

ChBE 4520: Capstone ChBE Design Project – Standard Option (0-6-2)

Context

The ChBE 4520 course is taken as the capstone senior design by all chemical & biomolecular engineering students who are taking the standard option (i.e., not in the biotechnology option). The students are organized into groups of four or five students based on balancing the average GPA of the groups and to ensure diversity of group membership (gender-based).

Text

Sieder, Seader, Lewin, and Widagdo, “Product and Process Design Principles”, Wiley, 3rd Edition.

Operation

The central activity of the course is a design project. This project has three phases of increasing complexity and decreasing scope.

- Phase I – About a two week exercise to examine a broad range of options for the objective.
- Phase II – Focus on the mass and energy balances for one design option.
- Phase III – Equipment Design and Economics, this takes the mass and energy balances from Phase II and complete equipment design and do a cash flow and investment analysis.

The completion of each of these phases requires the use of various chemical engineering and design skills that they have acquired over the course of their curriculum. The evaluations are simulation based and no actual experiments or equipment is built or used in the project.

The guided portion of the course consists of:

- feedback on intermediate reports that the students have submitted (two times during the semester)
- individual meetings with groups to check on group dynamics and workload (roughly every three-four weeks)
- collective meetings of the class to answer questions and provide clarifications so that everyone can hear the answers (weekly for an hour)
- tutorials on specific subject areas that are needed for the project, such as more advanced simulation topics or modeling elements that might not be covered in the curriculum (as needed – typically two-three times in the semester).

At the end of the course, each student group is asked to present their design for approximately 15-20 minutes to the chemical & biomolecular engineering faculty.

Recent Project/Sponsor List

2011 – Eastman Kodak

2010 – Exide (design of polymer battery separator, design of process to sulphonate lead oxide)

2009 – Chevron (design of algae based biofuel process, design of biodiesel process)

2008 – LyondellBasell (design of C4 refinery upgrade process, design of C3 refinery upgrade process)

The project is sponsored by a company:

The sponsoring organization is invited to participate in the course in several ways.

- Visiting Georgia Tech at least twice during the course offering
 - The first visit is to introduce the organization's general opportunities and needs and to provide the introduction to the specific problem. This occurs at the beginning of the design course semester.
 - The second visit is to review the top selected student projects (typically 3 of them), listen to their presentations, and help the faculty in determination of the prize awards. This occurs towards the end of the design course semester.
- Helping to answer student questions during the semester. We do this through a collaborative web site that is set up for the course. The students post questions and typically the faculty and TA's answer but there are sometimes issues best dealt with by the company.
- Visiting at other times during the semester to provide feedback on the student reports and to answer questions. This is typically very useful but is not required.

Project Champion

In order to achieve a smooth running of the ChBE 4520 course it is very important that the organization identify someone within the organization as a "project champion." This role is very critical to making the experience a positive one for the students. This champion will be responsible for:

- Identifying people within the organization that will be willing to help out with the design project and course. It is typically a good idea to identify a team of people rather than just one because that way if "things come up" we are not left dependent on the schedule of one individual.
- Working with the faculty teaching the design course in the semester previous to the course offering to help identify and formulate the three phases of the design problem. This typically involves the team identified in the first step. In general we are able to outline the project and carry much of the load at Tech, but quite often it is helpful to have input on the critical aspects of the project and in obtaining certain information.
- Reviewing problem statements with the faculty to enable them to provide students with a complete and accurate statement of requirements.
- Working with the faculty to guide the development of a base case solution to the problem to enable fair and accurate evaluation of the student designs. This typically involves giving feedback on the directions to take with the project in terms of the options to consider.