

CPE Capstone

Syllabus

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Course Description

This two-quarter design course covers the definition, specification, conceptual and detailed design, implementation and testing of a system for a real-world client. Topics include requirements elicitation techniques, research and data gathering methods; project planning, time and budget estimating; project team organization. Ethics and professionalism.

Prerequisite

CPE 329, may be concurrent.

Learning Objectives:

After successful completion of the course, students should be able to:

1. Articulate design specifications and criteria by which they are to be measured
2. Design and defend a solution to a real-world problem
3. Verify that a design implementation to solve a real-world problem satisfies all specified project requirements, such as marketing, engineering, and constraints
4. Evaluate the effectiveness of one's own team and other teams' designs
5. Effectively contribute one's own disciplinary knowledge on a team as well as locate and evaluate new information
6. Contribute to effective project management (e.g., through the use of Gantt charts)
7. Effectively communicate with others in a team, fulfilling one's individual role in the project and in interfacing with customers
8. Employ principles of effective communication
9. Employ ethical practices in all aspects of the design process
10. Reflect on aspects of design and the design process

Course Format

The course format is two 3-hour lab sessions per week during which lecture material will be presented and students will work on their team projects. In general, lectures/presentations will occur on Tuesdays, leaving Thursday lab sessions as dedicated project work time.

Required Textbook

Design for Electrical and Computer Engineers: Theory, Concepts, and Practice. F. M. Ford and C. S. Coulston, McGraw-Hill.

Design Notebook

The use of design notebooks is universal in industry and academia to maintain a clear record and dated history of innovations and inventions. All students are expected to document all work in a design notebook. This must be a bound notebook with numbered pages (hand-numbering is ok). Spiral-bound notebooks and three-ring binders are not acceptable. You must sign and date each entry in your design notebook.

Attendance policy:

As the Capstone experience mimics a real-world project, we are going with a real-world attendance policy. To be excused from a class, you must email both instructors and all students in both sections (since we will be meeting together) informing everyone as to why you will be missing class. Include your name and project/team name in the email. Note: This course is highly-participatory in nature. Multiple absences will impact what you get out of the class and your team's ability to be productive.

Grading Policy (CPE 350):

| Percentage | Item |
|-------------|---|
| 50% | Team portion |
| | 15% - Requirements document |
| | 20% - Design review and report |
| | 15% - Project design work |
| 5% | Peer Review |
| 45% | Individual portion |
| | 10% - Design notebook |
| | 25% - Individual assignments |
| | 10% - Professionalism, team participation |
| 100% | Total |

Projects:

CPE 350 is the first quarter of the two-quarter capstone sequence. You must register for CPE 450 during the subsequent quarter in order to complete your project. CPE 350 will cover the system requirements, system specification, and conceptual and detailed design portions of your projects. The development, implementation, and testing for your project will be in CPE 450. Projects have the following aspects to them:

Real World Character: The product must meet the needs of a real user and be deployable for use by those users. At the beginning of CPE350, given product requirements are unspecified or poorly specified. The major outcome for CPE 350 is that students will learn requirements elicitation and specification writing theory and practice. The major outcome for CPE 450 is a beta-level implementation of the system. The product must involve some ethical issues to be addressed by the students.

Capstone projects for this term are all community-based design projects. The class will use a type of instruction termed *service-learning* in which you will achieve the learning objectives for the class through these community projects. Because of this, you have the potential to make a great positive impact in your community. Throughout the quarter, you will have ample opportunity to interact with your clients and to reflect on both your learning and community work.

Interaction with a Customer: Regular communication between the customer and students, participation in design reviews of product deliverables, periodic visits to the classes and other activities enhance the real world character of the project.

Combination of Hardware and Software: As Computer Engineering is such an interdisciplinary field, each project must include substantive hardware and software development tasks of approximately equal size.

Independent Learning: It is important that students can become proficient in the project domain without much assistance from the customer or from the instructors.

Team Experience: The capstone course work will be done by teams of 4-6 students. The project must have sufficient substance to provide each team member major development tasks. All students must be assigned to one or more roles and be held accountable for their portion of the project.

Project Deliverables: Completion of the project must include beta-level functionality and appropriate professional quality design documentation. Project requirements must include a set of quality attributes such as reliability, power requirements, safety concerns, legal issues, etc.

Weekly Schedule (CPE 350, tentative)

| Week | Material |
|---------------|--|
| 1 | Lecture 1: Capstone introduction , Chapter 1 of text, Project overviews Class Tasks: Introductions, Speed Design Exercise |
| 2 | Lecture 2: Chapter 3 – Requirements Specifications Class Task: Project Preferences Questionnaires, Select teams HW: 1) develop first cut at specs individually, 2) Develop list of all knowledge areas and reference list, 3) contact sponsor (one way). |
| 3 | Lecture 3: Chapter 9 – Teams & TeamWork Class Task: Teaming Exercise, Create Team Roles, Talk about team processes that team should follow (communication out of class, meetings schedules, presentation building, etc.) HW: 1) contact project sponsor to discuss specs 2) Research related projects |
| 4 | Lecture 4: Chapter 4 - Concept Generation & Evaluation Class Task: Report contacts discussions and discuss/firm up specifications HW: 1) Research related projects, 2) complete specifications |
| 5 | Lecture 5: Chapter 12 - Oral Presentations Class Task: Project Personas & Stakeholders needs Meet with Professor individually to discuss project |
| 6 | Midterm Presentations – Theme is identifying the project problem |
| 7 | Lecture 6: Design Tools Class Task: Identify all hardware and software in system HW: Individuals scheduling out the entire project, identifying critical issues, key milestones, hardware purchases, and final demonstrations. |
| 8 | Lecture 7: TBA Class Task: Combine schedules, make knowledge teams |
| 9 | Lecture 8: TBA Class Task: Identify all design choices HW: Generate design choices |
| 10 | Peer Review, Technical Design Review, Conceptual Design Report Due |
| Finals | No final exam for the capstone |

Weekly Schedule (CPE450, tentative)

| Wk | Tuesday | Thursday |
|-----------|--|--|
| 1 | Lecture: Course intro | Team meetings with instructor: 350 recap Project work day |
| 2 | Lecture: Critical Evaluation of Sources | Project work day |
| 3 | Project status mtg with instructor (team-led, 45 min. mtg.) HW due: Technical White Paper Outline | Project work day |
| 4 | Lecture: System Verification | Project work day |
| 5 | Project status mtg with instructor HW due: Technical White Paper | Project work day |
| 6 | White Paper Technical Presentations | White Paper Technical Presentations |
| 7 | Project status mtg with instructor HW due: System Test Plan | Project work day |
| 8 | Lecture: Ethics & Society Project Status | Project work day |
| 9 | Project work day | Project work day Poster Printing (info TBA) |
| 10 | Poster Printing (info TBA) | Design Expo, <i>Thursday 4-7pm *tentative</i> Final Report and Users Manual (due Fri., 5pm) |