



EM Senior Design (Engineering Design VII & VIII) – EM/ISE 423 A/X5 & (Preview of EM/ISE 424 A/X5)

School of Systems and Enterprises
Fall 2023 & Preview of Spring 2024

Meeting Times: Tuesdays and Thursdays 2:30pm – 4:20pm

Classroom Location: Howe 102

Instructor: Prof. Hao Chen

Contact Info: North Building 216, hao.chen@stevens.edu

Office: (201) 216-5173

Office Hours: By appointment

Course Web Address: Canvas

Prerequisite(s): EM 322

Co-Requisite(s): IDE 400, 401, 402 (be in the same section as your Senior Design team)

Cross-listed with: ISE423 A/X5, ME/CPE/EE/EN 423 X5

COURSE DESCRIPTION

This year long, two-course sequence involves the students in a small-team Engineering Management project. The problem for the project is taken from industry, business, government or a not-for-profit organization, or an approved student defined project. Each student team works with a client and is expected to collect data, analyze it and develop a preliminary design to be written up in a report due the end of the first semester.

In the second semester the design solution to address the problem/need is completed as well as a prototype to demonstrate the feasibility of the design, and a final written report that covers the project from beginning to end. During the year, oral and written progress reports are presented to peers, faculty and clients.

The total project involves the application of the subject areas covered in the EM 385 Innovative Systems Design course, as well as skills learned in the other technical and non-technical courses of the Engineering Management curriculum.

LEARNING OBJECTIVES

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

Outcomes for EM 423	ABET
The student developed designs using appropriate methods/tools such as software packages, simulation, prototyping, research, and interviews.	6
The student conducted research and analyzed a client's or stakeholder's problem/need, and developed an understanding for the context of that problem/need and relevant constraints to serve as a foundation to design an appropriate solution.	2A
The student is applied rigorous methods to assess all critical design attributes.	6
The student applied EM tools and methods in decision making to make better decisions.	6
The student can assess the scope of their senior design project and prepare a project plan to achieve the desired outcome. The student can continuously assess their progress according to the plan and manage their project accordingly	4A
The student practices professional conduct and appearance throughout the course.	4A
The student demonstrates the willingness and ability to lead a team.	5A
The student demonstrates the ability to function on a team whose members may be different disciplines and may have different goals.	5B
The student appropriately documented the design, its rationale and impact and can communicate about it in writing and orally.	3
The student assessed the solution's wider impact on society and compliance with relevant regulations, social and environmental standards as well as considering economic concepts such as potential IP issues or opportunities.	4C
The student is able to actively research and learn new tools and methods and/or consult with faculty/subject matter experts when necessary to complete the design.	7

FORMAT AND STRUCTURE

Senior Design is not a normal class in the traditional sense. It is a framework for teams of students to complete a design project. Senior Design is also tightly integrated with the IDE 400, 401 & 402 Innovation and Entrepreneurship sequence that further guides the teams in identifying, describing, analyzing and presenting the potential entrepreneurial and/or business value of their design. ***Periodic presentations and written submissions will be required by individual team members as well as each team.*** These will provide the detail findings, methods used, decisions made etc. The presentations and written reports will form the basis for the final design report that is due at the end of the semester. Teams are required to meet during the scheduled meeting times and as needed for their project.

COURSE MATERIALS

Relevant resources will be distributed on the course page on Canvas

The project phases are as follow:

EM 423 – Fall 2023:

Week 1-4 Team Formation, Project Selection, and Definition of Project Mission

This phase is about building a team, finalize the project selection, and reach out to establish a relationship with subject matter experts, clients and/or “ideal customers” to define/understand the objectives for your project, how they fit into their overall business objectives and why this project is important to them. This phase culminates in the Project Kick Off Presentation that presents the team and the Project Mission to the class and interested clients and faculty.

Week 4 – 9 Concept Development

This phase is to develop a deep understanding of the opportunity/problem you are addressing as well as its context (such as society, business... wherever the problem to be addressed resides). You will identify critical stakeholders and their needs and requirements. You will also research the market for solutions that address the /similar opportunities/problems. You will need to research knowledge, technologies, products, tools that has potential to enable a solution. Based on this, you will create and analyze several alternative solution concepts and propose a solution concept that has been developed and evaluated based on a thorough understanding of the needs and requirements of relevant stakeholders within realistic and relevant constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. Key aspects of this have to be validated through tests/experiments with enabling technologies. It also includes an estimate of expected business value and cost to create. This phase culminates in the Concept Proposal Presentation and associated report.

Week 10-15 Preliminary Design

This phase is about evolving the chosen concept into a well specified preliminary design that identifies and specifies all internal subsystems/components with respect to what they do, how well they do it and how they come together to fulfill key performance and quality requirements as well as use-cases at the system level. This phase culminates in a Preliminary Design Review and associated report during finals week.

