What is Senior Design Project?
Senior Design Project is a set of two required courses that Electrical Engineering students usually take in their last two semesters of study. The Fall semester (ECE 480) includes a rigorous set of individual project experiences that prepare the students for a high probability of success with their team projects offered for the Spring semester (ECE 482). During the 15-week Spring semester students work closely with faculty and practicing engineers on projects with clients from industry and with faculty-based research activities.
The Boise State catalog describes it as: “Capstone design experience integrating previous design work with design theory and methodology. Applied through group project to integrate specifications based upon customer and engineering requirements, computer modeling, simulation, and reliability analysis. Includes a series of project reports, formal presentations, and a written report. Development of skills used in the engineering profession: teamwork, effective meetings, safety, ethics, project management, and time management.”

The class meets frequently for lectures on relevant topics. Individual teams meet regularly with their faculty advisor and other faculty members as appropriate. The team has access to the Senior Design lab and other BSU resources as needed and available. Typically each team finishes the semester with a poster presentation that is available to interested audiences.

How does Senior Design fit into the Electrical Engineering curriculum?
The Senior Design Project is the capstone of design education in Electrical Engineering at Boise State. It concludes the series of required design courses, purposely distributed across the curriculum, including: ECE 300 Electromagnetic Theory, ECE 310 Microelectronic Circuits, ECE 330 Microprocessors, ECE 350 Signals and Systems, and ECE 360 System Modeling and Control. Senior Design Project builds upon these courses and also upon previous courses in engineering, mathematics, basic sciences, humanities, social sciences, and communication skills. As a consequence it has been structured to be “the” major meaningful engineering experience for students.

What are the learning objectives?
The scope of work for each project is carefully formulated with the sponsor to satisfy business and learning objectives. Students develop knowledge, skills and attitudes in the course that help them to integrate previous course work and to successfully plan and execute design projects. Specific learning objectives include:

**Design Engineering:**

1. identify customer requirements, marketing decisions/issues
2. develop engineering design specifications
3. recognize and articulate design constraints
4. generate alternative concepts that meet specified functions
ECE Senior Design Capstone Project Guidelines

5. evaluate candidate concepts
6. refine preliminary designs, including configuration & parametric designs
7. identify & articulate issues wrt patents, legal liability, safety, and ethics
8. effectively select and where appropriate procure material from suppliers
9. complete simulation, construction, and verification activities as appropriate
10. verbally & graphically present and communicate design information
11. document the resulting design

Project Management:
1. document and present the project requirements
2. develop schedules
3. develop budgets for the project
4. establish & use project control methods & documents
5. establish & maintain a positive design engineer/customer environment
6. learn & use effective concurrent engineering / teamwork skills
7. effectively use project management terminology
8. verbally and graphically communicate project performance

Integration of Resources and Previous Course Work:
1. utilize concepts, topics & resources developed in previous course work
2. utilize library, laboratory, & computer hardware & software resources
3. implement physical and or numerical experiments, tests or simulations
4. develop “expertise relationships” with BSU Faculty mentors

What preparation do the students have to accomplish their final project?
In addition to the major core technology courses listed above along with a host of elective courses in a variety of areas, the students have participated in individual project-related courses during the fall semester. Here they learn about project life cycle from design through prototyping, debugging, and testing. They are involved with scheduling their project activities and dealing with the challenges of tight deadlines. They learn about project documentation, product specifications, test methods, and printed circuit design, SMT assembly, and debugging.

What kinds of projects are suitable?
The intent of each project is to provide the students with a valuable design experience. A significant portion of each project should include a primary design component related to electrical and computer engineering. This should include the design of circuits, systems, algorithms, processes, or other relevant design elements.
**Who are the sponsors of senior design final projects?**
Sponsors are companies that most often make a product or provide a service. Consequently, students deal with real customers, concerning real products or services, having real manufacturing limitations, and real deadlines, typical of the real work environment. Most companies are identified through faculty contacts with companies in the community. Often, the Senior Design Project instructor contacts likely sponsoring companies in the fall. In addition, interested companies will frequently initiate contact with Boise State.

**Why sponsor a Senior Design Project?**
Many of our previous sponsors say they like working with engineering students. It also makes economic sense when you consider the costs versus the benefits of engineering work. And in some cases, companies get a chance to meet some of the talent, one on one, for possible full time hiring upon graduation.

