**ECE 480 Course Syllabus**

**Spring 2013**

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Course Web Pages: <http://www.egr.msu.edu/classes/ece480/capstone/> CHECK THIS FREQUENTLY!

Office Hours: MWF 11:15-noon (after class time)

**ACCOMMODATION AVAILABLE:** Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Accommodations for persons with disabilities, with documentation from RCPD, may be requested by contacting Prof. Grotjohn at the start of the term and/or two weeks prior to the accommodation date (test, project, etc). Requests received after this date will be honored whenever possible.

**A. Purpose of the course and course learning objectives**

At the completion of this course, each student should have actively participated as a member of an engineering design team and made significant contributions to achieving the team's stated goal and objectives. Each design project should involve the collaborative development and evaluation of a "product" that contains an embedded computer. Students will also demonstrate individual competence in designing/building a digital circuit, programming a microprocessor, and writing a graphical user interface. Students will understand ethical and professional issues faced by engineers.

Specific team activities will include:

1. Preparing an engineering design proposal that has clearly stated specifications and design criteria, including realistic constraints, based on the problem area presented to the group.

2. Sharing in the day-to-day design activities and management of the project.

3. Sharing in the presentation of oral and written reports.

4. Sharing in the demonstration of results at key milestones during the life of the project.

5. Evaluating the project's progress and outcomes against a clearly articulated set of criteria.

At the completion of this course, each student will be able to:

1) describe various forms of technical communication and the reasons for using them;

2) write well-organized technical reports;

3) write a team proposal for a major design project and obtain approval;

5) comprehend appropriate content and style of oral presentations;

8) access relevant standards and interpret their meaning and application;

9) delineate the principal design criteria and constraints for an electrical or computer engineering design project—e.g., cost, size, power, environmental factors, reliability, safety, maintainability, and reusability;

10) describe and understand the overall engineering design process—e.g., project justification, identification of constraints, establishment of design criteria, establishment of timetables, identification/scheduling of critical path, the partitioning of work, project monitoring, and project evaluation;

11) describe and understand contemporary industry practices and trends with respect to electrical and computer engineering;

12) describe, understand, and apply key tools used in the overall electrical and computer engineering design process;

13) understand the benefits and potential problems of teaming, describe qualities and processes of effective teams, and describe the role of teamwork in system design;

14) acquire and understand information contained in contemporary technical literature—e.g., trade journals, magazines, books, conference proceedings, and supplier literature—about hardware components, software, design tools, third-party suppliers, etc.; and

15) browse the web to acquire information about electrical and computer engineering, software, design tools, third-party suppliers, etc.

**B. Overview of the course format**

The course is structured around four key activities, including (1) the completion of a team-based major engineering design project, (2) individual development of design and lab skills in a scheduled lab, (3) lectures and assignments on engineering ethics and professionalism, and (4) lectures and activities on electrical and computer engineering design.

The course places only minor emphasis on lectures by the professor. Instead, there is a strong emphasis on guiding the experiential learning of students, and on students teaching one another. The first 4-6 weeks of the course focus on formation of design teams and formulation of projects and project plans, and the last 9-11 weeks focus on design project work. Lectures focus on both technical issues and on teaming/ethics/professionalism issues.

Students will:

1. Attend lectures

2. Participate in class discussions

3. Give demonstrations and oral presentations about their team’s project

4. Write proposals, progress reports and a final report

5. Write individual papers – application note and professional self-assessment paper

6. Create web pages, a page for a brochure, and a CDROM disk

7. Build and test devices and systems, and deliver a completed prototype to their sponsor

8. Search for information and apply it

9. Extend their problem-solving skills

10. Maintain an "Engineering Project Notebook" of their design project activities

11. Participate in giving a technical lecture

12. Work in teams to share in the learning and to share in the work

13. Be responsible for "taskwork" and "teamwork"

14. Complete selected lab experiments/mini-projects in the first half of the course to become

familiar with the lab and its equipment

**Because of the nature of the class, calculators or computers are not required during the lectures and should not be open or in use. Cell phones should be turned off. It MAY be appropriate to write notes in the student’s lab notebook during class; that should be used rather than a computer to record any necessary information.**

**C. Design Team Composition**

Design Teams:

1. Teams will be formed by the second lecture and exist for the duration of the semester.

2. Each design team will be responsible for the design and completion of a design project. There will typically be 4-6 members per design team. Projects involve an array of applications, technologies, and strategies. Short descriptions of the projects to be worked on this semester can found on the class web page.