The teams are responsible for their own progress between the main milestones and to proactively seek the information, knowledge, and advice they need to complete their project successfully from previous course materials and notes, the literature, the client/sponsor, the Professor, the TA, other faculty members and other relevant sources. The professor will also have a more formal meeting with each team every week to discuss progress and potential issues and provide advise as needed.

Expenses and prototyping

EM Senior Design projects normally do not incur any significant expenses. We will reimburse expenses related to the project up to \$500 per team.

In some cases a project might have a need for a bigger budget (e.g. for prototyping). This is something that should be identified during the concept and preliminary design phases. A preliminary budget with justification should be presented at the Concept Proposal presentation, and a final budget, no later than the Preliminary Design Review. This will be evaluated and considered for additional funding.

OTHER COURSE MATERIALS

Relevant resources will be distributed on the course page on Canvas

COURSE REQUIREMENTS

Class Meetings with the Professor (Dedicated time for teams to meet):

Teams will meet with the course instructor **every Thursday** from 2:30 – 4:20 pm in the classroom Howe 102. Attendance will be randomly taken. You only need to come to the class meeting at your team's dedicated time slot. The instructor can provide guidance on system design, project progress, issues and action items/assignments.

Weekly Team Meeting (Team Assignments):

Each team must meet outside of class time before the class meeting to review the previous week's progress and plan next week's activities with clear responsibilities and expected outcomes. The discussions have to be captured in Meeting Minutes to be uploaded to the appropriate "Team Meeting Minutes" Assignment).

Individual Design "Notebook" submissions (Individual Assignments):

Each student should keep a dedicated, personal design notebook that you maintain on a regular basis where you record research findings, insights, ideas, and other thoughts briefly relevant to the project. The notebook should contain 5 sections:

- Exploring
- Planning
- Understanding
- Modeling
- Reflections

Submit your Notebook at each milestone, either as a pdf, a word document, or a Google Document link. If it is handwritten take picture(s) of or scan the pages.

Bi-Weekly Meetings with Advisors/Sponsor (Team Assignments):

Bi-weekly meeting with academic advisor/sponsor is preferred but not mandatory. Please schedule regular advisor/sponsor meetings based on your needs. Advisors/Sponsor can provide the team with detailed technical guidance on the project. Each team member will have an opportunity to serve as Project Manager for a period of time. The Project Manager is responsible for leading the team to set goals for the upcoming week and provide a brief written summary of the progress and issues encountered at the end of the week (made available on Canvas). Upload the meeting minutes to the corresponding Canvas Assignment.

Sponsor/Client Relationship Management (Team Assignments):

You are expected to maintain a professional and courteous relationship with anyone that supports you throughout your project. Especially important is the relationship with a sponsor. Some components of a good relationship are; keeping appointments, commitments and deadlines, staying in regular communication about project progress as well as any issues which arise. The score here will be based on a survey to your client/sponsor.

Presentation Skills:

Each team will schedule a brief presentation (~15 min) in a bi-weekly manner. Presentations are expected to be given in a professional and concise manner. This includes your appearance, your delivery, mannerisms and interaction with the audience before, during and after the presentation. It also includes the general narrative/flow of your presentation and the design of the presentation material. The content itself will be graded as part of the Presentation grade. All presentations must be uploaded to Canvas as noted in the assignments. Rubrics for the presentations will be available on Canvas.

Project documentation (Team Assignments)

The project includes all associated deliverables at each milestone as outlined in document templates, syllabus as well as in the kick-off lecture for each phase. It also includes prototypes and associated documentation.

GRADING PROCEDURES

The following represents the breakdown of how the effort will be graded for EM 423/424:

EM-423

Project kick-off	10%
Professionalism	15%
Individual Design “Notebook”	5%
Team meetings and dynamics	10%
Concept Proposal	30%
Preliminary Design Review	30%
TOTAL	100%

*Clients are encouraged to participate in all milestone presentations (e.g., concept proposal). They **MUST** be present (physically or on Zoom) at the final presentation of each semester for you to receive the full grade for Client Relationship (when your project has a sponsor).*

ACADEMIC INTEGRITY

Generative AI Technologies

I understand that generative AI programs e.g. ChatGPT can be useful in your future careers. You may use AI programs to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor).

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's

commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

“I pledge my honor that I have abided by the Stevens Honor System.”

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other disabilities to help students achieve their academic and personal potential. They facilitate equitable access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/student-diversity-and-inclusion/disability-services>. If you have any questions please contact the Office of Disability Services at disabilityservices@stevens.edu or by phone: 201.216.3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to

further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your pronouns and/or name, please inform the instructor of the necessary changes.

