ISyE 4106 Senior Design Syllabus

Spring 2007

1 Organization

Senior Design Coordinator

The senior design coordinator, Dr. Steven Hackman, has final authority over all matters pertaining to the course.

Faculty Advisors

Faculty advisors are responsible for the day-to-day progress of their teams during the semester. You are responsible for keeping your advisor informed of the team's progress and intentions on a regular basis. The faculty/team assignments are:

Section A: Monday-Wednesday-Friday, 12-2pm and 6-8pm

Dr. Shabbir Ahmed (Groseclose 410, 4-2320, shabbir.ahmed@isye.gatech.edu)
Buckhead Baseball Little League, Office Depot, Rock-Tenn Distribution Systems, United Parcel Service

Dr. Marc Goetschalckx (Groseclose 321, 4-2317, marc.goetschalckx@isye.gatech.edu)
Home Depot, Panasonic Automotive Systems Company of America, Piedmont Fayette Hospital, Reliance Electric

Dr. Anton Kleywegt (Groseclose 409, 4-4323, anton.kleywegt@isye.gatech.edu)
Matador Distribution, Porsche Cars North America, Project Open Hand, Ryder Systems (Rebuild)

Dr. Joel Sokol (Groseclose 418, 4-6484, joel.sokol@isye.gatech.edu)
BlueLinx, Norfolk Southern Railroad (Macon Yard), Norfolk Southern Railroad (Scheduling)

Section B: Tuesday-Thursday, 12-3pm and 6-9pm

Dr. Ozlem Ergun (Groseclose 220-B, 4-2369, ozlem.ergun@isye.gatech.edu)
Georgia Poison Center, Norfolk Southern Railroad (Maintenance), Paccar Parts

Dr. Paul Griffin (Groseclose 210, 4-2431, paul.griffin@isye.gatech.edu)
InterContinental Hotels Group

Dr. Joel Sokol (Groseclose 418, 4-6484, joel.sokol@isye.gatech.edu)
Southern Company

Dr. Julie Swann (Groseclose 411, 5-3054, julie.swann@isye.gatech.edu)
Atlanta Gastroenterology Associates, AT&T Network Services, Ryder Systems (Layout)

The regular schedule for each team's meetings with the faculty advisor will be determined by the advisor. As a general rule, for each meeting the team should prepare in written form an agenda for the meeting, a progress report on the work done over the previous week, a list of unresolved issues, and the proposed next steps. Faculty advisors are entitled to make exceptions to this rule.

Consultations with Other Faculty

Teams may consult with faculty other than their advisor regarding their project, *but must request permission from their faculty advisor* before doing so. To maintain impartiality in grading, the senior design coordinator is **not** eligible to directly advise teams on their project content once they are assigned a faculty advisor.

2 Course Objectives

Senior design provides a system design experience similar to ISyE professional practice, and an opportunity for you to learn about the business world. You will learn how to

- properly define and scope a problem;
- identify and analyze relevant factors;
- apply appropriate industrial engineering methodologies and computational tools;
- generate and evaluate alternative solutions; and
- improve your skills in
  - technical writing,
  - public speaking,
  - working within a team, and
  - project and time management.

The vehicle for this learning is an intensive, semester-long, team-based engineering design project. You are responsible for finding a suitable project and a project team.

3 Project Requirements

There are three main requirements that a senior design project must meet:

- *Design*. A design project may involve the analysis and presentation of data, cycle time analysis, simulation, optimization, determining standards, documenting process flow, etc., but in and of themselves, these contributions do not constitute a senior design project. A senior design project must involve **design**; that is, *a recommendation for a change to a system and an economic analysis of the cost and benefits of the proposed change(s)*.
- *Methodology*. The project must require the use of *significant* industrial and systems engineering tools and methods learned in the curriculum. Building a tool (e.g., a simple spreadsheet) for an engineer or manager to use might be quite valuable for a company, but if it does not contain ideas and/or methods not generally recognizable by a non industrial engineer or manager, it does not meet the methodology requirement.
- *Value*. Each team member is expected to spend a minimum of 12 *productive* hours per week on the project for a total of 180 hours for the semester, which equates to a minimum of 1080 hours for a six-member group. **The project's scope must be consistent with this expectation.**

In addition to completing a project that meets these requirements, you are required to present your results in oral and written form, and to act in a professional manner toward the faculty, the client company, and your fellow students at all times throughout the process.

