

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Senior Design Courses

Definition and Guidelines

Objectives

- To apply knowledge learned in other courses.
- To enhance the thought and planning process.
- To expose students to a team design and implementation similar to that encountered in industry
- To improve the written and oral communication skills of the students.

Courses Involved

- ECE 405 and ECE 406 are the computer engineering and electrical engineering senior design sequence courses
- ECE 405 and ECE 406 are also IPFW General Education Courses (Category C: Capstone). They meet all outcomes of their GenEd category.
- ECE 405 and ECE 406 are multidisciplinary capstone courses open to students from any academic program.
- Enrollment in ECE 405 and/or ECE 406 of students from non-ECE academic programs is subject to the approval of the corresponding faculty coordinator.

Project Teams

- All senior design projects must be performed as teams. No individual projects will be permitted. Each project has one ECE faculty member as main advisor. Depending on the nature of the project faculty members from other academic program can be designated as Co-Advisors.
- The minimum size of any team is two. The size and composition of the team should properly match the nature and complexity of the project. It is strongly discouraged to have a team with more than five students.
- Multidisciplinary projects may include students from non-ECE academic programs. Students from non ECE programs, upon approval by the corresponding coordinator, can enroll in ECE 405 or ECE 406. Alternatively, non ECE students can be enrolled in a course in their own program and still can be listed as member of the ECE multidisciplinary senior design project. The nature and amount of their participation should be clearly defined at the start of the project on a case by case basis.

Proposing Projects

Project suggestions may come from a number of different sources such as:

- senior design students;
- faculty members; or
- industry

Project suggestions must meet the following criteria in order to be accepted as a design project:

Each project must be sufficiently complex, yet able to be accomplished within the allocated time, with the understanding that a functioning product will result from the project.

All project proposals must be directed and discussed with the prospective team main advisor. The final decision, to accept a project proposal or not, will be made by the main advisor.

Course Activity

▪ ECE 405

- All students enrolled in this course shall attend the lectures arranged by the coordinator. Failure to attend these lectures is subject to the penalty as outlined below under responsibilities of the coordinator.
- The first activity is the formation of project teams. Shortly after that (two weeks into the semester), each team is required to develop a problem statement and a written project plan that covers the activities planned for the entire semester.
- Each team must accomplish certain tasks such as:
 - brainstorming
 - conceptual designs
 - evaluations of conceptual designs
 - detailed design of the selected concept
 before the end of the first semester. Deadlines for these task completion dates and design reviews are set through discussion between the main advisor and the project team.
- Complete a set of design reviews
 - System Requirement Review (SRR) – Faculty members and the project advisor assess the completeness and suitability of the problem statement and resulting set of requirements which quantify the problem definition. This review will be carried out in the form of oral presentation by each design team of their problem statement. The oral presentations will be scheduled during the weekly common meeting time with the coordinator. Advisors must attend the presentation of his/her design team. Faculty members are encouraged to attend and participate in the review.
 - Preliminary Design Review (PDR) – Faculty members and the project advisor assess the selected conceptual design to confirm that the design approach satisfies the requirements, risks are under control and that the preliminary design is ready to be detailed. This review will be carried out in the form of oral presentation by each design team of their selected conceptual design. The oral presentations will be scheduled during the weekly common meeting with the coordinator. Advisors must attend the presentation of his/her design team. Faculty members are encouraged to attend and participate in the review.
 - Critical Design Review (CDR) – A formal end-of-semester oral presentation of the detailed design to the faculty and sponsors.
- Near the end of the semester, each team is required to submit a final design report **in electronic form** to its main advisor(s) and to the coordinator, and hold a critical design review (CDR). The format of the report should comply with the guidelines for this type of report. The due date for the final design report and CDR are set by the coordinator.

- **ECE 406**
 - Teams should complete their projects by implementing what they have designed in the first semester, that is, building, testing and evaluation, and demonstration of the end products. Deadlines for these tasks are set through discussion between the advisor and the project team.
 - A schedule of the semester's tasks should be submitted by the main advisor to the coordinator by the end of the second week of the semester.
 - Near the end of the semester, each team is required to submit, in electronic form, a final design report to the team advisor(s) and senior design coordinator and hold a System Verification Review (SVR). The submission dates for the final design report and SVR are set by the coordinator.
 - Complete a formal System Verification Review (SVR) at the end of the semester where the students present the results of their semester work to faculty and sponsors that demonstrate that their prototype meets the needs of the problem statement and satisfies the requirements.

