1. Course Description
This is the first quarter in a 4-quarter sequence in Bioengineering Design. The goal of the entire sequence is to gain experience with the design process, and have hands-on experience with engineering design for biomedical applications. Techniques for defining problems, generating solutions and deciding between them are used to setup and solve design problems that are analyzed by students using fundamental engineering principles. Computer modeling of systems is introduced for use in design. Students learn both written and oral technical communication skills by presenting their engineering work and conclusions in the form of reports and oral presentations.

The course consists of 4 one-unit lecture courses (187A, B, C and D held in the spring, fall, winter, and spring quarters, respectively), and 2 three-unit lab courses (1XXA and 1XXB in the fall and winter quarters). In 187A, students form groups of 3-5 people, and keep those groups for the duration of the sequence. Each group is matched with a faculty or industry advisor and a biomedical design project. These groups are final and cannot be changed. Assignments will be given for both the 1-unit lecture course, and for the 3-unit lab course. These assignments will be part of an engineering design process. Groups will work individually with their faculty sponsors on their engineering design using information and design fundamentals acquired in the 1-unit course.

The BE187B gives general information on engineering design topics and to structure the development of the designs. During BE187B, the groups complete their design and engineering analysis, they also get ready to begin building and testing a prototype of their design. During 187C, the groups work on testing and prototyping the final version of their design. The projects will be presented in 187D to rising seniors enrolled in 187A.

The lecture course this quarter will consist of presentations of previous and proposed design projects for the 2013-14 design sequence. For the bulk of the quarter, teams from the 2013-14 school year will make their final design presentations to the entire class. During the quarter, new design projects will be described for the BE187A students. Instructor will assign groups of 3-4 students based on student preferences, availability of projects and the design goal of the project. The assigned groups will be fixed for the duration of the sequence. Each group will be matched with a faculty sponsor, in some cases in collaboration with industry or outside clients. By the end of the 3rd (Winter) quarter, the groups should have a working/tested prototype version of their design. Each 187D team will present their project orally in class and in a poster session(s) during the Spring Quarter of 2015 [subject to Intellectual Property (IP) status].

Course Outcomes and Learning Objectives:
1. Apply the stages of the engineering design process to develop innovative and practical solutions to technical problems (ABET a, c, e, f, j, k).
2. Work effectively in project teams by establishing common goals, equitable workloads, a framework for mutual accountability, strong communication, and a collegial environment. (ABET d, g, i).
3. Present various project results in effective written and graphical formats, and through informative oral presentations (ABET g, h, i).
4. Evaluate ethical issues in engineering practice in terms of NSPE’s Code of Ethics (ABET f) and apply techniques in failure analysis and hazards analysis to engineering systems (ABET a, e, h).

ABET Program Outcomes Engineering programs must demonstrate that their graduates have:
   a) an ability to apply knowledge of mathematics, science, and engineering
   b) an ability to design and conduct experiments, as well as to analyze and interpret data
   c) an ability to design a system, component, or process to meet desired needs
d) an ability to function on multidisciplinary teams

e) an ability to identify, formulate, and solve engineering problems

f) an understanding of professional and ethical responsibility

g) an ability to communicate effectively

h) the broad education to understand the impact of engineering solutions in a global and societal context

i) a recognition of the need for, and an ability to engage in life long learning

j) a knowledge of contemporary issues

k) an ability to use modern engineering tools

2. **Prerequisite(s)**

   **BENG 187A**: Grade of C– or better in BENG 101; BENG 112A or CENG 101A; BENG 140A; or BIBC 102; BENG 123 or BENG 186B Bioengineering or Bioengineering: Biotechnology majors only or consent of instructor.

   **BENG 187D**: Grade of C– or better in BENG 187C; concurrent enrollment in one of the following lab sections: BENG 119B, BENG 126B, BENG 127B, BENG 128B, BENG 129B, BENG 139B, BENG 147B, BENG 148B, BENG 149B, BENG 169B, or BENG 179B; Bioengineering or Bioengineering: Biotechnology majors only or consent of instructor.

