

## Principles of Biomedical Engineering Design

Department of Applied Biology and Biomedical Engineering, Rose-Hulman Institute of Technology

### Course Description:

In this course, junior BE majors are introduced to the engineering design methodology as utilized in biomedical engineering. Students will learn engineering design through completion of a team design project with realistic constraints. This course serves as the entry point for the four-quarter sequence in which students undertake and complete their capstone design project.

### Design Sequence Goals/Rationale:

Design is something every engineer should learn to do and do well. It is our philosophical goal to help students learn to conduct and critique engineering design and to develop an understanding of the critical difference between theory and practice in design. In this course we seek to develop a 'can do' attitude in our BE students and to provide them with the technical skills and experience needed to confidently and competently undertake ill-defined, open-ended problems. Since the vast majority of design decisions - from individual components to entire projects - must be made with uncertain and/or incomplete data subject to a variety of constraints, this is an important challenge we want our students to be prepared to meet!

### Learning Objectives:

Upon successful completion of BE 390, students will be able to:

- Assess client needs to *establish* problem-specific constraints
- *Identify* relevant constraints (e.g. regulatory, manufacturing, economic, environmental, societal, etc.)
- *Formulate* problem statements incorporating client input and relevant constraints
- *Generate* multiple, creative solutions for a problem and *develop* criteria by which to rank the merit of feasible solutions
- Critically *review* the performance of a solution in achieving the identified needs and *suggest* relevant improvement or necessary revisions

### Meeting Location and Times:

BE 390 is a two-credit-hour class (1R-3L-2C) which meets:

Section 1: Mondays 9th hour (3:25 - 4:15 pm) in O259, and Wednesdays 7th-9th hours (1:35 - 4:15 pm) in O101.

Section 2: Tuesdays 9th hour (3:25 - 4:15 pm) in O259, and Wednesdays 7th-9th hours (1:35 - 4:15 pm) in O103.

### Instructors:

Glen A. Livesay, Ph.D.  
D-223 Moench Hall; Phone: #877-8504  
e-mail: [livesay@rose-hulman.edu](mailto:livesay@rose-hulman.edu)  
Office Hours: Tuesdays and Thursdays, 8th hour (2:30 - 3:20 pm)

Renee D. Rogge, Ph.D.  
D-222 Moench Hall; Phone: #877-8505  
e-mail: [rogge@rose-hulman.edu](mailto:rogge@rose-hulman.edu)  
Office Hours: Tuesdays and Thursdays, 8th hour (2:30 - 3:20 pm)

*Note:* Drop by or e-mail to set up appointments as needed.

### Who Should Be in This Class/Course Pre-requisites:

This class is for 3rd year BE students who have taken Introduction to Biomedical Engineering (BE 200).

### Required Text:

Dym, C.L. & Little, P: Engineering Design: A Project-Based Introduction (2nd edition), Wiley, 2004.

### Course Format:

The course meets two times weekly (one lecture + one lab). Classroom presentation will be in a format which is primarily lecture-based, while laboratory activities will be largely hands-on supplemented with demonstrations. Students are expected to attend lectures and labs and to actively participate in the learning process.

**Attendance:**

Students are expected to attend every class. Students who miss more than one class without a valid excuse (see below) provided within one week of each absence will receive a reduced grade for the course. Continued absences will result in withdrawal from the course and a grade of WF. During class periods when students give oral presentations, attendance is required. Failure to provide a valid excuse (see below) for missing such a class will result in the reduction of the students' grade for that project.

**Valid Excuses:**

Students who fail to complete an assignment and who provide a valid excuse may arrange to complete the assignment/project at a later date. A valid excuse consists of written communication from the Dean of Students on institutional letterhead. Plant trips, job and graduate/professional school interviews, attending scientific conferences and Institute-sponsored activities are also valid excuses provided that the student notify us *in writing* and *at least one week in advance* of the event. Illness and other unexpected circumstances are also considered valid excuses with a confirming memo from the Dean of Students.

