# Update on Managing Engineering and Engineering Technology Summer Internships for Academic Credit

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## Abstract

Baccalaureate engineering and engineering technology programs typically require senior design projects which greatly aid in fulfilling ABET outcomes. An issue with some engineering and engineering technology programs is that they have too few faculty and an abundance of students working on senior design projects. This causes a large demand on the faculty to advise senior design project students throughout the academic year. To alleviate these demands on the faculty, summer internships can be offered for credit allowing the student to substitute their internship in the place of the senior design project. This would reduce the demands on faculty to advise senior design projects. In addition to alleviating the demands on the faculty, industrial work experience is very valuable and provides both the sponsoring company and the senior many benefits. Summer internships need to be managed properly to ensure consistency between the internship and the senior design. This paper will discuss how to manage the summer internships.

The summer internship course should be open to students who have completed required core courses within the major and who are between their junior and senior year of their baccalaureate engineering or engineering technology program.

## Internship Requirements

Below shows a list of course requirements for the summer internship:

- Students must find suitable summer employment at a company that allows them to complete engineering and engineering related tasks. The college offers two career fairs that greatly help the student to obtain summer employment as an engineering intern.

- Students must complete the online Internship Agreement Form (IAF) and fulfill the tasks stated on the IAF. Students are not permitted to self-enroll in the course. Enrollment is controlled by the faculty supervisor and department chair. The student's IAF is reviewed and if deemed appropriate the student is departmentally enrolled in the course. This is done to ensure the student has met the course prerequisites and the projects listed on the student's IAF will fulfill the engineering and engineering related tasks required by the course. The IAF serves as a contract between the student, their summer employer and the college.[1]

- Satisfy the course prerequisites. Courses such as Machine Design, Production Design, Computer Aided Design, Advanced Strength of Materials and Thermodynamics are the prerequisite courses. The combination of these courses ensures that the student has

senior level standing and that they are prepared to employ upper-level coursework during their internship to satisfy a level of engineering tasks consistent with the senior design course.

- Complete 120 hours of engineering related tasks. Students are not permitted to use mundane tasks (e.g. sweeping floors, turning wrenches, turning a sign from slow-to-stop alongside a road, etc…) towards the fulfillment of the 120 hours requirement. They must be researching, calculating or analyzing problems associated with engineering.[1]

- Submit weekly emails to the faculty supervisor; therefore, the student must use their college email address and check their emails on a daily basis. This done to make sure the student is completing the tasks shown on their IAF and to mentor the students with their engineering tasks. There is not a formal class meeting at any time during the summer because students may be in different states or even countries.

- Complete online assignments. Several online quizzes are assigned. The assignments help the student relate diversity and the need for lifelong learning to their summer internship employment. This not only helps the student but also helps the program to fulfill ABET requirements.

- Prepare a 20 minute presentation highlighting their internship experience. Students are assigned a deferred grade until they return to their fall semester and deliver their presentation. Internship presentations are scheduled in the early portion of the fall semester. Once the student completes their presentation, the deferred grade is changed on their transcript to the appropriate letter grade.[1]

## Communication

This is a difficult task because students cannot attend regularly scheduled class meetings due to schedule conflicts with their summer employment and the location of their summer employment. The weekly emails are satisfactory for accomplishing regular communication; however, a more effective method was found by giving the students an option to enroll in secretive group on Facebook. For the past four years, it was found that every student enrolling in the summer internship course had a Facebook account. The instructor creates a secretive Facebook group and enrolls each summer intern into the group. The secretive group allows only the students in the group (i.e. internship course) to read and respond questions or comments.

The secretive Facebook group was found to be an effective and efficient method to communicate with students. In addition to all the students having a Facebook account, they also had smart phones which allowed them to have the Facebook application on their phone. The student could ask questions and upload pictures (i.e. with company permission) asking a question. The instructor has a Facebook account and the Facebook application on their smart phone. Within seconds of a student comment or question, the instructor is able to respond. This is similar to a classroom environment for open communication. Some might argue that is better than a classroom environment because there is log of the questions and instructor responses that could

be read or referred to students at any time throughout the summer. The group allowed each student to read the question and the instructor's response. This proved to be better than emails because other students may have had a similar question but went unanswered because they forgot or just did not ask the question. Students are encouraged not to share proprietary information pertaining to their company but to ask questions that helped them to satisfy the requirements of the internship course.

Overwhelmingly, the students appreciate the Facebook group with the ability to read comments and ask questions. When the Facebook group was first initiated years ago, a couple students resisted using Facebook because of privacy issues, but in the recent years, Facebook has proved to be a staple item amongst students.

## Grading and Assessment

The student's grade in the internship course is comprised as follows:

- Internship Presentation - 40%
- Industry Supervisor's Evaluation - 20%
- Faculty Supervisor's Evaluation - 10%
- Internship Notebook - 10%
- Assignments - 20%

Students are required to deliver a 20-25 minute presentation. Typically there are 3 grading faculty members present during the student's presentation. The student prepares a grading packet for each grading faculty member. The grading packet is comprised of a grade sheet, a print-out of the student's presentation slides and the Internship Agreement Form. Presentations are scheduled for early in the fall semester.