3. **Textbook(s) and Other Required Material** (Available on reserve in the science & engineering library)


4. **Course Objectives**

   - Identify design objectives, functions and specifications
   - Compare alternative designs
   - Incorporate basic FDA requirements
   - Document the design process and evolution
   - Make effective technical presentations in oral and written formats
   - Learn to use feedback effectively for design revision
   - Work effectively as a team
   - Including communication among team members, assignment of tasks
   - Integration of results
   - Scheduling

5. **Course Outline**

   **BENG 187A**: During the quarter, new design projects will be described for or suggested by the BE187A students who will be assigned to one of these newly submitted projects by the end of the spring quarter. 187A students will make appointments to meet with randomly assigned **187D mentor three (3X) times** and write report based on these meetings.

   **BENG 187D**: For the bulk of the quarter, 187D teams from the 2010-11 school year will make their final design presentations to the entire class. The 187D students will mentor 187A students by random selection and meet with **187A mentee three (3X) times**.

5. **Topics Covered & Tentative Schedule**

   **BENG 187C**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>BE187D Presentation</th>
<th>HW BE187A</th>
</tr>
</thead>
</table>
   | 1- Apr 4 | Introduction to the course and goals for the quarter. **187A&D Assignment of mentors**  
Register for BE day  
[http://www.jacobsschool.ucsd.edu/events/beday/](http://www.jacobsschool.ucsd.edu/events/beday/)  
**BE 187D** Final group presentations | 17 | 8 |
<table>
<thead>
<tr>
<th>Date</th>
<th>Course Code</th>
<th>Event Description</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2- Apr 11</td>
<td>BE 187A</td>
<td>Attend poster evaluation (tomorrow BE Day)</td>
<td>9</td>
<td>5</td>
<td>One page poster evaluation</td>
</tr>
<tr>
<td></td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- Apr 18</td>
<td>BE 187A</td>
<td>Poster evaluation</td>
<td>7</td>
<td>11</td>
<td>One page poster evaluation</td>
</tr>
<tr>
<td></td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4- Apr 25</td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5- May 2</td>
<td>BE 187A</td>
<td>Mentor-Mentee Assignment 1</td>
<td>14</td>
<td>1</td>
<td>One page Mentor-Mentee assignment 1</td>
</tr>
<tr>
<td></td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6- May 9</td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td>15</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>7- May 16</td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td>2</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>8- May 23</td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td>6</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>9- May 30</td>
<td>BE 187A</td>
<td>Deadline for students chose top five picks</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10- Jun 6</td>
<td>BE 187A</td>
<td>Mentor-Mentee Assignment 2</td>
<td>20</td>
<td>16</td>
<td>One page Mentor-Mentee assignment 2</td>
</tr>
<tr>
<td></td>
<td>BE 187D</td>
<td>Final group presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **Class Location & Time**

   Lecture BENG 187AD: Friday 10:00 – 10:50 PETER 108

7. **Methods of Evaluation**

   The 187 sequence uses an “in progress” or “IP” grading scheme. A single letter grade will be given at the end of 187D in the spring quarter that reflects the quality of work completed throughout the 4 quarter sequence (187A-D). The letter grade awarded at the end of 187D will carry a weight of 4 units.

   **Requirements for BENG 187A:**
   - Assignments (50%): Individual assignments related to the engineering design process will be announced in class.
   - Project selection (10%): Successful matching to a design group and project
   - Attendance and Participation (40%): Students are expected to attend lecture and participate in in-class engineering design activities. There is no grade penalty for missing up to 2 lectures.

   **Requirements for BENG 187D:** Letter grades for all 1-unit classes (187A, B, C, and D) will be assigned this quarter.
   - Final presentation of the design projects to BENG 187A class (grade suggested by BE187A, 25%).
   - Poster and presentation at the Bioengineering Day (grade suggested by BE187A, 25%)
   - Mentoring 187A students (grade given by mentee, 20%)
   - Video presentation of your design (grade suggested by BE187A, 15%)
   - Website (grade suggested by BE187A, 15%)

   If there is a grade discrepancy, please submit, to a TA, the original homework, project or exam along with a written request for a re-grade within a week from the date the assignment is returned. If re-grading is desired, then the entire assignment is subject to re-grading.