**How much does it cost to sponsor a project?**
The principal requirement of a sponsor is to provide a contact person, preferably an engineer, to communicate project information and give guidance to the students, and if possible, to participate in project review meetings. Across the country, some electrical engineering departments charge $1500 to $2500 to sponsor a project. At Boise State we do not charge a lump sum fee or hourly rate to sponsor a project. However, note that we provide significant resources to support the design, construction, and testing to support the projects. These are quite expensive, even with educational discounts. Therefore, we most graciously accept contributions to the ECE department with the assurance that 100% of that contribution will directly support student design efforts in the ECE department at Boise State. Also, since the project will often result in development of a costly physical prototype, we appreciate any real or in-kind contributions to defray these expenses.

**How much work will the team complete?**
Each team, including expert faculty, will devote about 300-600 man-hours, or between $4000-12,000 of engineering labor to its project. And, we have a great track record at solving the given problem. Just ask some of our past sponsors including: Electronic Controls Corporation, Micron Technology, Hewlett Packard, Cypress Semiconductor, Zilog, Telemetric Corporation, Idaho Power, and Bogus Basin.
Does the project involve real-world elements including design, build/simulate, test, etc.

Students are required to validate and or test their designs, via physical experiments, physical models, prototypes, or computer simulations. When appropriate, vendors are contacted for quotes and product literature to validate final design configurations, details and cost estimates. In some cases, our sponsors have used their own resources and facilities to fabricate prototype parts and systems. In other cases the students can often produce and test prototypes using equipment available in our various BSU labs.

Are projects only for ECE students?

We strongly encourage interdisciplinary projects. We are glad to create teams drawn from other departments including Mechanical and Biomedical Engineering and Materials Science and Engineering.

May students or faculty suggest project topics or companies?

Absolutely, as long as the project has a real customer, and has an appropriate scope of work that satisfies the learning objectives. Students or faculty that wish to suggest a Senior Design Project idea should contact the course instructor in the summer. Student-originated projects are typically very successful because of the strong student interest and motivation.

May a student employee or his or her employer suggest project topic related to the ongoing work of the employee?

These requests will be considered on a case-by-case basis. In general it is preferred that a project be completed by a team of BSU students. We recommend that the employing company consider the possibility of defining a suitable project from their ongoing work that could involve a BSU team which included the employee.

Who owns the Intellectual Property when the project is complete?

Per BSU policies and procedures, the Intellectual Property rights (“IP”) of the BSU faculty members, if any, that are creators of the IP will vest in BSU and the IP rights of the student creators will vest in the students. If it is important to you to acquire rights to IP developed during the project, the BSU Office of University and Industry Ventures, along with the College of Engineering, will work with you to make the necessary legal arrangements prior to the beginning of the project period. Additionally, BSU cannot ensure that work done on the project does not infringe on the IP of any third party.
Will information surrounding the project remain confidential?
Since students are expected to present the results of their work in several public forums, BSU cannot assure that confidentiality will be maintained regarding the project work. In general we cannot ask the students to sign non-disclosure agreements that cover the project results or that might conflict with any current or future employment agreements. Exceptions may be made in rare cases but only if any legal arrangements are completed and signed by the appropriate parties prior to the beginning of the project period. More details are available in the Boise State University Capstone Sponsor Agreement.

How does a potential company project get proposed?
The first step is for the company to write a brief proposal describing the prospective project. A faculty member will be selected to work with the company to help to complete the project description so that it meets the goals for the course. This should be completed at around the middle of the fall semester. This proposal must then be expanded to a document that includes:

- a more detailed project description
- any NDA that the sponsoring company expects the students to agree to
- any IP statement that the sponsoring company expects the students to agree to

If there is an NDA or IP constraint on the project, the course faculty will provide the sponsoring company with contacts at the BSU Office of University and Industry Ventures and the College of Engineering to develop a mutually agreeable contract.

How does a potential company project get selected?
We normally try to have teams of 2 to 3 students, depending on the project requirements. In some cases there may be an insufficient number of teams to address all potential projects and certain projects may not match the interests of a student team in a particular year. In those cases we welcome the opportunity to offer the same or alternate project from the company the following year. Please note that students are not required by the University to incur any legal project-related obligations and they may choose to avoid selecting a project if they feel the legal obligations are objectionable to them. That is not to suggest that sponsoring companies should avoid proposing projects in which they wish to retain IP rights, as in many cases these are the most meaningful and successful projects for our students.

How are students selected for each project?
A final list of companies and project descriptions are given to the Senior Project students in the late fall. Students will have visibility of these projects when they become finalized. The students then indicate their preference for project and team makeup to the course instructor. Then the course instructor forms teams with advice from the faculty, balancing strengths of each team. This process provides for the highest levels of success for the individual student, the team and the sponsoring company.
Whom do I contact if I am interested?
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