EEE488 & 489 Senior Design Laboratory I & II (3 + 3) [F,S]

Course (Catalog) Descriptions:

EEE488: Capstone senior project. Design process: research, concept, feasibility, simulation, specifications, benchmarking, and proposal generation. Technical communications and team skills enrichment. Lecture, lab.

Prerequisites: Engineering BS/BSE student and a D or better in EEE 334 or ECE 334 AND a D or better in EEE 203 or 303 AND a D or better in EEE 241 or 340 AND a D or better in EEE 352 or ECE 352 or co-enrolled AND a D or better in EEE360 or co-enrolled.

EEE489: Capstone senior project. Implement, evaluate, and document EEE488 design. Social, economic, and safety considerations. Technical communications and team skills enrichment. Lecture, lab.

Prerequisites: EEE488 in the immediately preceding semester.

Required

Note: EEE488 and 489 fulfills an ASU Literacy (L) requirement.

Textbooks: None

Coordinator: J. Aberle

Prerequisites by topic:

Completion of a majority of the junior (300-level) electrical engineering courses to allow undertaking a meaningful design project.

Course Objectives:

- Students can define and plan an engineering project involving multiple tasks and contributors.
- Students can communicate and critically evaluate technical information.

Course Outcomes:

- Students can define an engineering project, setting objectives that are appropriate for the project purpose and scope and that incorporate most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.
- Students can plan an engineering project involving multiple tasks and contributors.
- Students can communicate technical information in writing.
- Students can communicate technical information in oral presentations.
- Students can provide informed and constructive criticism on engineering projects.

Course Topics:

- Engineering design
- Proposals
- Oral presentations

- Technical progress reports and memos
- Project planning, budgeting, and management
- Intellectual property, professionalism, ethics
- Business planning, entrepreneurship
- Impact on big issues facing society, for example, environmental.

Sample List of new topics: The topics will be presented by course coordinator. Outside speakers (experts from industry) will be invited to make presentations. Discussion with the students will be held. Students will be required to do turn to address these issues in the written and oral presentations.

1. Analyze markets, business risks, technology risks.
2. Raising capital (venture capitalists, SBIR, ATP, large corporations, IPO)
3. Establishment of companies, LLC v. incorporated, tax implications.
4. Business plan development
5. Dealing with corporate commission
6. Patent laws, intellectual property, non-disclosure agreements
7. Employee contracts, compensation packages-stock purchase, stock options, etc
8. Engineering v. marketing conflicts
9. Improving manufacturing efficiency
10. Business financial analysis and planning, cashflow, product cost analysis
11. Big issues like outsourcing
12. Environmental issues.

Computer Usage:

Specific computer usage is not dictated; however, written reports are typical generated on a word processor and many oral presentations are prepared using PowerPoint. Generally, students also prepare Gantt charts with the aid of computer software. Particular design projects will require the use of computer simulation software such as SPICE, Logic Works, MATLAB, Labview etc.; in addition, other projects may require the use of specialized software such as FPGA design and simulation.

Laboratory Experiments:

There are no prescribed lab experiments in this course. The entire class of students meet once weekly with the course coordinator in the classroom; the individual design teams then meet once weekly with the faculty advisor/mentor for their particular design project.

Assessment:

As part of the Electrical Engineering Department's assessment of the undergraduate program, the student's work is extensively evaluated. Part of this assessment process involves student completion of anonymous surveys through the semester. Although the surveys are anonymous, a record is kept as to whether each individual student has completed the survey. Answers to the survey do not affect the computation of the course grade; however, non-completion of ANY survey is grounds for award of an incomplete grade. Grading for the class is based on three aspects (also see above note about incomplete)

- Contribution of the individual to the team (weighting factor)
- Technical communication: written reports and oral presentations (50%)
- Technical performance: assessment of the group's technical work (50%)

Students will be asked at the end of the project to "grade" the team members (including him/her-self) as to each member's contribution as well as the grade that they feel the individual deserves. There are no exams in this course.

Technical Communications Grade: Note that EEE 488 and 489 each satisfy the ASU literacy requirement, and hence, at least 50% of the course grade is based on written and oral reporting. All written submissions must be typed. All written submissions must be corrected and returned (along with the copy marked in red) within one week after being graded to have the original grade recorded.

Technical Assessment Grade: The technical work is predominantly graded by the faculty (technical) advisor (30% of total grade). The remaining 20% is assigned by the course coordinator in order to equitably smooth any differences between groups working under different faculty advisors.

Design Team Formation: Each design team will consist of three or four students. Students are allowed to form their own teams. The Course Coordinator will assist students in forming teams if requested. The team will remain intact for both EEE 488 and EEE 489 (which must be taken sequentially). Responsibility for the overall completion of the design project rests entirely with the student design team. Each team should rotate the selection of a group facilitator who acts as the project manager.

Design Project Selection: A list of possible design projects is given on the class website along with the advisor willing to sponsor the project. Note that some faculty members are willing to mentor more than one group doing the same project. Sign-ups for a particular project are first-come first-serve basis with the faculty advisor. You also have the option of generating your own project idea and finding an EE faculty member who would be willing to mentor such a project in their area of expertise.

Course Performance Indicators:

- Students can prepare a feasible statement of work (SOW) identifying project objectives and deliverable items.
- Students can prepare a project schedule identifying planned start and completion dates for major tasks and milestone events by which project progress can be assessed.
- Students can identify risks intrinsic in a project plan and project schedule and develop a Risk Management Plan.
- Students can develop realistic labor estimates and a labor management plan projecting the person-hour contribution of each member of a project team to each major project task.
- Students are able to develop a realistic project budget.
- Students can write a proposal defining a technical project.
- Students can write progress reports that describe project progress, issues and modifications clearly and concisely.
- Students are able to design and deliver oral project proposals and reports involving team presentation in a small group setting.
- Students can prepare poster presentations and real-time project demonstrations suitable for a large public forum.
- Students can expertly reply to questions concerning their projects.

- Students are able to write constructive critiques of other student projects after observing their progress throughout the semester.

Course Contribution to Engineering Science and Design:

During the course, the students are typically required to integrate their experiences towards analysis and/or design and/or implementation of devices or systems. The course goals can be directly traced to meeting engineering accreditation requirements. Specifically, ABET Criterion 4 partially states:

> *Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.*

Course Relationship to Program Outcomes:

Contributes to outcomes a,b,c,e,f,g,h,i,j:

Students will go through practical experience that will be applied to engineering practice. The course is very practical and meets the program objective of providing students with practice and theory of engineering. By nature and design, the course contributes towards all EE educational objectives, except perhaps interdisciplinary teams:

- Problem solving capabilities, critical and evaluative manner, technical and non-technical.

- Leadership and communication through teamwork and emphasis on reports and presentations of the progress.

- Some projects selected by faculty are technical problems (or sub-problems) that are of current interest and the education and expertise that the students receive will be useful in graduate studies, either by directly adding to their technical knowledge or by improving their overall perspective of EE applications. Other projects are selected by faculty with or without explicit collaboration with industrial partners. These projects are often of immediate need to the industry and serve as an excellent preparation of the students for industrial employment.

- Significant effort is devoted to the technical part of the proposal whose level of complexity is significantly higher than all previous student experiences.

Person preparing this description and date of preparation: Ravi Gorur, K. Tsakalis Apr. 2009. Revised J. Aberle, 2015.