SYSE 2310: Systems Architecture

Instructor:	Aykut C. Satıcı	**Term:**	Fall 2026
Email:	aykut.satici@utdallas.edu	**Course Time:**	Tue & Thu 10:00 – 11:15 a.m.
Room:	ECSN 3.716	**Classroom:**	SLC 1.202

Course Page: https://elearning.utdallas.edu/ with Teams links.

Office Hours: Tuesdays and Thursdays 11:30 a.m. – 12:30 p.m. at ECSN 3.716, or by appt.

Prerequisites: This class requires an understanding and working knowledge of basic engineering principles. Exposure to basic probability and calculus is recommended.

Course Description: This course covers the fundamentals of systems architecture, focusing on the mapping of function to form, handling ambiguity, generating concepts, and tradespace exploration. We apply these principles through a semester-long project designing a Guidance, Navigation, and Control (GNC) system for an Urban Air Mobility (UAM) eVTOL network. Offered for the first time, SYSE 2310 is built AI-native from the ground up: rather than adding AI to an established course, it incorporates an "AI Literacy Arc" from the foundation, teaching students to use Large Language Models (LLMs) as generative design partners during the conceptual phases, then re-casting AI as an adversarial auditor (never the author) during the independent mathematical modeling phases, where human engineering judgment owns every safety-critical result.

Learning Outcomes:

- Evaluate the need for systems architecture and desin for large-scale decentralized systems.
- Analyze and understand stakeholders involved and how they interact.
- Evaluate, analyze, customize and apply business process models for decision making purposes.

Texts and Materials: The following textbook is required for this course. Classroom materials may not be reproduced or shared with those not in class. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

- E. Crawley, B. Cameron, and D. Selva, *Systems Architecture: Strategy and Product Development for Complex Systems*, Pearson, 2015.
- **AI Tools:** Students are expected to use UTD's freely available CometAI platform for AI assistance.

Optional/Supporting Resources: The following books will be helpful in understanding broader systems engineering concepts and methodologies:

- M. W. Maier and E. Rechtin, *The Art of Systems Architecting*, 3rd ed., Boca Raton, FL: CRC Press, 2009.
- D. M. Buede and W. D. Miller, *The Engineering Design of Systems: Models and Methods*, 3rd ed., Hoboken, NJ: John Wiley & Sons, 2016.
- S. Friedenthal, A. Moore, and R. Steiner, *A Practical Guide to SysML: The Systems Modeling Language*, 3rd ed., Waltham, MA: Morgan Kaufmann, 2014. (Optional deeper reference; SysML notation is not covered in class).
- K. T. Ulrich and S. D. Eppinger, *Product Design and Development*, 7th ed., New York, NY: McGraw-Hill Education, 2019.

Class Recordings: Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the AccessAbility Resource Center has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared.

Grading Policy: Homework (25%), Midterm 1 (20%), Midterm 2 (20%), Project (35%).

- Homework must be submitted on the due date and time on eLearning. Extensions may be granted for special circumstances and only when requested at least one day in advance.
- You are responsible for all the information given in class verbally and/or in writing. Any information about the course on the web may be superseded by the information given in the class.
- **Project Milestones:** The 25% project grade is divided across four key milestones: Milestone 1: System Framing [AI-Assisted] (5%), Milestone 2: Concept Generation [AI-Assisted] (5%), Milestone 3: Needs, Goals & Refinement [AI-Assisted] (7.5%), and Milestone 4: Value Modeling & Tradespace Exploration [Human-Authored, AI-Audited] (7.5%).

Homework Sequence (AI Literacy Arc): The homeworks are sequenced to build AI literacy intentionally and progressively. **HW1, HW3, HW5** are AI-supported assignments in which the student uses AI as a brainstorming and critique partner, but not as a substitute for engineering judgment: HW1 uses AI to generate alternative system-boundary and decomposition framings (graded on the judgment used to select and defend one), HW3 uses AI to brainstorm morphological options (graded on pruning and filtering with engineering judgment), and HW5 red-teams a student-built MAU model (graded on defending or correcting each AI critique). **HW2, HW4** are conventional, AI-free problem sets that drill the underlying mathematical methods unaided and establish a baseline for independent technical reasoning.

Important Dates (Tentative):

Project Milestone 1	Week 4
Midterm Exam 1	Week 6
Project Milestone 2	Week 8
Project Milestone 3	Week 11
Midterm Exam 2	Week 13
Project Milestone 4	Week 15

Academic Honesty (Comet Creed): Academic dishonesty is **not** tolerated. Students are responsible for reading and understanding the student code of conduct. For more information, please see the student code of conduct.

Comet creed was voted by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

> As a Comet, I pledge honesty, integrity, and service in all that I do.

Accommodations for Students with Disabilities: Please review the section within the UT Dallas Syllabus Policies and Procedures webpage.

UT Dallas Syllabus Policies and Procedures: Please visit the Syllabus Policies page to view the University's policies and procedures segment of the course syllabus.

Tentative Course Outline:

Weeks 1 – 3: System Thinking and Complexity

- Crawley et al. Chapters 1 – 3
- Form vs. function, the Instrument-Process-Operand view, and emergence
- Decomposition and complexity heuristics

Weeks 4 – 6: Form, Function, and Interfaces

- Crawley et al. Chapters 4 – 6
- System boundaries, functional decomposition, and form–function mapping
- AI-assisted exploration of alternative system framings
- **Milestone 1 (System Framing) due at end of Week 4**
- **Midterm Exam 1 at end of Week 6**

Weeks 7 – 9: Concept Generation and Ambiguity

- Crawley et al. Chapters 7 – 9
- Solution-neutral concepts, morphological matrices, and the architect's role under ambiguity
- Counterbalanced concept-generation sprints (AI-assisted vs. unassisted) to compare design-space breadth
- **Milestone 2 (Concept Generation) due at end of Week 8**

Weeks 10 – 11: Upstream/Downstream Influence and Stakeholder Needs

- Crawley et al. Chapters 10 – 12
- Upstream/downstream influences; translating stakeholder needs into prioritized goals
- AI stakeholder personas: eliciting needs and detecting hallucinations
- **Milestone 3 (Needs, Goals & Refinement) due at end of Week 11**

Weeks 12 – 15: Concept Refinement, Value Modeling, and Tradespace Exploration

- Crawley et al. Chapters 13 – 16
- Revisiting earlier framings and concepts in light of stakeholder input; applying creativity to concept refinement
- Managing complexity in architectural decision making
- Multi-Attribute Utility (MAU) functions (authored independently)
- Pareto frontiers, sensitivity analysis, and optimization (authored independently)
- AI red-team audit of the student's own value model and tradespace analysis (dominated options, edge cases, code errors)
- **Midterm Exam 2 at end of Week 13**
- **Milestone 4 (Value Modeling & Tradespace) due at end of Week 15**