**Mandatory Formatting for All Team Assignments:**

- 12-pt font
- Arial or Times New Roman font (symbols are allowed)
- 1 inch margins all around
- Header including your names, date, project number, project title, advisor’s name
- Footer containing page number
- Professionally made figures (no hand-drawings)

**Assignments Policies:**

   ALL parts of the homework must be turned in and will be graded. Late homework will not be accepted unless pre-arranged (and only for extenuating circumstances, e.g. medical or family emergency; an exam in another class is not an acceptable excuse).
Any requests for a re-grade must be made in writing to the TAs and will result in a re-grade of the entire assignment, not just a specific section, first by the TAs themselves and, if following this dispute remains, by the course instructor. Such re-grading could result in a higher or lower overall grade.

The Department of Bioengineering adheres to the UCSD Policy on Integrity of Scholarship. An excerpt of this Policy states that "Integrity of scholarship is essential for an academic community. The University expects that both faculty and students will honor this principle and in so doing protect the validity of the University's intellectual work. For students, this means that all academic work will be done by the individual to whom it is assigned, without unauthorized aid of any kind."

All suspicion of academic misconduct will be reported to the Academic Integrity Office according to university policy. Academic misconduct is not just blatant cheating (e.g., copying off another student during an exam), but what you might have thought of as "minor cheating" in high school, for example: copying other students' papers or homework; copying or using old papers/reports; working with others on individual assignments; forgetting to cite material you took from an outside resource; turning in work completed in total or part by another. The Policy on Integrity of Scholarship (academicintegrity.ucsd.edu) and this syllabus list some of the standards by which you are expected to complete your academic work, but your good ethical judgment (or asking me for advice) is also expected as we cannot list every behavior that is unethical or not in the spirit of academic integrity.

Those students found to have committed academic misconduct will face administrative sanctions imposed by their college Dean of Student Affairs and academic sanctions imposed by me. The standard administrative sanctions include: the creation of a disciplinary record (which will be checked by graduate and professional schools); disciplinary probation; and attendance at an Academic Integrity Seminar (at a cost of $75). Students can also face suspension and dismissal from the University; those sanctions are not at my discretion. Academic sanctions can range from an F on the assignment to an F in the class. The appropriate sanctions are determined by the egregiousness of the Policy violation. Students who assist in or are complicit with cheating could also be in violation of the Policy. Thus, students who become aware of their peers either facilitating academic misconduct or committing it should report their suspicions to me for investigation.

In other words, cheating of any kind whatsoever will not be tolerated in any form in this course and will be punishable to the maximum extent possible as per university rules and policies. The full policy is available in the Academic Integrity Office (at http://senate.ucsd.edu/manual/app2.htm). Group study and discussion of homework assignments is allowed, but the contributions of others should be clearly documented in writing in the homework. Students are allowed to discuss approaches to problem-solving and design, but are not allowed to obtain or provide written solutions. In cases of suspected academic dishonesty, the case will be referred to the appropriate Dean.

Students agree that by taking this course all required papers will be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site.

How to Do Well:
It is imperative that you do not fall behind. Who attend class regularly get the most out of the course, and perform the best on the assignments. Students have found it best to jot down supplemental notes on the lecture, and then use these notes to review. This approach will allow you to listen in lecture and ask questions. Do NOT fall behind in your design project; you will find it difficult to catch up once you fall behind.

Miscellaneous: If you have a learning disability and require special teaching conditions, please see me during the first week of class so that we can make the needed arrangements. If you are an observant member of a religion that has a holiday that conflicts with a lecture sometime during the semester, please see me during the first week of class so that we can ensure that you do not miss any assignments. Also, please do not be late. We will begin class promptly.

E-MAIL Messages: Please put “BENG 187A” or “BENG 187D” in your subject line. Otherwise my SPAM filter may block your message from my Inbox, or I may delete it without reading it as I routinely delete messages with ambiguous subject lines.