



ISE 495ax

Senior Project Design

Fall 2021 — Friday - 9:00am - 11:50 pm
Location: GFS 118

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Catalogue Course Description

Preparation and development of the senior project proposal. Open only to industrial and systems engineering majors.

Prerequisites

- ISE225 – Engineering Statistics
- ISE460 – Engineering Economy
- Either DSO 435 or ISE 382 – Enterprise Data Architecture / Database Systems

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Netiquette Policies For Zoom Conference Software

- Be respectful and considerate towards each other. Pay attention to the cultural and background differences.
- While in Zoom sessions please show your complete first name and last name, as in the roster.
- While in Zoom sessions please have your VIDEO ON. It assists in building a sense of community. However, if Internet signal issues preclude you from having a reasonable audio, you may wish to “split” your signal by connecting with both your phone (for audio) and computer (for video)
- While in Zoom sessions be respectful to the LEARNING ENVIRONMENT such as: be attentive, have proper background, follow [business casual](#) norms, and be in a stationary location (not driving). Please reduce distractions for others.

Communications Policies

- Please include course number (ISE495a) and project name in subject line of emails to Coaches.
- Please use (required) your USC email account when contacting the client or Coaches.

Format Requirements for Submissions

- Presentations: MS Power Point (*.pptx)
- Documents: PDF
- Project Schedules: PDF
- At a minimum, students are expected to be able to:
 - prepare professional papers and presentations in the English language using proper citation;
 - use multimedia in **MS PowerPoint** with embedded audio and/or video that begins automatically with the beginning of a presentation (Please test this. Points will be deducted if embedded media do not operate properly);
 - prepare and present a Preliminary Design Review (PDR, See Guidelines for preparing for PDR);
 - access a computer with a web camera and microphone, preferably with a headset with microphone and headphone;
 - be proficient with the use of the BlackBoard system (NO work will be accepted by email unless previous arrangements have been made); and
 - convert report files to PDF

Course Overview

This course will prepare students for engineering practice through a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. This activity includes:

- Preparation and development of the senior project proposal.
- Identification and definition of appropriate engineering standards.
- Identification of constraints that will help define and bound the project proposal.

USC's first priority is the education of our students. Our goal includes graduating engineers capable of serving the public good, reaffirming their commitment to core academic principles and equipping our graduates to face contemporary global challenges.

This course serves as the experiential capstone in USC's undergraduate ISE curriculum. Students apply their classroom knowledge to a real project in a real ISE work setting, e.g., on the manufacturing floor, in a healthcare clinical setting, at logistics distribution facilities, etc.

The students in ISE 495ax will learn to:

- handle difficulties associated with defining and organizing a realistic problem statement;
- manage impediments in obtaining information and approval;
- present and sell ideas to higher-level management;
- convert a project's worth into financial indicators;
- understand the importance of continuous exchange between engineers, management and employees in solving an existing problem, given a set of constraints;
- gain experience in the organization and management of a technical project that includes application of industrial engineering tools and methods, time and cost estimates, communication techniques, and project monitoring and follow-up;
- navigate the politics of a company and how it impacts a team's progress;
- meet aggressive deadlines with a multidisciplinary team effort;
- improve project-based presentation skills, both in-class and in company settings;
- establish contacts with local industry;
- recognize the need for application of industrial engineering principles and their corresponding value to an organization; and
- describe opportunities for applying industrial engineering principles to the client's future work assignments.

Format of the ISE Senior Project Design Sequence

The **ISE 495ax,bx** sequence consists of three parts, specification of a Preliminary Design confirming the current state of a client problem. A **Preliminary Design Review (PDR)**, includes

an assessment and comparison of relevant alternatives. The PDR links the projects mission in terms of measurable outcomes, requirements, and verification and validation steps consistent with the requirements. Upon approval of the client and Coaches, the specification of a Countermeasure to the problem is constructed and presented in the **Critical Design Review (CDR)**. Building upon the specifics of the Preliminary Design, accounting for the constraints of the client's site and organization, a proposal evaluating alternatives is presented showing a recommended detailed Countermeasure. Upon approval Critical Design by the faculty coaches and Client, execution of the project begins. The PDR and CDR activities involve both documents and presentations. The execution of the project element includes both a presentation and a final report. PDR activities take place in **ISE 495ax**. Project execution takes place in **ISE 495bx**, and CDR activities span the two semesters. See the Appendix below the Blackboard *Content* section for templates and guidance concerning PDR and CDR organization and content.

Students are organized into teams and each team is assigned to solve a representative industrial and systems engineering problem for a client, typically a local firm, nonprofit entity, or public agency. Any number of different manufacturing, service, or business enterprises in any sector might be a source of projects. The team spends an academic year defining the problem and approach and executing their approach to the problem. This is a project activity. The faculty delivering the course act as coaches, offering feedback at specific milestones in the process, and meeting regularly with individual teams to discuss activities, progress, and options; and to offer advice. These meetings are typically weekly and may be scheduled for standing lecture periods or for times feasible for the coaches and teams. At least two coaches will normally be present for each PDR and CDR presentation by the various teams.

