INSY 7720/7726 – Systems Engineering I
Fall 2020 – TR from 2:00 PM-3:15PM – Shelby Center 1122

Instructor: Gregory Purdy (OR Gregory Harris)
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Credit Hours: 3

Catalog Description:
Processes and tools for engineering large-scale, complex systems: architecture, requirements, risk management, evaluation, concept exploration, decision-making, tradeoff studies, life cycle models, decomposition, system coupling, test, verification, validation, system modeling, business process re-engineering, sensitivity analysis, teamwork, process maturity, and documentation.

Course Description:
This course is an introduction to the foundation of systems thinking and the presentation of concepts to allow students to see and comprehend the total function of a system. The application of systems thinking is a crucial success factor for a career in systems engineering. Systems engineering is not about creating documents that describe systems; it is the ACTIVITY of understanding the needs, designing a solution, and bringing the system into existence. The goal of this course is for the student to gain an overall appreciation for the breadth and depth of Systems Engineering and the development of a *"Systems View"* of the products, services, and environments in which Systems Engineering is applicable. Emphasis is placed on developing the ability to exercise systems thinking.

Course Topics:
Seeing the System
System Types
System Life Cycles
Systems Engineering Overview and Processes
System Requirements
System Analysis
Functional Analysis
System Architecting
Architecting and Implementation

Learning Objectives:

When you complete this course, you will be able to:

1. Describe the defining characteristics of a system and its boundaries.
2. Describe the phases of the system life cycle and the characteristics and actions that define each of these phases.
3. Write system/subsystem requirements statements.
4. Describe the documentary elements of project and system engineering (Statement of Work, Work Breakdown Structure, System Engineering Management Plan) and program control methods such as configuration management.
5. Describe the importance and principles of interaction and coordination among multidiscipline, system development teams.
6. Demonstrate the fundamentals of reliability, maintainability, analysis, and testing and describe the characteristics of these disciplines in the context of systems development.
7. Describe the importance and elements of human factors, system logistical support, production, and disposal.

Textbook:

1. International Council on Systems Engineering (INCOSE). (2015). *Systems Engineering Handbook* (4th Edition). Hoboken, N.J.: Wiley. ISBN: **9781118999400**.

NOTE: INCOSE membership is required for the course. If you are enrolled as an undergraduate, master's or graduate student and if your course load is at least ¾ of full time in an engineering or related field you are eligible for a student membership of $50 at: https://www.incose.org/incose-member-resources/join-incose

2. Senge, Peter M. (1990, 2006). *The Fifth Discipline: The Art and practice of the Learning Organization.* London: Random House. ISBN: **9780385517256**.

Reference Materials:

1. Wasson, Charles S. (2006). *System analysis, design, and development: concepts, principles, and practices.* Hoboken, N.J.: Wiley-Interscience. ISBN: **9780471393339**.

2. National Aeronautics and Space Administration. (2007). *Systems Engineering Manual*. NASA Headquarters, primary points of contact: Stephen J. Kapurch, Office of the Chief Engineer, NASA Headquarters, and Neil E. Rainwater, Marshall Space Flight Center. NASA/SP-2007-6105 Rev1 http://www.acq.osd.mil/se/docs/NASA-SP-2007-6105-Rev-1-Final-31Dec2007.pdf

3. The Institute of Electrical and Electronics Engineers, Inc. (2005*). IEEE Standard for Application and Management of the Systems Engineering Process*. New York, NY: Software Engineering Standards Committee of the IEEE Computer Society. IEEE Std 1220-2005. https://ieeexplore.ieee.org/document/1511885/

4. The Institute of Electrical and Electronics Engineers, Inc. (1998). *IEEE Guide for Developing System Requirements Specifications*. New York, NY: Software Engineering Standards Committee of the IEEE Computer Society. IEEE Std 1233, 1998 Edition. https://ieeexplore.ieee.org/document/741940/versions

Grading Policy:

Grading Distribution

Category	*Percent of Grade*
Project Assignments	15%
Mid SEMP	25%
Case Study	10%
Article Reviews	10%
Exercises/Homework	10%
Final SEMP	30%

Grading Scale

Range	*Letter Grade*
90-100	A
80-89	B
70-79	C
60-69	D
0-59	F

GRADING NOTE: All graded activities in this course earn scores from zero to 100. The Canvas Gradebook then calculates and weights the scores appropriately. This means that while you can potentially earn the same points for all graded activities in the course, the weights are different. Your final grade is based on the weighted scores, not the score total. See the Grading Distribution above for the grade categories and weights. If you have questions about the scoring and weights, please contact me.

Required Work:

1. ***Class Attendance***

   Given the unprecedented circumstances we find ourselves in due to COVID-19, we will not be having in-person lectures. All lectures will be recorded on Panopto and available for students in the class. These lectures will be available for you to view asynchronously and at your leisure. Students need to stay current with the course material via the recorded lectures or by attending class in-person (in-person is COMPLETELY OPTIONAL). We cover a great deal of material in this course and use much of it through the SEMP. Therefore all students must stay up to date on the material.

   In response to COVID-19, and in alignment with Auburn University's Presidential directives, and local, state, and national health official guidelines face coverings are required at all times while on campus, except when alone in a private office. This includes the classroom, laboratory, studio, creative space, or any type of in-person instructional activity, and public spaces. "A "face covering" is defined as a "covering that fully covers a person's nose and mouth, including without limitation, cloth face mask, surgical mask, towels, scarves, and bandanas.

   All students choosing to attend in-person lectures **MUST** wear a mask correctly to help ensure a safe environment for all. Additional information regarding this policy is provided in the "Health and Safety" section below.

2. ***Assignments***

   Throughout the class, you will need to complete project-related assignments and exercises to help you understand aspects of systems engineering. Additionally, you will be asked to read journal articles on various topics related to Systems Engineering and complete a case study. Graduate students are responsible for all assignments and will work individually unless

otherwise directed by the instructor. Additional information about these assignments will be provided in class and on Canvas.

Due dates for assignments will be announced in class. Assignments turned in a day late will receive a letter grade lower than the work would typically achieve. Assignments turned in two days late will receive a two-letter grade reduction. Assignments later than one week late will generally not be accepted.

If any unforeseen circumstances arise, please email me about the issue. I will provide changes to any scheduled due dates on a case by case basis.

3. **Systems Engineering Management Plan (SEMP)**
   Students will be asked to work in teams to complete a Systems Engineering Management Plan (SEMP) for a project prompt provided by the instructor. Project assignments will be used to guide the teams through the process of creating a SEMP. The Mid (semester) SEMP and the Final SEMP are the two major deliverables for this course. Teams will be asked to submit various sections for the Mid SEMP to receive feedback and evaluation on their progress. These sections will be used in the Final SEMP turned in at the end of the semester.

   More information about the three project options and the requirements for the SEMP will be provided throughout the semester.

Course Policies:

This class relies on creating a learning community in which we attain new levels of knowledge together. For this to be successful, it is important to engage with the material and better understand how Systems Engineering can be used to solve complex problems. My goal is to provide you with a safe environment to question and learn about various aspects of systems engineering and all the different facets of this field.

Health and Safety

If you become ill during the semester, you must notify the instructor immediately and maintain an open line of communication so we can make appropriate plans for you to keep up with or make-up class content and assignments.

In response to COVID-19, and in alignment with Auburn University's Presidential directives, and local, state, and national health official guidelines face coverings are required at all times while on campus, except when alone in a private office. This includes the classroom, laboratory, studio, creative space, or any type of in-person instructional activity, and public spaces. "A “face covering” is defined as a “covering that fully covers a person’s nose and mouth, including without limitation, cloth face mask, surgical mask, towels, scarves, and bandanas.

If a student has a medical exception to the face covering requirement, please contact the Office of Accessibility to obtain appropriate documentation. This documentation will need to be presented to the instructor **BEFORE** attending a class meeting.

