# INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT SENIOR DESIGN PROJECTS

## Overview

The purpose of the senior design sequence is to demonstrate the student's abilities at performing an engineering design project – projects (by definition) require the management of three major facets: (1) time; (2) budget; and (3) intended functional results. For the IEEM program, the senior design sequence consists of two consecutive terms, totaling five credit hours, and performing the design function as a team with an identified sponsor (client). The courses IENG 464 (2 cr hrs, Fall) and IENG 465 (3 cr hrs, Spring) are required. Students within three terms of graduation and/or senior standing may register for these classes.

Faculty, graduate students, and undergraduate students not meeting the registration criteria may work with an IEEM senior design project team in either consulting or directly supervised roles (such as fabrication, programming, or drafting, etc.) subject to two caveats: (1) their role(s) in the project must be approved by the course instructor and the client; and (2) the project team roles (see below), project management and design processes must be led by the registered senior design team student members.

## Senior Design Process Description

### PRIOR TO FIRST PROJECT TERM

***Student Project Descriptions*** **-** Descriptions of the available team projects will be available to the registered senior design students approximately 2 – 3 weeks prior to the start of the term. Students wishing to suggest and form their own project teams should submit their planned sponsor, project description, and team member information to the course instructor approximately one month prior to the start of the term.

***Resume*** **-** After students review the Project Descriptions, students should prioritize their project choices and prepare a resume in electronic format (MS Word or PDF) that addresses their qualifications to work on the prioritized projects. An email prioritizing the projects (first choice to last) should be sent to the course instructor, along with the electronic copy of the resume prior to the SDSM&T Registration Day.

### FIRST PROJECT TERM

***Project /Team Selection*** **-** Using the student priorities and resumes, the course instructor will attempt to match a team of four to five students to the selected projects. These team assignments will be announced on the Registration Day to allow for some last minute adjustment at the start of the term.

~~***Engineering Design Project Seminars*** – At the start of the first project term, approximately ten Engineering Design Project Seminars will be presented. Each student is required to attend four, forty-five minute seminars reviewing basic, professional engineering design project topics during the first project term. Up to three of these seminars may be required by the course instructor, the remainder of the requirement may be selected to meet the needs of the project team – it is expected that each student team member will contribute expertise and skills as necessary to help the team complete the~~

~~professionally complete the project. As a team, it is expected that all professional aspects will be demonstrated at a high level of competency. See the course website for current seminar topics.~~

***Engineering Project Proposal -*** Approximately two to three weeks into the first project term, the student team will develop and submit an Engineering Project Proposal to course instructor and project client. This document will identify the problem(s) to be addressed, the project constraints to be faced, and will identify the general project deliverables. This document is intended to delineate the negotiated scope and objective(s) of the project between the project team and the project sponsor. Intellectual property and non-disclosure agreements and other legal protections (as necessary) will be in-place by this point. Upon the acceptance of the project proposal, the project team will receive the initial release of funds for concept development.

***Conceptual Design Development & Progress Reporting -*** Between the Project Proposal and the Design Concept Presentation, the student team will collect preliminary data, conduct preliminary analyses, and research potential design solutions. The student team members will record relevant information in their individual engineering notebooks; schedule, conduct, and record meetings; and document and report project progress. The course instructor will help coordinate progress reporting.

***Design Concept Presentation, Documentation, and Development Funding -*** By the end of the first project term, the team will develop engineering documentation of the proposed conceptual design and present this design to the project sponsor, course instructor, and other pertinent parties. The document will contain an executive summary, problem statement with constraints, design methodology, summary of preliminary data collected and relevant analysis, proposed design solution, and references. As part of the designed solution, the team will address alternatives considered, decision criteria, and proposed development schedule, costs, and functionality. The presentation portion should summarize the documentation and highlight the proposed design solution and components. It should include a conceptual prototype that demonstrates important aspect(s) of proposed design. At the conclusion of the term, using the cost estimates developed by the team and in consultation with the project sponsor, the amount(s) and release of implementation funds for the project will be scheduled for the following term. An initial project grade will be entered based on the results of the first term deliverables.

**SECOND PROJECT TERM**

***Design Development and Testing -*** By the start of the second term, and continuing to the Project Results Presentation, the team will be responsible for developing, prototyping, detailed design, and appropriate testing of the selected design. The student team members will again record relevant information in their individual engineering notebooks; schedule, conduct, and record meetings; and document and report project progress. The course instructor will help coordinate progress reporting.

***Project Results Presentation, Documentation, and Poster -*** At the conclusion of the second term, the student team is responsible to provide final project documentation and presentation of results to the project sponsor and course instructor. A project poster, using the poster template and summarizing the project outcomes will be produced for general public display. For projects terminating during the Spring Term, these deliverables should be prepared and coordinated to coincide with the SDSM&T Design Fair.

The project will be considered complete with confirmation that the final deliverables have been transmitted to the project client/sponsor, and copies of the project documentation have been submitted to the course instructor. Based on the entirety of the project deliverables and project performance, an individual, final grade will be submitted at the end of the second term.

## Managing Project Team Member Roles

**OVERVIEW**

It will be up to the team to identify the necessary project sub-tasks, assign responsibilities and schedule these subtasks, and professionally conduct the project. Many of these tasks will differ between projects, but there are some team member roles that must be addressed early and maintained consistently. The common roles identified below must be addressed early on (by at least the Project Proposal), but they may be shared, reassigned, rotated, or otherwise filled by registered senior design students on the project team. These role assignments must be communicated to the course instructor, if they change after the Project Proposal. These basic roles are:

***Project Management*** - at least one team member will need to be responsible for collecting, documenting and reporting project status. This will require maintenance of the following project documents: Gantt Chart (weekly), Budget/Cost Accounting Spreadsheet (weekly), Project Task RACI (bi-weekly).

***Design / Development Management*** - at least one team member will be responsible for driving and coordinating the design and development process and the efforts of the individual team members and project associates. Included in these responsibilities are resource identification, acquisition, scheduling, necessary training and safe production of any prototype(s).

***Analysis/Test Management*** - at least one team member should be assigned to develop and implement plans for appropriate testing and analysis of the design(s). Aspects of the plan include the acquisition of valid data, selection of analysis methods, appropriate reporting and interpretation of results.

***Intellectual Property Management*** - at least one person on each project team will be responsible for identifying the appropriate engineering documentation, maintaining the documentation, and controlling communication and dissemination of the project results.

## Minimum Project Deliverables

The minimum project deliverables include: individual resume, bi-weekly project meetings with the course instructor, bi-weekly e-mailed progress reports, Engineering Project Proposal, Design Concept Presentation, Design Concept Documentation, Project Results Presentation, Project Results Documentation, Testing Prototype(s), and Project Poster. See website for details and deadlines.