SERVING INDUSTRIAL CLIENTS BY DESIGN

In 1978, the Mechanical Engineering Department of The University of Alabama initiated a required ME Design Clinic Internship. Now called the Capstone Design Program, the program carries on the tradition of providing students with realistic experience in the practice of engineering with area industries. Over the years, the Program has conducted studies for more than 160 companies involving more than 900 mechanical engineering students.

REAL SOLUTIONS FOR REAL PROBLEMS

PROGRAM PHILOSOPHY AND SUMMARY

The Capstone Design Program is the culmination of a senior engineering student’s education at a four-year college. The program provides a “learning-by-doing” exercise that integrates the concepts students have studied in the classroom. They tackle real world projects to smooth the transition into employment as an engineer.

The ME Department at The University of Alabama uses a two-course sequence to provide this experience. The first, ME 489, exposes students to outside speakers that include practicing engineers, media consultants, code officials, attorneys, marketing consultants, government regulators and manufacturers. Faculty members conduct lectures on engineering economics, report writing, oral presentations, information gathering, shop drawings and cost estimating.

The course’s primary exercise is a competitive design project in which student teams design, build and test an assistive device for use by a person with a disability. It concludes with each team of students being assigned a project from an “outside” client. Teams do background investigations and prepare proposals for the project they will undertake during the following semester in the second course, ME 490.

ME 490 involves student teams that undertake industry sponsored projects. These projects have six to nine month timetables and would normally be assigned to entry level engineers.

Examples include:
• Development of design tools
• Prototype design, construction, & testing
• Lab testing - design, measurement, & analysis

• Manufacturing system design and optimization
• Energy conservation studies
• Code and regulation compliance designs
• Feasibility and alternative studies

Each student is expected to provide seven to ten hours of work per week. Faculty members supervise the teams, consisting of three to four students, at no cost to the client.

TEAM AND CLIENT: A PARTNERSHIP

Students make an initial site visit to get a better perspective on the problem. The teams work on campus and have contact with the project’s monitor.

Teams are required to send written progress report letters during the term and submit two copies of a bound engineering report. Clients who help the students formulate the project task initially and then give periodic direction will benefit the most from the effort. Near the end of the semester, students present the project to the faculty who critique it and offer suggestions prior to the students’ presentation to the client. The teams then make an on-site 30-minute presentation of their project to the client.

Clients are expected to have a minimum of five engineers and managers present to critique the students’ work. Evaluations by these professionals are used to determine a significant portion of the final grade in the course.
DESIGN CLINIC PROJECTS

The Clinic obtains projects from industries that have engineering problems. The projects must be real and demand a rigorous, professional, creative response from the students.

Past projects have included an array of interesting and relevant projects involving project design, automation and machine improvement. For example:

- Construction and testing of a large model of a boiler with a coal dust accumulation problem
- Construction of a high speed stacking device for a disposable diaper production facility
- A horse-drawn wagon with a wheelchair locking mechanism
- Catfish pond aeration system
- Recovery of waste heat for commercial kitchens
- OSHA compliance study for woodwork shop
- An automated trimming device for an injection mold process
- Energy audits for educational facilities
- A cutting device for asphalt shingle sample displays
- Design of a production method for a putting improvement device

UNIVERSITY RESOURCES

Student team assignments are made in October (for projects ending in May) and in March (for projects ending in December). Teams have access to the full resources of the University, including libraries, CAD facilities, the Internet, faculty expertise, and the fabrication and electronic shops.

Design Clinic students sharpen communication skills to complement their technical background.

CLIENT REQUIREMENTS AND PROJECT SCHEDULE

Project description: One to three paragraph description of project with background, description of problem, objective, and constraints (cost, timetable, codes and regulations, space, etc.); November (spring semester projects) or April (fall projects)

Host site visit (for off-campus projects): one to three hours; early November or April.

Proposal review: Evaluate a five to ten page document to insure the students are doing what is needed; January or September.

Host second site visit (for off-campus projects): One to three hours; More site visits can be arranged if approved or desired by client; January or August.

Review final presentation and report: Teams will present results to clients at facility (or some other location chosen by the client). Written report will precede oral report by three days. Client evaluations account for 25% of final course grade; late April or early December.

COST TO THE CLIENT

In order to provide clinic services beyond that possible with state funds, each participating client pays a modest overhead fee in addition to the normal direct costs incurred by the student team. Presently, total project costs to the client range from $1400-$1600. Students and faculty do not receive salaries or honoraria. However, costs would be higher for projects requiring expensive equipment or a large amount of skilled fabrication.

- Project overhead fee of $1250
- Direct costs of the project -- travel, telephone, publishing (typically $200-$300)
- Material of construction (if necessary)
- For projects requiring skilled fabrication, $20 per hour.
- Student labor and faculty time is not charged to the client.

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