Students completing **ISE 495ax** receive a grade of IP (In Progress) at the conclusion of the semester. A letter grade is assigned for both **ISE 495ax** and **495bx** at the conclusion of the second semester in the sequence. Students who complete **ISE 495ax** but do not continue in **ISE 495bx** the following semester receive a grade of NC (No Credit) in **ISE 495ax**. A grade of NC has no impact on a student's GPA, but no credit is earned for the course.

Recommended Preparation:

- Many projects require a formal statistical analysis as outlined in ISE 225: *Montgomery, Runger, and Hubele, Engineering Statistics*, 5th Ed., John Wiley and Sons, New York, NY (2011), ISBN 0-47-063147-3.
- Many projects require an analysis as outlined in ISE460: *Park, Chan S., Contemporary Engineering Economics*, 5th Ed., Prentice Hall, (2011), ISBN 0-13-611848-8.

Required Readings, Supplementary Materials, and Course Notes

Product Development for Technical and Non-Technical Managers and Practitioners, 1st Ed., Lu, P. Kendall Hunt (2021), ISBN: 978-1-7924-7707-2.

ISE 495ax is Web-Enhanced with high reliance on Blackboard. Readings and supplementary materials will be posted to Blackboard as needed, accompanied by a posting on Announcements. All assignments will be submitted via Blackboard. No assignments will be accepted by email or paper unless arrangements have been made in advance. Copies of lecture slides and other class information will be posted on Blackboard. Supplementary materials and other reference guidance will be posted to Blackboard under *Content*.

Grading Breakdown

Course Component	Weight
Progress update reports (4) emailed to clients and coaches	20%
Preliminary Design Review (PDR Presentation) <ul style="list-style-type: none"> • Introductory Meeting with Client (5%) • Readiness Review with Coach (5%) • Dress rehearsal with Coaches (15%) • Presentation (15%) • Paper (10%) 	50%
Instructors' Evaluation (Individual) <ul style="list-style-type: none"> • Quality of peer evaluations you provide (4%) • Interim feedback from the sponsor (15%) • Quality of your interaction with other team members • Participation 	30%
Total	100%

Punctuality is considered in the evaluation of performance. This relates to meetings of your team, punctual class attendance, and scheduled meetings with the instructor(s). Absence or extreme tardiness of a chronic nature will be noted and result in a lower Instructors Evaluation grade.

There are no extra credit assignments or makeup assignments for missed or late work. A score of “0” will be assigned.

Schedule

The Calendar is **approximate** and **subject to change**, especially this year. The teams and clients are working in an uncertain environment. This is a living document and will be modified as needed based on the course requirements. Presentations are to be coordinated and scheduled with your coach.

Note: All client deliverables must receive customer approval prior to proceeding to the next phase.

Copy coaches on all communications to the client.

Week	Friday	In Class	Activity	Deliverable
1	8/27	Intro Meeting	Read Step 1	Form Teams and assign client
2	9/3	Case: Step One (Team 1)	Read Step 2	Prepare for initial client meeting: Contact customer to set up meeting. (use 5Ws and 1H, 3Fs, and requirements gathering templates)
3	9/10	Case: Step Two (Team 2)	Introductory meeting between Teams and Clients Read Step 3	1. Customer Requirements: use requirements templates to client for approval 2. Initial Design Concepts: consider methods to show initial design to client for approval.
4	9/17	Case: Step Three (Team 3)	Prepare Specifications Start working on PDR Read Step 4: PDR (pp35-80)	1. Initial Specifications: Submit preliminary spec worksheet to client for approval 2. Peer Evaluation
5	9/24		PDR: Refer to Steps 6 to 10 for supporting details	1. PUR 1: customer requirements, initial design & specification summary to clients / coaches 2. Requirements Hierarchy (use template as a guide) to client for approval
6	10/1		PDR Readiness Review with coach	Meet Coach: Status of PDR
7	10/8	Case: Step Four (Team 4)	PUR 2	1. PUR 2 2. Meet Coach: PDR Readiness Review
8	10/15	RECESS (10/14,15)	By 10/13 - PDR Dress Rehearsal	1. Upon approval, team to request PDR presentation with client - Incorporate Templates as appropriate 2. Peer Evaluation
9	10/22		Prepare Final PDR - Read Step 4: Exiting PDR (p80-p89)	