1. A member of the ECE 480 faculty team will facilitate and evaluate the work of each design team.
2. Occasionally, some design teams (identified at the beginning of the semester) will also contain students from another department or university (multidisciplinary design teams).

Design Team “Non-Technical” Roles: (These roles are in **addition** to the *technical* responsibility you will have on your design team.)

Individuals on a design team will have one of the following roles:

* 1. Manager (manages project, including calling meetings, seeing that deadlines are met, revising project plan in response to changing circumstances, etc.).

2. Web site preparation (coordinates preparation and maintenance of the design team’s web site).

3. Document preparation (coordinates the preparation of documents including proposals, reports, posters, etc.).

4. Presentation preparation (coordinates the preparation of presentations using PowerPoint, posts on web site).

5. Lab coordinator (manages the physical lab equipment, interfaces with ECE shop and part ordering personnel.

Prizes: ECE 480 design teams compete for various prizes awarded on Design Day Judging is done by a panel from industry who attend the final presentations, ask questions of the teams, and view the posters and demonstrations.

**D. Scheduled Laboratory**

In the scheduled lab sections the students work individually and independently on three mini-design projects. The purpose of the lab is to improve lab skills and become acquainted with the ECE 480 lab equipment, to assure that all students possess certain basic competencies, to improve skills at finding and reading technical literature such as specification sheets, to get practice at working on some simpler design problems, to increase the student's confidence and independence in the lab, and to get some practice at using written and oral communication skills.

Lab design miniprojects: (labs start next week)

Weeks 2-3: Build a timer (555)-based circuit: Use spec sheet, prototyping on protoboard first, then putting on circuit board with solder.

Week 4-5: Program a PIC microcontroller using an ICD.

Week 6-7: Do serial communication from microprocessor to/from PC, and write a GUI in Labview on the PC.

**E. Travel policy for students**

Some teams may wish to travel out of the greater Lansing area to the site(s) of their sponsors for meetings/tours, etc. That will be permitted subject to the University’s travel policy. **In advance of each trip each student MUST file a travel authorization form** with the Dept. of Electrical and Computer Engineering. These forms are available at the ECE office in room 2120 EB. Some students may travel as passengers with other team members who drive, but all must file a travel authorization. If the trip is outside the greater Lansing area, the driver may turn in mileage after the trip and be reimbursed by university check. Note that is the only travel expense that will be paid by the department unless other arrangements are made.

**F. Ordering parts for your design team projects**

You **will not be reimbursed** for any parts ordered or purchased from any source except through the ECE Shop, unless you have in advance the WRITTEN permission of the ECE Shop staff to do so.

**G. Course Grading Policy**

1. Grades are based on both team performance and individual performance. Often, not all team members receive the same grade, based on differences in their contributions to the team and on differences in their performance on non-team-based activities in the course.

2. What affects your grade? You lose points:

By not attending class or by arriving late to class

By not attending team meetings

By not participating in class activities

By not participating in team activities

By not developing *and documenting* an identifiable and appropriate

"intellectual property/*technical* contribution" on your team’s project

By not completing class deliverables with a high standard of quality

By not completing scheduled lab deliverables

By not having a positive impact on team outcomes or course outcomes, as

demonstrated by your own reporting and by evaluations of your work

by faculty facilitator and fellow team members

By failing to demonstrate that you have fulfilled the course learning objectives

Please note that an identifiable "intellectual property/technical contribution" by each individual is required. The teams, as they plan their projects, will be asked to clearly divide the technical tasks and identify individual responsibilities for the technical portions of the team design project (not “web master”, “project management,” etc., roles, but *technical* responsibilities). Each individual will be required to submit an **application note** documenting his/her intellectual property/technical contribution to the project. In addition, all such technical contributions should be documented in each student’s **engineering notebook** – that means that the notebook should contain the drawings/schematics/etc., not words like “designed xyz circuit today.” The engineering notebook is NOT a “meeting log,” but rather the place where the student performs and thereby documents the technical work he/she has performed, signing it after each day’s entries (in industry, it would also be periodically witnessed, to assure its usefulness in documenting time of first creation/discovery of intellectual property). The Professional Self-Assessment paper turned in by each individual must also describe the student’s technical contributions to the project. Also, the facilitator should be briefed by each person at the meeting each week, so that the facilitator can clearly identify the technical contributions made by each individual during the semester.