Students are graded as follows:

- Professional Attire – 5%
- Speaking Ability (Clarity, Speed, Eye Contact, Enthusiasm, Posture, etc…) – 5%
- Presentation Format (Organization, Thoroughness, Correctness, etc…) – 10%
- Technical Knowledge of Subject Matter (design problem statement, correctness of solution to design problem, and conclusions) - 70%
- Non-Technical Content (Summary, IAF, Company Info, Background Info, Timeline, Courses most used during internship, What could MET program could have done to better prepare you for your internship?, etc...) – 5%

- Response to Questions – 5%

Also, students are evaluated during the presentation in a PASS/FAIL manner. The following items are the basic criterion for satisfying the course requirements:

- Acceptable and Appropriate use of junior-level or higher courses.
- Satisfied Requirement of 120 Hours of Engineering or Engineering Related Tasks
- Appropriate Mastery of knowledge, techniques, skills, and modern tools of engineering.
- Completion of Internship project(s) as described on IAF.

If all grading faculty members assign "Fail" in any single category, or if the student receives a score of 65 or below then the student will not be able to substitute their internship course for the senior design course. If the grading faculty feel that the student gained valuable knowledge but not at a level consistent with the senior design course, the student may substitute the internship course for technical elective course.

The industrial supervisor completes a form and assigns a grade based on the student's performance during the summer. The form is related to ABET course outcomes[2]. The industrial supervisors are asked to specify the level at which the student completed any of the following criterion and to record an N/A if the student did not have experience with a particular criteria.

- Rate the intern's appropriate mastery of the knowledge, techniques, skills, and modern tools of mechanical engineering technology.
- Rate the intern's ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
- Rate the intern's ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes.
- Rate the intern's ability to apply creativity in the design of systems, components, or processes.
- Rate the intern's ability to function effectively on teams.
- Rate the intern's ability to identify, analyze and solve technical problems.
- Rate the intern's ability to communicate effectively.
- Rate the intern's ability to recognize the need for, and ability to engage in lifelong learning.
- Rate the intern's ability to understand professional, ethical and social responsibilities.

- Rate the intern's respect for diversity and knowledge of contemporary professional, societal and global issues.

- Rate the intern's commitment to quality, timeliness, and continuous improvement.

- Rate the intern's ability to apply specific program principles to analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes.

The Faculty's Supervisor's Evaluation consists of the student's response to questions or comments, promptness and thoroughness of weekly emails, and the level of professionalism of which they conducted themselves during their internship.

An internship notebook is to be completed by the student. The notebook (3-ring binder with a cover sleeve) should be professionally formatted. The notebook is due at the time of the student's presentation. The notebook is to include company information, copy of the student's IAF, a record of weekly emails, design concepts, engineering calculations, Gantt chart, presentation slides, and miscellaneous information pertaining to the student's internship.

Assignments consist of online quizzes. Questions on the online quizzes aid the student and in fulfilling ABET course requirements. Students are asked questions as follows:

- Are there professional engineers (PE) working at your company, if so interview one of them and ask them how their PE license has impacted their employment. If there are not PE's working at your company, inquire as to the possibilities why this is so? The students are then asked whether or not they will seek there PE licensure.

- Recognize Diversity in the Workplace as it applies to your place of employment. Also, what is the impact of level of diversity or lack thereof?

- Did you serve on a team? If so, what was your level of participation? If not, do you feel working on a team could have benefited you or hindered you?

## Current Status

I have seventeen years of experience serving as the faculty supervisor of the summer internships, I have witnessed only positives for the student. In rare instances where negatives arose, it was still a valuable learning experience for the student. The average enrollment for the past 17 years has been 12 interns per summer.

Students performing internships have an advantage entering the workforce over a student performing a senior design project because they have more insight of the responsibilities associated with engineering and how their responsibilities fits into a corporate structure.

Our department consistently uses the summer internship course to satisfy many of the ABET course objectives. Some students are able to satisfy many if not all the ABET course objectives.

## References

1 Nitterright, Fredrick; Roth, David; Fisher, Kenneth, "Implementing and Managing Summer Internships at the Pennsylvania State University, The Behrend College, for Seniors in the Mechanical Engineering Technology Program," International Conference on Engineering Education, 2001, Session 3149.

2. ABET (IV.C.3.d(3)(c)), Criteria for Accrediting Programs in Engineering in the United States, Effective for Evaluations During the 1995-1996 Cycle, Engineering Accreditation Commission, Accreditation Board for Engineering and Technology, Inc., Baltimore, Maryland.Author1, First Name and First Name Author2, Book Title, Publisher, Place, Year, pg.

## Biographic Information

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