10	10/29		PDR Presentation with Client Read Step 4: From PDR to CDR (p89-93)	<ol style="list-style-type: none"> 1. Presentation to Client 2. Approval of PDR; Note / resolve exceptions
11	11/5		PUR 3	<ol style="list-style-type: none"> 1. PUR 3 2. Complete PDR Exit: Client approval
12	11/12		Read Step 5	<ol style="list-style-type: none"> 1. Prepare CDR - Update templates and logs in preparation of CDR Launch (Due 11/23) 2. Peer Evaluation
13	11/19	Case: Step Five (Team 5)	PUR 4 (Due 11/23)	PUR 4 (Due 11/23)
14	11/26		Thanksgiving Holiday	
15	12/3			<ol style="list-style-type: none"> 1. Meet Coach: CDR Launch Review 2. Transition to CDR Plan to Client
Finals	12/10			

- You must submit a completed and approved PDR to receive an IP (In Progress) grade for **ISE 495ax**. If circumstances beyond the team's control emerging after the 12th week of class, preclude this outcome, a grade of IN (Incomplete) will normally be issued, to be cleared as soon as possible during the next academic semester. Incomplete grades can usually be avoided.
- You must submit a completed and approved CDR to receive a passing grade for **ISE 495ax** and **bx**, i.e., to be able to present the course toward your degree. We expect you all intend to do better than this.

Additional Information the Provost Wants Us to Provide to You

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards,” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

The Viterbi School of Engineering adheres to the University of Southern California's policies and procedures governing academic integrity as described in *SCampus*. Students are expected to be aware of and to observe the academic integrity standards described there, and should expect those standards to be enforced in PPD 570, because they will be.

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention, studenthealth.usc.edu/counseling.

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, suicidepreventionlifeline.org.

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm, studenthealth.usc.edu/sexual-assault.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants, equity.usc.edu, titleix.usc.edu.

The Office of Disability Services and Programs

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs. dsp.usc.edu.

USC Campus Support and Intervention - (213) 821-4710

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student, campussupport.usc.edu.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, dps.usc.edu, emergency.usc.edu.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

Non-emergency assistance or information, dps.usc.edu.

APPENDIX

Guidelines for Preparing Progress Update Report (PUR,) - Copy to Client(s), coach

Any project is measured upon three main criteria. Scope, budget, schedule. An update report should convey progress in those three areas of standing concern. The client wants to know that what was promised in the Scope document can be accomplished.

Typical progress update reports include the following, but not all items will be in all reports

1. Progress toward scope, budget & schedule goals
2. Progress toward breaking down of larger goals into smaller ones
3. Major accomplishments (milestones) attained as outlined in the submitted schedule
4. Issues encountered and requests for client help

Guidelines for Preliminary Design Review Document (PDR, Individually scheduled by team, 2 Coaches to be present)

Additional details are available on the Blackboard site.

CONTENT (This is to be completed by team members)

1. Mission Objective – Think in terms of measurability.
2. Architectural Design Development – Present the chosen architectural design.
3. Requirements – List requirements that are derived from the mission and those that have originated from the sponsor or other stakeholders.
4. Enumeration of Alternatives – List a small set of feasible options.
5. Concept of Operations – Describe how the system will operate comparing “as is” and “future state.”
6. Validate and Verify – Formulate a test plan that focuses on the requirements.
7. Interfaces and Interface Control Document (ICD) – List the mechanical, electrical, thermal and operational boundaries.
8. Mission Environment.
9. Technical Resource Budget Tracking – Identify and estimate resource budgets if necessary.
10. Risk Management – Identify risks to safety, performance, and the program; and mitigation steps.
11. Configuration Management and Documentation.

PROJECT MANAGEMENT / CONCLUSIONS / REFERENCES

Guidelines for Preparing Preliminary Design Review (PDR) Presentations

PDR Readiness Review - Coach

- The presentation is nominally 5 slides, a maximum 6 minutes, with audio recorded on a PPT file.
- Content should be per guidelines for preparing PDR at the initial stages (nominally Content items 1-4)

PDR Dress Rehearsal Presentation - Coaches

The **Dress Rehearsal** presentation is the review of the PDR prior to presentation to the client. As such, content should be complete and PDR ready.

There is probably much more each team will want to say at this point, but the purpose of the **Dress Rehearsal** is only to understand and approve the strategy for the **Final Presentation**. Teams are **strongly** encouraged to make available detail information in a separate file, submitted to *Bb* for review if the instructors have any questions.

The objective of the coaches' feedback is to position the team to execute a successful project. Teams are sometimes asked to revise the presentation and execute it again if the coaches do not believe this standard has been met. A single **Dress Rehearsal** presentation may suffice.

Please Do Not make arrangements with the client for the **Final Presentation** until this presentation has been reviewed and approved by the instructors, even if the client presses you to do so.

Sponsor Evaluation

Each team will present to client an evaluation sheet outlining the points below to provide the team with feedback at the end of each semester, and possibly during the semester. See Blackboard.

1. Execution of project
2. Quality of work
3. Creativity
4. Improvement of team over course of project
5. Client communication and interaction
6. Responsiveness of team
7. Ability to take ownership of project
8. Tasks completed on time