Religious Holidays

Stevens is a diverse community that is committed to providing equitable educational opportunities and supporting students of all ethnicities and belief systems. Religious observance is an essential reflection of that rich diversity. Students will not be subject to any grade penalties for missing a class, examination, or any other course requirement due to religious observance. In addition, students will not be asked to choose between religious observance and academic work. Therefore, students should inform the instructor at the beginning of the semester if a requirement for this course conflicts with religious observance so that accommodations can be made for students to observe religious practices and complete the requirements for the course.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177), online at <https://stevensportal.pointnclick.com/confirm.aspx>, or in person on the 2nd Floor of the Student Wellness Center.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about your own safety or the safety of someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year-round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.

TENTATIVE COURSE SCHEDULE

Semester Schedule Fall 2023:

Week	Tuesday 2:30pm-4:20pm	Thursday 2:30pm-4:20pm	Misc.
1 Sep. 4	Class Meeting: <u>Intro Lecture & Project selection</u> (Starts at 2:30 PM)	Class Meeting: Project/Team Adjustment (Starts at 2:30 PM)	09/01 First day of class 09/04 Labor Day
2 Sep. 11	Class Meeting: Finalize Project/Team Selection (Starts at 2:30 PM)	Reach out and meet with sponsor/client/advisor (No class) (Come to class for RASC-AL only – Kick-off meeting, 2:30 PM)	
3 Sep. 18	Meet with sponsor/client (No class)	Class Meeting: Student Presentation: Project Kick Off	
4 Sep. 25	Status Meeting with your team	Class Meeting: <u>Lecture: Concept Selection and Project Proposal</u> (Starts at 2:30 PM)	
5 Oct. 2	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	
6 Oct. 9	Monday Schedule (No class) Status Meeting with your team at other place/time	Class Meeting: Instructor meeting with teams	10/09 Fall Recess 10/11 Notice of Intent Submission Deadline for RASC-AL only
7 Oct. 16	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	
8 Oct. 23	Status Meeting with your team	Class Meeting: Student Presentation: Concept Proposal	Concept Proposal Report Due <u>Oct. 27</u>
9 Oct. 30	Status Meeting with your team	Class Meeting: <u>Lecture: Preliminary Design</u> (Starts at 2:30 PM)	
10 Nov. 6	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	

11 Nov. 13	Status Meeting with your team	Class Meeting: Student Presentation: 75% Preliminary Design Review	
12 Nov. 20	Status Meeting with your team	Thanksgiving (No class)	
13 Nov. 27	Status Meeting with your team	Class Meeting: Instructor meeting with teams	
14 Dec. 4	Status Meeting with your team	Class Meeting: Student Presentation: Preliminary Design Review	
15 Dec. 11	Status Meeting with your team	Work on your report (No class)	Preliminary Design Review Report Due 12/15

Semester Schedule Spring 2024 (TBD):

Week	Tuesday 2:30pm-4:20pm	Thursday 2:30pm-4:20pm	Misc.
1 Jan. 15		Class Meeting: Semester Kick Off Lecture (Detailed Design/Implementation)	Jan 17 th First day of classes
2 Jan. 22	Status Meeting with your team	Class Meeting: Instructor meeting with teams	
3 Jan. 29	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	
4 Feb. 5	Status Meeting with your team	Class Meeting: Instructor meeting with teams	02/07 Internal deadline for Proposal and Video for RASC-AL only

5 Feb. 12	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	
6 Feb. 19	Status Meeting with your team	Class Meeting: Instructor meeting with teams	Monday Feb 19 th . – Presidents Day
7 Feb. 26	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Student <i>Presentation: Progress</i>)	
8 March 4	Status Meeting with your team	Class Meeting: Test Readiness Review (Incl. Demo of Functional Prototype)	03/07 Deadline to Submit Proposals and Videos to RASC-AL
9 March 11	SPRING BREAK (No class)	SPRING BREAK (No class)	
10 March 18	Status Meeting with teams	Class Meeting: <u>Lecture: Test and Design Analysis</u>	
12 March 25	Status Meeting with your team	Class Meeting: Instructor meeting with teams (Poster board draft)	March 29 – Good Friday
12 Apr. 1	Status Meeting with your team	Class Meeting: Instructor meeting with teams	
13 Apr. 8	Status Meeting with your team (Poster board is due)	Class Meeting: Review EXPO Layout, Material and “Props”	04/05 Fianlist Teams are Notified (RASC-AL)
14 Apr. 15	Prepare for the Senior Design Expo and the final presentation		
15 Apr. 22		Friday 4/26 SENIOR DESIGN EXPO (No class)	
16 Apr. 29	Schedule Final Presentations (with Sponsor) this week		

17 May 6	Final Report (Technical Paper Draft) Due Monday 05/06 @ 8am		Final week
Extra (RASC-AL)	05/27 Deadline to Submit Technical Paper	06/08 Deadline to Submit Presentation Chart Deck & Digital Poster Files	06/10 – 06/12 RASC-AL Forum in Cocoa Beach, Florida