a number, e.g., *gburdell3*) and your GT account user password. Once on Canvas, select the AE6393 course. Distance Learning students can access lecture videos through this website.

5 Office Hours

Prof. Dimitri Mavris will hold office hours by appointment in Weber 301A.

6 School Calendar

The official school calendar of Georgia Tech is provided by the Office of the Registrar and is available at registrar.gatech.edu/home/calendar.php.

7 Student Expectations

7.1 Class Material Documents

Students are expected to complete reading assignments before lectures. It is the student's responsibility to understand the material to the best of his/her abilities before the lecture; the student may use the class material documents and any additional sources necessary. If a student is new to a certain topic it is his/her responsibility to become familiar with it outside lecture time. Class assistants will be available to help students in directing them to recommended sources and material.

7.2 Lectures

Students are expected to participate in the lecture discussions and to ask questions whenever in doubt about class material. Lectures are performed in a discussion type atmosphere where consistent questioning of concepts takes place and student engagement is crucial. For more information, please refer to the Institute's absence policy found at catalog.gatech.edu/rules/4/.

7.3 Honor Code

Students are expected to abide by the Honor Code of the Georgia Institute of Technology. Honor Code can be found at osi.gatech.edu/content/honor-code.

It is the responsibility of the students to become familiar with the Honor Code and be aware of rules and expectations. If you have any questions regarding the Honor Code please contact a representative of the Honor Advisory Council of the Institute. Violations to the Honor Code have serious consequences and will be enforced at all times.

7.4 Students with Special Needs

Your experience in this class is important to us. If you have already established accommodations with the Office of Disability Services, please communicate your approved accommodations to the instructor at your earliest convenience to discuss your needs in this course.

If you have not yet established services through Disability Services, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), please contact the Office of Disability Services at (404)894-2563 or dsinfo@gatech.edu.

Disability Services offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and Disability Services. It is important to the Georgia Institute of Technology to create inclusive and accessible learning environments consistent with federal and state law.

7.5 Health and Well-Being

Georgia Tech and the School of Aerospace Engineering understand that many students experience stress through a variety of academic, financial, and personal experiences. We value you and want to make you aware of resources available to you should you need them. Your well-being and mental health are important, and we are here for you.

- Center for Assessment, Referral and Education (CARE)
- Campus Police (any emergency): 404-894-2500
- Counseling Center: 404-894-2575
- Dean of Students Office: 404-894-6367
- Georgia Crisis and Access Line: 800-715-4225
- National Suicide Prevention Lifeline: 800-273-TALK (8255)
- Crisis Text Line: Text HOME to 741741
- VOICE: Victims Survivor Support: 404-385-4464 (or 4451)
- Stamps Health Services

A Class Schedule

Week	Date	Topic
1	TBD	Course Introduction, Terminology, & Team Forming
2	TBD	SWARMING Project Introductions
3	TBD	Systems Eng. Foundations & Basic Concepts
4	TBD	Principles of Systems Thinking & Architecting
5	TBD	Systems Modeling Language Basics
6	TBD	Systems Modeling Language Execution
6	TBD	Project 1 Report Due
7	TBD	Project 1 Review
8	TBD	System of Systems Architecting & DoDAF
9	TBD	Executable Architectures
10	TBD	Fall Recess (guess)
10	TBD	Project 2 Report Due
11	TBD	Project 2 Review
12	TBD	Discrete Event Simulation Theory & Application
13	TBD	Agent-based Simulation Theory & Application
14	TBD	Thanksgiving
15	TBD	Final Reviews & Project Report

Table 2: Schedule of classes