

BMED 2300

Projects in Biomedical Engineering II

Spring 2015

Professor: James Rains rains@gatech.edu
Design Lab and Shop Instructors: Raja Schaar raja@gatech.edu
Marty Jacobson marty@gatech.edu
Office Hours: By Appointment.

Lecture: Monday, 1:05 - 1:55 PM, location Mat Sci & Eng. G011
Design Lab: Section A: Tues. Thurs. 12:05 - 1:25 BME 0209
Section B: Tues. Thurs. 3:05 - 4:25 BME 0209
Section C: Wed. Fri. 09:05 - 10:25 BME 0209
Section D: Wed. Fri. 11:05 - 12:25 BME 0209
Section E: Wed. Fri. 1:25 - 2:55 BME 0209

Text & Refs: **Engineering Design 4th Edition**, by Clive L. Dym and Patrick Little, 2013 and selected readings assignments

Description: This preparatory engineering design course introduces BME students to the skills and processes required to be successful in the medical device industry. Through the reverse engineering of an existing medical device, the students to gain a foundation in engineering intuition, design thinking, and collaboration strategies. Evidence of this new understanding is demonstrated through drawings, prototypes, formal presentations, and technical documentation.

Course Objectives:

- To analyze the biomedical context and physiological need for existing medical devices
- To apply engineering design processes to medical products and systems
- To exercise skills in design communication including: drawing, modeling, and CAD
- To prepare students for future team activities through a project design experience incorporating relevant engineering design practices

Lectures: Lectures will focus on the design process, engineering design in the commercial enterprise, project planning, FDA regulations on design and manufacturing, human factors and ergonomics, intellectual property and development of written and oral presentation skills. Much of the material on the exams will come from the lectures, which will include information not addressed in the textbook. The written exam account for 15% of the course grade.

Design Lab: Students will meet in two (2) design lab sessions each week. Students will be assigned to a team for the semester to work on the assigned projects. Each lab section with have a teaching assistant (TA) to communicate assignments, facilitate work during the lab sessions, grade assignments, reports, project notebooks, and assist in final grading. Requirements for design project work account for 59% of the course grade.

There will be three (3) design exercises during lab sessions, each emphasizing development of your problem-solving and creative skills. Through assignments and projects, you will also be learning the basics of CAD design software. You will be required to keep a detailed project notebook, build physical models, give oral presentations, and write technical reports on your design projects. Your participation and contribution during lab sessions and to team projects outside of class are part of your course grade as evaluated by the teaching team observations and feedback from your peers.

Attendance: Attendance is required for all design lecture and lab sessions. If you are late by more than 10 minutes, you are considered Late. You are only allowed to be Late without a valid excuse three (3) times or (1) unexcused absence in lab. After being late 3 times or 1 absence, each additional absence or late may lower your course grade by one letter. If you are going to be late or unable to attend a session, you are expected to inform your GTA and peers (by email) PRIOR to the lab session. Failure to do so will result in an unexcused absence.

Notebooks: Students will be required to maintain a project notebook to document their individual work in this course. These notebooks MUST be brought to each lab and team session. Notebooks will be collected and graded during lab sessions without advance warning several times during the semester. If you fail to bring your notebook to the lab session when they are collected at ten minutes after the start of class, you will receive a '0' for that notebook grade. Students may not leave the classroom to retrieve their notebook if it is not with them when they arrive.

Project notebook guidelines are described in "How to Keep a Project/Lab Notebook". Notebooks should be 9" x 12" or smaller. Different size notebooks are sold at the GT bookstore. A low-cost option (~\$2 + tax) is a quad-ruled composition notebook.

Your notebook grade will be based on:

- Adherence to guidelines - following notebook protocol in documenting your work
- Substance - quality and quantity of work described
- Timeliness and readability - Up-to-date and legible entries.

Teamwork & Professionalism:

A professionalism grade will be assessed from an evaluation of your teamwork & course participation. The teaching team will base this grade on observed classroom habits including timely and complete submittals, effort and engagement in lecture/lab settings, quality and care in your work, and attitude towards your peers, TAs and instructors. The results of regular peer evaluations (rating teamwork, participation, and effectiveness on the project team) will also be taken into consideration.

Grading: Final grade will be a weighted composite of scores on exams, notebook, project reports, CAD proficiency, Semester Portfolio, attendance, and your lab instructor's & peer evaluations.

Projects	Notebook	Exam	Take-Home Quizzes	CAD	Teamwork & Professionalism	Total
59%	6%	15%	3%	10%	7%	100%

See page 4 for a breakdown of assignments and due dates.

Many design assignments cannot be graded by a concrete objective standard due to the variables involved (sketches, models, and quality of design solutions are examples) and will rely on the evaluation of the instructors. Grading for this type of assignment will be at the sole discretion of the teaching staff and guided by the following definitions:

F (<60%): Failure to meet minimal course requirements

D (60-70%): Demonstrates minimal efforts, poor grades, and overall poor design lab performance.

C (70 – 80%): Acceptable work that demonstrates an understanding of the learning objectives, adequate practice in required skills and meets course requirements.

B (80 – 90%): Work that demonstrates proficiency in achievement of learning objectives and is executed with a consistently high level of craft, care, and originality.

A (90-100%): Excellent performance that consistently exceeds requirements and expectations in terms of learning proficiency, thoughtfulness, originality, craft, detail, professionalism and teamwork skills.

Some exercises in this course may require skill sets that are foreign to the student. In order to promote iterative improvement and personal growth, Skill Building assignments (Perfect Cube/Cylinder and Sketchbook Drawings) may be re-submitted at any time during the semester for grading, and full credit will be granted if the work is satisfactory.