Anyone who is not wearing a face covering will be asked to put one on or leave the class immediately. Individuals may also be asked to leave class if they remove their face covering during the class, or have to be asked multiple times to wear it correctly.

Failure to comply with a request to leave class for not correctly wearing a face covering is a serious health issue, and may result in any or all of the following:

- Immediate cancellation of the entire class period or activity. All students will then be required to cover the material for that class or activity on their own
- Submission of a complaint to Student Conduct concerning the incident and the individual's refusal to wear, or correctly wear, the required face covering
- A final semester grade of an F for the course for the person refusing to wear, or correctly wear, the required face covering

Additional Personal Protective Equipment (PPE) may be required for some courses and labs, and using it properly will be treated with the same severity as the requirement to wear a face covering.

Social distancing **WILL BE** required for all in-person class activities.

It is expected that all students will complete the online health check through AU-Access every day. If your result is anything other than the green checkmark, your class participation mode must be online.

NOTE: In the event of a change of course modality due to health concerns, either at the individual class level or the university level, this syllabus may be replaced with one that is tailored to the new modality.

Disability Accommodations

Please let me know as soon as possible (preferably week one) about any accommodations which you may need to be successful in this course. Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting the first week of classes, or as soon as possible if accommodations are needed immediately. Please let me know as soon as possible so we can work on a plan together. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT)

Academic Integrity

All students are required to comply with the Auburn University Student Academic Honesty Code. All portions of the Auburn University student academic honesty code (Title XII) found in the Student Policy eHandbook (http://www.auburn.edu/student_info/student_policies/) will apply to this class. Academic misconduct can result in an "**F**" regardless of % earned through the course

Canvas

Resources for the course are located in Canvas. I will try to post slides for class the night before, but there may be some minor changes on the day of as I am continually tweaking material and adding information.

Tentative Course Schedule:

Class meets virtually Tuesday and Thursday from 2:00 pm to 3:15 pm on Panopto. This schedule is tentative and some of the dates may be shifted around based on the pace at which we get through material or unforeseen events. Any changes to course timing or deadlines will be discussed in class and posted on Canvas.

Week	Date	Lec	Topic	Reading
1	08/17	-	Class Overview, Syllabus	
		-	Intro to Systems Engineering	
2	08/24	a	Seeing the System	5th Discipline: Chapters 1-7
		b	Seeing the System	
3	08/31	a	Systems Types	Wasson 1-5, 13
		b	Systems Types	
4	09/07	c	Systems Types	Wasson 7-9, 12
		a	Systems Life Cycle	
5	09/14	-	Guest Speaker	IEEE Std 1220-2005 Sec 5
		b	Systems Life Cycle	
6	09/21	c	Systems Life Cycle	INCOSE SE Handbook §2, 4 & 5
		a	Systems Engineering	
7	09/28	b	Systems Engineering	Wasson 26
		c	Systems Engineering	Wasson 5, 14, 15 & 17
8	10/05	d	Systems Engineering	
		e	Systems Engineering	
9	10/12	a	Systems Requirements	Wasson 18-20, 32,33
		b	Systems Requirements	
10	10/19	c	Systems Requirements	
		a	Functional Analysis	Wasson 28-31

11	10/26	b	Functional Analysis	NASA Tool Box §3.4, 7.12 & 7.15
		c	Functional Analysis	
12	11/02	a	Systems Architecting	Wasson 35-38
		b	Systems Architecting	INCOSE SE Handbook §4.3
13	11/09	c	Systems Architecting	Chapter 10.2.3/11
		d	Systems Architecting	
14	11/16	a	Architecting & Implementation	Wasson 52, 53, 55
		b	Architecting & Implementation	
15	11/23	c	Architecting & Implementation	
	11/24	Last Class		
11/25		**No Class – Thanksgiving Break Begins**		
	12/04	**FINAL SEMP DUE 5:00PM CST**		

Syllabus Update Log:

None