4 Project Phases and Reports

The senior design project has three major phases. Each phase culminates in an oral presentation and a written report, both of which are delivered to the faculty and the client.

- *Project definition phase.* The problem, deliverables, design strategy, project plan, and value to the client are defined. At the end of this phase, the **Project Proposal Presentation and Report** spell out the work you plan to do and the value the client can expect to receive.
- *Interim phase.* Data are collected, analyzed, and validated; relevant factors are understood; and the design strategy is finalized. At the end of this phase, the **Interim Progress Presentation and Report** describes the work product to date and the remaining plans for the semester.
- *Final phase.* The design strategy is evaluated and its value demonstrated. At the end of this phase, the **Final Presentation and Report** give a comprehensive and self-contained description of the work completed during the semester.

All presentations and reports should be submitted both in hard copy and electronic form to the senior design coordinator and the faculty advisor according to the course schedule (as late submissions will be severely penalized), and should be received by the client **no later** than the time of the client presentation.

Additional Presentation and Report Guidelines

- Each team member must present a significant portion of at least one presentation to the faculty and a significant portion of at least one presentation to the client.
- Strict time limits will be imposed for the in-class presentations:
  - at most 15 minutes for the project proposal presentation,
  - at most 20 minutes for the interim progress presentation,
  - at most 30 minutes for the final presentation.
- Client presentations must be scheduled at times that are suitable to all attending parties (all team members, the faculty advisor, and all client-side attendees). You are encouraged to hold one or more of your client presentations on campus, provided the client agrees.

The ISyE Workforce Communication Lab (http://www.isye.gatech.edu/communication) assists Senior Design students on their presentation skills by critiquing their slides and giving them space in which to practice their presentations. The lab is located in Room 115 of the Main ISyE Building (the old Management Building, not Groseclose). Dr. Judith Norback (Director of Workforce Communication, Groseclose 314, 5-1079, judith.norback@isye.gatech.edu) will announce the lab's regular and extended hours.

IMPORTANT NOTE: All presentations and reports **must** be approved by the faculty advisor before being sent to the senior design coordinator or the client.

5 Schedule

Date	*Time*	*Activity*
Jan 23	3pm	Submit project proposal presentation and report to faculty advisor and senior design coordinator (hard copy and electronic** version)
Jan 24-26	Class times*	Present project proposal to faculty
Jan 29-Feb 2	TBD	Present project proposal to client
Feb 22	3pm	Submit interim progress presentation and report to faculty advisor and senior design coordinator (hard copy and electronic** version)
Feb 26-Mar 2	Class times*	Present interim progress to faculty
Mar 5-9	TBD	Present interim progress to client
Apr 19	3pm	Submit final presentation and report to faculty advisor and senior design coordinator (hard copy and electronic** version)
Apr 23-25	Class times*	Present final report to faculty and class (full section attendance required at all presentations)
Apr 26-May 2	TBD	Present and deliver final report to client
Apr 26-May 3	TBD	Senior Design Award finalist presentation session

* Evening sessions (Section A: MWF 6-8pm; Section B: TR 6-9pm) may be used, so plan your schedule accordingly. The schedule of presentations will be determined by the faculty. Do not request a specific date or time for your team's presentation, unless there are extenuating circumstances.

** The names of the files you submit should identify the client company's name (as it appears on the faculty/team assignment list; include parenthetical description if your client company is sponsoring multiple projects) as well as the file's content (i.e., progress/interim/final and report/presentation). For example, "Norfolk Southern Railroad (Macon Yard) Progress Presentation.ppt" would be an acceptable file name.

In addition to the above schedule, there will be a Senior Executive Panel on workplace communication; the date and time will be announced during the semester.

Your faculty advisor may also require you to meet other deadlines (e.g., providing him/her with a copy of your reports a week before the submission deadline, in order to verify the report's correctness and/or give you helpful feedback).

6 Grading and Feedback

Grading

The senior design coordinator is responsible for determining final grades for all groups and group members. The faculty advisor, other faculty, Dr. Norback, and the client will provide input. Each team's grade will be based on the following components with these specific questions in mind:

- *Work Product (60%)*

  Approach and Vision
  - Did the team tackle the right problem? Were any important aspects missed?
  - Did the team exhibit creativity in their approach?

