Course Description

ECE U790 is the first of a two-course sequence that aims to give undergraduate engineering students (you) significant experience in dealing with a large design project from the beginning to end. In ECE U790 you will select a project and prepare a detailed proposal describing the work to be done for completing it. In ECE U792, you will implement the project and provide the final report.

This semester as member of a design team you will be responsible for researching the project topic, identifying the tasks to be performed, determining the availability of all the tools and equipment needed, defining your milestones, and preparing and delivering written and oral presentations on the design proposal. The emphasis will be first on selecting an interesting and challenging project and then on explaining the design tradeoffs that exist at all stages of the project. In addition you should have all equipment that you will need identified and ordered before the start of the second phase in ECE U792.

Course Objectives

The main objective of the senior capstone design course is to provide a multidisciplinary experience, integrating knowledge from the core, intermediate, and advanced courses in electrical
engineering. Most undergraduate engineering courses teach students problem solving in a particular area. Information is presented in organized lectures and students demonstrate their mastery of it through written problems and exams.

In contrast to this learning style, practicing design engineers are often given an open-ended problem, and they must seek the appropriate resources to solve it while they remain within certain budget constraints. These resources may include hardware and software tools, research papers and reports, books describing relevant ideas and other people with useful experiences. Part of their task may be to determine if any solution to the problem exists at all. They may work in teams, so they have to be able to organize themselves, decide who does what and meet regularly to check on progress and discuss the difficulties encountered in the process. Finally, at the end of the project they need to be effective in demonstrating their results and defending their design decisions. By taking part in this course, you will get experience with all these aspects of team work during the engineering design process.

ACE Objectives

ECE U790 incorporates the following University-wide Academic Common Experience (ACE) Goals: the skills of effective thinking and communication, information literacy, and interpersonal skills, the awareness of the contexts of the natural world and the social and cultural world, and connections across disciplines, between theory and application, and between college and work. In addition many projects will incorporate the ACE Goals of awareness of historical, ethical, aesthetic, and personal perspectives and connections between individuals and society and between college study and lifelong learning.

Facilities:

You will have workspace and some equipment, along with a storage locker, available to you in the ECE Capstone Lab in Hayden.

Course Requirements

Your major task this semester is to formulate and write a detailed proposal, due August 14, describing the work to be done on the project and defend it orally. The proposal should at least include:

1. A complete specification of the problem you will try to solve.

2. The results of a thorough literature survey of the appropriate topics and a bibliography.
3. A break down of the project into tasks and a description of how these tasks interact with each other.

4. The approach you will use to address the technical problems associated with each task and a description of work in progress.

5. A description of the tools and equipment that you think will be needed, and orders for all equipment parts you need to get.

6. A project organization plan identifying individual responsibilities, team work, status report, realistic schedule for the next quarter with milestones to the project completion.

**Tentative Schedule**

<table>
<thead>
<tr>
<th>Date</th>
<th>In Class</th>
<th>Deliverables</th>
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<tbody>
<tr>
<td>June 30</td>
<td>Introduction to Capstone</td>
<td></td>
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<tr>
<td>July 3</td>
<td>Form project groups</td>
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<tr>
<td>July 8</td>
<td>Propose project ideas and brainstorming</td>
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<tr>
<td>July 10</td>
<td>Discuss proposal ideas</td>
<td>Brief “white” papers</td>
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<tr>
<td>July 17</td>
<td>Present tasks breakdown</td>
<td>Preliminary Proposal draft</td>
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<tr>
<td>July 22</td>
<td>Discuss approach for each task</td>
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<tr>
<td>July 24</td>
<td>Discuss responsibilities and time plan</td>
<td></td>
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<tr>
<td>July 29</td>
<td>Final Technical Discussion of Study Phase</td>
<td></td>
</tr>
<tr>
<td>July 31</td>
<td>Preparing Proposal presentation</td>
<td>Revised Proposal draft</td>
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<tr>
<td>Aug 5</td>
<td>Identify the equipment needed for the project</td>
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<tr>
<td>Aug 7</td>
<td>Preparation of the Design Phase</td>
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<tr>
<td>Aug 12</td>
<td>Report on Progress, Cost Analysis and Ordering Arrangement</td>
<td></td>
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<tr>
<td>Aug 14</td>
<td>Final Proposal Presentation</td>
<td>Final Proposal due</td>
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**Grading Scheme**

Your grade will be based both on group and individual work and is out of 100 points.