Responsibilities of the Senior Design Courses Coordinators

ECE 405

- Request from the ECE faculty titles and brief descriptions of any project they would like to supervise. The faculty member should indicate if the prospective senior design project is being supported by outside funding. This request should be made three weeks before the end of each semester.
- Publicize all the prospective senior design projects received from the faculty. Students should be encouraged to go and discuss the prospective projects with the relevant faculty advisors.
- Collect student applications for projects. For application to be considered, it must be submitted by the student by the first day of the semester in which the project begins.
- Organize a meeting, during the first week of the semester in which the project begins, with the senior design committee and project advisors to assign students to projects.
- Post a list of the final team assignments on the department website before the second meeting of semester.
- Give lectures that cover the following topics:
 - Formulation of design problem and developing a set of requirements which quantify the problem statement
 - Brainstorming of conceptual designs
 - Engineering Standard Considerations
 - Evaluation of conceptual designs;
 - Initial design, modeling and simulation, iteration and development of an acceptable design.

ECE 406

- Arrange for at least four lectures to cover the following areas
 - Understanding professional and ethical responsibilities;
 - Knowledge of contemporary issues;
 - Recognition of the need for life-long learning;
 - The broad education necessary to understand the impact of engineering solutions in global and societal contexts.

ECE 405, ECE 406

- Being in charge of the common meeting times.
- Arrange the time and place for the team reviews at least a month in advanced
- Attend all reviews.
- Coordinate the evaluations of the presenters by the attending faculty members (i.e., distributing the evaluation forms to the attending faculty members before the presentations and collecting them afterwards) and then calculate the average value that, properly weighted, will be used in the computation of the final course grade.
- Assign a maximum of 15% of the final course grade for each student, based on activities/assignments during the common meeting hour and oral presentation performance.
- Collect grades from the main faculty advisor and compute the total grade for each student and submit the final course grade to the Registrar office.

Senior ECE Design Committee

Its charge is to continuously assess and improve the capstone senior design program. Whenever the committee deems appropriate it revises the guidelines and presents them to the ECE faculty for their consideration and approval.

- The coordinators of ECE 405 and ECE 406 are the co-chairs of this committee
- An additional ECE faculty member should be appointed as member of this committee
- Each ECE program (EE, CmpE) should be represented by at least one faculty member

Team Advisors

- ECE Faculty members shall be assigned by the department chair to serve as main advisors.
- Co-Advisors from non-ECE programs, e.g. civil engineering, mechanical engineering, physics, computer science, can also be included in multidisciplinary projects.
- The team main advisor shall follow the grading scheme outlined below. The advisor has control of 75% (for ECE 405) and 85% (for ECE) of the final course grade for each student. This portion of the grade covers all the activities listed in the “Grading of the Projects” section except for the oral presentations. The other 15% is assigned by the coordinator.
- The team main advisor shall forward, to the coordinator, her/his portion of the grade (i.e., 85%) for each student in the team by the deadline set by the coordinator.

Grading of the Projects

The team advisors/coordinator shall follow the grading scheme outlined below.

- The grades of the students in ECE 405 shall be based on the following distribution:

Problem Statement / Requirement Set	10%
System Requirement Review (SRR) Oral Presentation	5%
Conceptual Designs (CD)	10%
Preliminary Design Review (PDR) Oral Presentation	5%

Evaluation Summary of CD	10%
Detailed Design (including cost analysis)	35%
Compiling of Final Design Report [†]	5%
Semester Schedule, Progress Reports, and Teamwork	5%
System Verification Review (SVR) Oral Presentation [†]	15%*

[†] Satisfactory completion of the final design report and the SVR is required to pass ECE 405

* The grade for the SSR, PDR, and SVR shall be assigned by the coordinator based on the average of the evaluations of the presentation by the attending faculty minus any penalty (up to 5%) for failing to meet the requirements during the common lectures.

- The grades of the students in ECE 406 shall be based on the following distribution:

Measured Parameters Statement	10%
Building Prototype	20%
Testing and Evaluation	40%
Compiling of Final Design Report [†]	5%
Semester Schedule, Progress Reports, and Teamwork	10%
System Verification Review (SVR) Oral Presentation [†]	15%*

[†] Satisfactory completion of the final design report and the SVR is required to pass ECE 406

* The grade for the SVR shall be assigned by the coordinator based on the average of the evaluations of the presentation by the attending engineering faculty minus any penalty (up to 5%) for failing to meet the requirements during the common lectures.

A penalty (e.g., 10% per day) for failing to complete the specified tasks or submit written sections of the report by the dates agreed to on the semester schedule is recommended. This penalty should be decided by the main advisor and communicated to the team.

It should not be expected that all students on a given team to receive the same grade.

Modifications to the above grading schemes are permissible if warranted; however, any modifications require the approval of the Senior Design Committee.