**Grading:**

The nature of design means that there will be several different types of assignments in this course; they will be discussed in detail in class, but are listed here for your reference. For the group and design projects, a portion of your individual grade will be based on peer evaluation forms filled out by your team.

	Percent of Total:
a) Homework/Quizzes	15%
b) Labs	15%
c) Team Evaluation	10%
d) Preliminary Design Work	25%
e) Presentations	10%
f) Final Design Work	<u>25%</u>
	100%

**Notes:**

- Letter grades (no minus grades) will be assigned according to the system outlined in the Rose-Hulman Institute of Technology, Undergraduate Bulletin, 2005-06.

**Academic Integrity:**

In this course, collaborative or group work will be encouraged in many instances. However, it is expected that individual assignments completed by a student will be his or her own and in no way or part a duplicate of someone else's work.

The Academic Policies of Rose-Hulman (<http://www.rose-hulman.edu/academicpolicies/>) clearly outline the procedures to be followed in the event of academic misconduct, and the student should be aware that plagiarism, misuse of computer facilities, and other types of academic dishonesty can result in harsh penalties. "The Institute values its reputation for moral leadership as much as its reputation for academic excellence and expects all persons associated with it to maintain this reputation. The Institute's Code of Ethics is simple and direct: Rose-Hulman expects its students to be responsible adults and to behave at all times with honor and integrity."

**Academic Accommodations:**

We understand that "invisible" disabilities (learning and attention deficit disorders, chronic fatigue syndrome, clinical depression, etc.) can significantly affect a student's academic performance. We strongly encourage students to document special academic needs with staff at the Office of Student Affairs, and then to contact us as soon as possible so that we can work together to provide recommended academic accommodations while protecting your privacy.

**Electronic Devices and Other Things That Go Beep:**

The instructor is aware that many of us would like to 'be connected' to the outside world at all times, however, please turn any and all devices so they don't "beep", "ring" or "scream" in class. Of course, if your phone (or other device) should ring, it is probably best to take the call outside in the hallway.

**The Fine Print:**

The instructors reserve the right to alter course content, calendar, policies, etc. outlined in this syllabus, subject to extenuating circumstances. Updates to the course schedule will be provided as needed.

**Course Calendar:**

<b>Week:</b>	<b>Date:</b>	<b>Day:</b>	<b>Topic:</b>	<b>Notes:</b>
1	3/6-7/06	Monday or Tuesday	Design, clients, and problem statements!	Lecture
1	3/8/06	Wednesday	Interviewing clients and making decisions, Intro. to project	Lab
2	3/13-14/06	Monday or Tuesday	Teaming and team issues	Lecture
2	3/15/06	Wednesday	Mini-grab bag lab!	Lab
3	3/20-21/06	Monday or Tuesday	Reverse engineering and subsystems	Lecture
3	3/22/06	Wednesday	Conceptual prototyping	Lab
4	3/27-28/06	Monday or Tuesday	Documentation and Design	Lecture
4	3/29/06	Wednesday	Skills lab	Lab
5	4/3-4/06	Monday or Tuesday	Technical communication, oral and written	Lecture
5	4/5/06	Wednesday	Senior Design Presentations!	Lab
		<i>No class</i>	<i>Spring Break!</i>	
6	4/17-18/06	Monday or Tuesday	Test plans, Evaluation of performance vs. design specs	Lecture
6	4/19/06	Wednesday	Skills lab	Lab
7	4/24-25/06	Monday or Tuesday	Intellectual property, Patents, Final documentation	Lecture
7	4/26/06	Wednesday	Project time	Lab
8	5/1-2/06	Monday or Tuesday	Regulatory agency review	Lecture
8	5/3/06	Wednesday	Project time	Lab
9	5/8-9/06	Monday or Tuesday	Professional responsibility	Lecture
9	5/10/06	Wednesday	Junior Design Showcase!	Lab
10	5/15-16/06	Monday or Tuesday	Concept Mapping, Team Evaluations, BE 410 Preview	Lecture
10	5/17/06	Wednesday	Pass along design 'wisdom'!	Lab

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