Modeling and Methodology

- Did the models developed capture the salient features of the problem?
- Were the models integrated in an appropriate way?
- Were the correct formula(s) and tool(s) applied?
- Did the team understand the methodology they applied?
- Were methodologies applied in an ad hoc or sloppy fashion?

Execution

- Did the team complete what they said they were going to do?
- Did the team display a proactive approach to recognizing and solving problems?
- Did the team set its own goals and objectives, or wait for the faculty advisor to do so?

Value

- How much real value did the project create for the client?
- Did the client perceive the value of the project?
- Was the initial potential value of the project realized?

- *Oral Presentations (20%)*

  - Did the presentations address all relevant content areas?
  - Were technical terms properly understood and conveyed?
  - Was the information presented in a logical, organized, easy-to-follow sequence?
  - Did slides have a professional look?
  - Was the text easily readable?
  - Did the speakers convey full knowledge of the material?
  - Did the speakers project confidence and enthusiasm?
  - Did the speakers answer questions effectively?

- *Written Presentations (20%)*

  - Did the reports include all necessary content?
  - Were all equations accurate and clearly labeled and explained?
  - Were technical terms properly defined and used correctly?
  - Were all prior works and references acknowledged?
  - Were the reports concise?
  - Were the reports visually appealing and easily navigated?
  - Was information placed appropriately in either the main text or an appendix?
  - Were all figures accurate and of good quality, and did they enhance the text?
  - Were the sentences complete and grammatically correct? Did they flow together easily?
  - Did the reports contain any misspelled words and typos?
  - Were the words chosen for their precise meaning?

- **Deductions.** In general, the ideal is for all team members to receive the same grade. However, individual and team deductions from the overall grade will be assessed if you do any of the following:

  - do not contribute a fair and significant share to the team's effort;
  - fail to get your advisor's approval before sending a presentation or report to the senior design coordinator or the client;
  - miss a meeting without prior approval;
  - arrive late to a meeting without prior approval;
  - miss a presentation to the faculty and/or class (**even for an interview**; companies understand that you need to schedule your interviews around immovable academic commitments);
  - appear at the client site dressed inappropriately;

- do not display proper attitude during a formal or informal meeting;
- do not display proper attitude or work ethic during the semester;
- miss a due date;
- violate course rules;
- fail to respond in a timely manner to a request from the client, faculty advisor, or senior design coordinator; or
- behave unprofessionally toward client, faculty, senior design coordinator, or fellow students.

Penalties will be assessed according to the severity of the action. They can range from as little as a quarter letter-grade deduction to a full letter-grade deduction from your team's overall assigned grade. Egregious cases may result in a deduction of two or more letter-grades, the assignment of a D or F in the course, or even termination from the course midway through the semester.

Feedback

- Faculty advisors will provide feedback and guidance to their teams throughout the semester. Faculty advisors are also responsible for communicating their teams' progress to the senior design coordinator throughout the semester and receiving feedback.
- Faculty advisors and the senior design coordinator will provide detailed feedback after the project proposal presentation and after the interim progress presentation.
- Teams will provide self-evaluations after the proposal, interim, and final presentations to the client. This input will be used in addition to the faculty advisor's opinions when assessing grade deductions and penalties.

Caveats

- The senior design coordinator will consider the project's scope and any factors outside the control of the team that might have influenced the project's outcome. A narrowly-scoped or "safe" project will receive less credit than a more ambitious project.
- Exceptional work by a team member may be recognized with a higher grade at the discretion of the senior design coordinator.
- If at any time the senior design coordinator determines that a team or individual's progress and accomplishments are unacceptable, then the senior design coordinator has the discretion to determine the remedy. Examples of remedies include requiring special assignments for individuals or the team, or terminating that team or individual's participation in the course.

7 Honor Code

You are expected to conduct yourself in accordance with Georgia Tech's student honor code. Please consult http://www.deanofstudents.gatech.edu/Honor and/or your faculty advisor if you have any questions.

8 Legal Issues

- Only the Office of Sponsored Programs and the Legal Services Department of the Georgia Institute of Technology are allowed to enter in a contract on behalf of the Georgia Institute of Technology.
- On all written communications, proposals, forms, data collection sheets, presentation handouts, and other documents, **a disclaimer must be prominently displayed** that the document has been

created in the framework of a student design project and that the Georgia Institute of Technology does not officially sanction its content.