3. **Class and team meeting attendance are required**. Unexcused absences will result in a reduction in your grade. Repeated tardiness will be treated as unexcused absences. An absence is excused if you notify the instructor prior to the class session (by leaving an email message), or if you notify the team leader in advance of the team meeting. In both cases, a legitimate reason is required (for example, “In Cleveland for job interview with XYZ Company,” not “Out of town” or “Need to work that day.”) In accordance with university policy, a valid medical excuse from the Olin Health Center allows an excused absence whether presented before or after the class session missed. You are responsible for the information discussed in the class or at the meeting. The overall grade is reduced by unexcused absences or tardy arrivals beyond 2. Each team will develop its own policy for governing excused absences from any team meeting.

4. You will be evaluated through the following graded activities:

 Design team outcomes, reports, presentations, technical lectures, web pages, brochure page, demonstrations (progress and final), and final report

 Other assignments: individual lab experiments (miniprojects)

 Individual engineering design notebook, application note and professional self-assessment report

 Final evaluations of your contributions to the project by your fellow team members

 Participation in meetings with facilitator (documenting and demonstrating your technical and other contributions)

5. Your reports, technical lecture, presentations, and demonstrations will be reviewed for *individual technical* accomplishments and contributions, as well as for *teamwork*. Your personal engineering design notebook and in-class assignments will be key documents, recording your ideas and efforts as well as supporting other reporting requirements (such as the professional self-assessment and team progress reports). Although you will assess team members' performances as part of group processing, final assignment of grades is the responsibility of the instructor.

6. Communication Skills Practice: Each student will:

 talk three times in an oral presentation before the class.

 write 2 papers individually (application note and professional self-assessment).

 participate in preparing 3 oral presentations during the semester.

 be involved in a team.

 participate in writing team reports during the semester.

7. An approximate breakdown of the grading is:

15% Professional self-assessment paper, notebook and application note (individual)

5% Design issues paper (group)

15% Miniprojects (in scheduled lab)

65% Design project work (technical aspects-1/2, teaming-1/4, communications-1/4)

 Note: A portion of your design project grade will be based on completing your project on time. This semester your working prototype is scheduled for demonstration to Dr. Grotjohn and your facilitator on April 19th. Design Day this semester is April 26. So you are expected to have your working design completed and demonstrated one week before Design Day. This is a change from previous semesters.

(Input comes from facilitator, teammates, instructor and judges)

*The overall grade is also reduced by unexcused absences or tardy arrivals beyond 2.*

**H. Estimated time required per student**

Each student should plan on budgeting approximately 12 or more hours/week (3+ hours per credit) for this course on average. (Some weeks may require less time and some more time, particularly toward the end of the semester.) This includes:

 time spent in the classroom

 time spent completing homework/lab assignments/papers

 time spent in design team meetings

 time spent working individually on design project

 time spent on preparing for oral presentations

**I. Class Meeting Time**

ECE 480 meets on Monday, Wednesday, and Friday.

Labs sections meet once per week, for 2 hours and 50 minutes. You are required to attend your lab section approximately the first 6 weeks of the semester, until you have completed all miniprojects. However, once you have completed and presented to the teaching assistant any particular miniproject, you need not attend lab until the scheduled date of assignment (beginning) of the next miniproject.

You should make every effort to reserve an evening from 7-10:00 p.m. for special meetings of your team to guarantee a weekly time when all members are available. However, your regular weekly team meetings can be set for other days/times as appropriate. Your weekly meeting time with your facilitator must be scheduled for a time when all team members and the facilitator are available, before 5pm M-F.

**J. Tentative Schedule of Deliverables throughout the Semester**

See class schedule on the main web page.

Estimated hours per week: (4 credits x 3-4 hours per credit) gives 12+ hours/week.