- Weekly Progress Report 10
- Notebook and Proposal Draft 15
- Midterm Proposal Presentation 15
- Final Written Proposal 20
- Final Oral Presentation 20
- Class Participation and Teamwork 20
- TOTAL 100 points
All members of a team receive the same score for all the parts except from the last one. The Class Participation score may vary among members of a team. It will be used to evaluate an individual’s participation not only in the presentations of his/her own team, but also in the presentations of other teams.

Areas of Instructors’ expertise

Prof. Bahram Shafai areas of expertise are in: Control Systems and Signal Processing.
Prof. Charles Dimarzio areas of expertise are in: Optics, Electromagnetics, Sensors and Signal Processing.

Examples of Project Areas of interest

- RoboSoccer Project
- Design of a Robot-Guided Mapping System
- Design of a Double Inverted Pendulum System
- Design of a Collision Avoidance System for an Unmanned Vehicle
- Traffic Light Control Systems
- A Communication-Based Motion Control System
- Web Camera Motion Control
- Motor Control Experiments for Crane Operation, Floating Ball, etc.
- Biomedical-based Control Systems
- CenSSIS Oriented Projects
- Motorized Scooter
- Design of an Automatic Wine Opener
- Other ideas will be shared with the students during the assembly meeting

List of Past Projects

- Library Book-Finder
- Digital Guitar
- Personal Area Network
• Source Localization Controlled System
• Wireless Home Automation System
• A Novel Rear-End Collision Avoidance System
• The Interactive Classroom
• Wireless PC
• Design for an Automated Door Locks (Smart Keyless Entry)
• Design of an Automatic Bottle Selection and Retrieval System
• Remote Control Vehicle with a Camera
• Automated Vehicle Detection System
• CadiJukebox: The Home Digital Jukebox
• Corner Adapting Motorcycle Headlight
• A Mobile Self-Guided Robot Firefighter
• Aquatic Quality Automation System
• Voice recognition lock
• Fingerprint-based ignition
• Bluetooth-based cellphone system
• Autotest fixture
• Visual Aid for Visually Impaired People

List of Recent Projects
• Heart Ailment Prediction Device
• E-Clock
• Store Product Location System
• iCADE: The Next Generation Arcade Machine
• Ambient Noise-Sensitive Volume Control
• Intelligent Collision Avoidance System
• MediaRx: Streaming Video
• Accident Warning System
• Hybrid Motorcycle (Joint Project with ME)
• Automatic Snow Melting Machine
• ePhonebook
• Bluetooth to Infrared Multipoint Hub
• Personal Portable Security Device
• Pothole Detection System
• The Saint (Skier Access and Identification NeTwork)
• Swarming Robots
• Autonomous Decentralized Coordinated Robotic Search
• Wireless Mobile Robotics Control via TCP/IP
• Microchip Controlled DC-DC Power Converter
• VITAS (Visually Impaired Traffic Alert System)
• Movie Theater Seating System
• Portable Confocal Microscope
• Automated Storage/Retrieval System
• Heartbeat or Cadence Beat-Matching iPod Accessory
• Home Assure
• All-in-One Signal Processing Analysis Resource
• Face Finder
• Optimized Radiologist Workstation
• Configurable, Airborne, Ad-hoc Network of Sensors
• Medication Dispensing System
• Interactive Easy Menu
• The Bar Buddy
• Car Jamz
- Wi-Drive: USB Flash Drive with Integrated Wireless File Sharing
- BLAIR
- VoMotion