- Students are not allowed to receive formal compensation for work done in Senior Design. Companies may provide assistance in the form of photocopying, binding and typing services, and in some cases, supplies, meals and travel expenses.

9 Tips for Success

The following tips are based on the faculty's observations of years of successful and unsuccessful senior design projects.

Maintaining Progress

- The semester moves very fast; *never* stop working hard. If you meet a personal or team goal ahead of schedule, start the next task(s) right away—the jump you get will help you avoid falling behind later, when some other task takes longer than expected.
- Resolve any information-gathering issues (getting data from the client, answers from your faculty advisor, etc.) as soon as possible.

Client Relations

- Make sure to identify a company contact who agrees to take on the responsibility of providing your group the requisite information you will need in a timely and accurate manner.
- Keep the project's big picture in mind. How will your work provide value to the client? Express what you are doing from your client's perspective.
- Spend as much time at the client site as you can—learn their business and operations first-hand.

Faculty Relations

- When time is a constraint, the faculty's priority may (and should, as teachers) be to point out how and where you need to improve, rather than making you feel good by going over what you have done successfully. The fact that they criticize your work does not mean that they don't like you, respect you, or want to see you succeed.
- Listen to your faculty advisor and respect his/her knowledge and experience. Faculty—even those whose personalities might appear gruff or abrasive at first—are here because they care about teaching you.

Teamwork

- Teams work together best when they can improve (and even criticize) each other's work and ideas without having to worry that criticism might be construed as an insult.
- Work together as a team. Lack of effective teamwork is a sure prescription for failure. Effective teamwork generally leads a successful project.
- Find a way to contribute—standing around watching others do the work is *not* "helping".
- Resolve any problematic issues as soon as possible.
- Consider getting together with your teammates socially in addition to working on the project, as an aid to team-building.

Project Content

- A necessary condition for a successful project is that your client is happy with your work; however, it is far from sufficient. Keep in mind that you are, after all, taking an academic course, and must satisfy the requirements of design, methodology, value, professionalism, etc.

- A basic user interface and/or instruction manual might be necessary in order for the client to make use of your ideas, but it should *not* be the focal point of your project. Content, vision, and analysis are much more important.
- Stretch—don't be afraid to learn something new and don't be afraid to make mistakes. That's how you learn, which is what this course is all about.
- Accept the fact that it takes time and effort to write well. You will need to write and revise several times in order to construct a professional-quality report. Here are a few tips:
  - Figure out the order in which you need to present material. Logical flow of ideas is absolutely essential.
  - Formatting techniques (e.g., headings, bulleted lists, italics and bold fonts) help the reader navigate the report, but be careful not to overdo it.
  - Remove redundant and meaningless words and sentences, and be sure *every* word you use has the precise meaning you need it to.
  - Eliminate spelling and grammatical errors—they reflect poorly on the group (not to mention their effect on your grade).
  - Do not wait until the last minute to start writing—you'll need more time to craft a quality report.

Project Management

- Keep focused on the goal—do not spend an inordinate amount of time on one specific task out of proportion to its value to the project.
- Project and time management are absolutely necessary. Make sure every week your group has specific tasks to accomplish and members know the tasks for which they are responsible.

Professionalism

- View criticism as an opportunity to improve, rather than as a personal attack.
- Be professional and maintain your personal and academic integrity at all times.
  - Don't be afraid to say "I don't know" and "I was wrong".
  - Be honest in your dealings with teammates, clients, and faculty.
  - Show respect.
  - Accept disappointment; do not complain if/when things do not go your way.

10 The Challenge of Senior Design

Senior design is one of the most valuable, rewarding, and difficult courses in the curriculum. Here are some of the challenges it presents:

- You will face situations unlike those presented in class or in textbooks. Problems will not be clearly defined, data will be unavailable or hard to obtain, and (consequently) solutions might not be exact.
- The proper techniques might not be apparent, and team members might disagree about the right course of action.
- Not only will you need to use material learned in classes; you will also have to learn new material.
- You might discover you are on the wrong track and need to redo significant portions of your work.

Accept and deal with these challenges. You will not be alone—you will be mentored through this process by the faculty.