Honesty: *In fairness to the honest majority, **ALL** incidents of suspected academic misconduct will be reported to the Office of the Dean of Students. In this course plagiarism is a potential type of Student Honor Code violations. Students are cautioned to be mindful that the submission of material that is wholly or substantially identical to that created or published by another person or person, without adequate credit notations indicating authorship constitutes plagiarism. When you refer to work of other people in your projects and reports, make sure to use proper reference citations.*

BMED 2300 Spring 2015 Schedule

WEEK OF	TOPICS	WEEKLY READING ASSIGNMENTS	TUESDAY/WEDNESDAY LAB	THURSDAY/FRIDAY LAB	Weekend Workload	Quiz/Tut's
1 Jan 5	Intro to BME & The Design Process	Eng. Design – Ch 1, 2, 5	P1 - Analyze It! <i>Form P1 Groups, RTK</i>	Widget Introduction & Orthographic Drawing Intro <i>Skill Building Supplies in hand Group Product Choice Made</i>	Summaries	Take-Home Quiz 1
2 Jan 12	Usability & Human Factors	Eng. Design – Ch 3, 4, 15	Skill Building – 5 widget pages <i>(Teams Locked)</i>	Widget Refinement in perspective	Widgets	Take-Home Quiz 2
3 Jan 19	No Class (MLK Day)		Widget Final Drawings Due	<i>Build Widgets</i>	Widgets	Take-Home Quiz 3
4 Jan 26	Manufacturing Basics	Eng. Design – Ch 13 & 14	Widgets Due <i>P1 Device In Hand Skill Building Sketchbook Due</i>	Device Teardown Day <i>Photo Documentation/Usage Flow Chart Due Assembly Orthos Due</i>	Exploded. View (Med/High)	SW1
5 Feb 2	Product Development & FBD's, Design Specifications	Eng. Design – Ch 11 & 12	<i>Presentation Prep Finish exploded views</i> Skill Building Final Dwg's Due	P1 Presentations <i>(Digital)</i>	P1 Paper Due on Monday	SW2
6 Feb 9	Generating Ideas	Eng. Design – Ch 7 & 8	P2 - Redesign It! <i>Begin Concept Development</i>	<i>User Competition Day Select user by end of lab</i>	Concept Dev. (High)	SW3
7 Feb 16	Prototyping & Modeling	Eng. Design – Ch. 11	<i>Continue Concepts</i>	Pin Up & Voting Concept Sketches	Build Model (High)	SW4
8 Feb 23	Intellectual Property	Eng. Design – Ch 14	<i>Prototype & Model Development</i>	<i>Prototype & Model Development</i>	Pres. Prep (Med/High)	SW5
9 Mar 2	FDA & Regulatory Concerns	Eng. Design – Ch 13 & 16	<i>User Study / Survey</i>	Informal P2 <i>"Beta" Presentation</i>	SW Practice	SW6
10 Mar 9	Ethics and Morals	Eng. Design – Ch 17	SW Review	SW Basic Quiz <i>Sketching & Basic Features</i>	Practice 2D (High)	Take-Home Quiz 4
11 Mar 16	No Class (Spring Break)		<i>Spring Break</i>	<i>Spring Break</i>	Practice 3D (Med/High)	
12 Mar 23	Engineering Documentation & Lecture Review	Eng. Design – Ch 9	<i>SW Advanced Features & Assembly.</i>	SW Advanced Test	P3	Take-Home Quiz 5
13 Mar 30	Exam Based on readings and Lectures	Review lectures, text and materials	Begin P3 – Build It! <i>Come to lab with a build plan</i>	<i>P3 Work day</i>	P3	Take-Home Quiz 6
14 Apr 6	Guest Lecture - Entrepreneurship		Refine Design & Build CAD	Propose Final Design Details	Refine & Build	
15 Apr 13	Undergrad Internship Experience		<i>Prototype Progress Demonstration</i>	<i>Outside Validation of Final Design & Presentation Prep</i>	Pres. Prep (Med/High)	
16 Apr 20	Dead Week		Final Project Presentations	Final Project Presentations	Port. Prep	
17 Apr 27	Portfolio & Tech Report Due @ Final Exam Period <i>Monday – April 27th By 3:00pm</i>					

Course Deliverables & Grading

Assignment	Weight	Individual or Group Deliverable	Due date for Tue/Th Labs	Due date for Wed/Fri Labs
Skill Building: Widget Final Drwgs	3	Indiv.	1/20/2015	1/21/2015
Skill Building: Widget Models	4	Indiv.	1/27/2015	1/28/2015
Skill Building: Sketchbook	2	Indiv.	1/27/2015	1/28/2015
P1: Presentation	6	Group	2/5/2015	2/6/2015
P1: Tech. Report due by 2pm	6	Group	2/9/2015	2/9/2015
P2: Concept documentation	3	Indiv.	2/19/2015	2/20/2015
P2: Presentation & Prototypes	11	Group	3/5/2015	3/6/2015
Skill Building: SolidWorks Tutorials	2	Indiv.	See pg. 3	See pg.3
Skill Building: SolidWorks Quiz	2	Indiv.	3/12/2015	3/13/2015
Skill Building: SolidWorks Advanced Test	6	Indiv.	3/26/2015	3/27/2015
¾ Term Exam	15	Indiv.	3/30/2015	3/30/2015
			4/21/2015	4/22/2015
P3: Prototypes	7	Group	4/23/2015	4/24/2015
			4/21/2015	4/22/2015
P3: Presentation	7	Group	4/23/2015	4/24/2015
			4/21/2015	4/22/2015
P3 : Technical Report	8	Group	4/27/2015	4/27/2015
Semester Portfolio / Process Book (Built cumulatively throughout the semester, due during final exam period, period #8)	2	Group	4/27/2015	4/27/2015
Notebook Grade 1	2	Indiv.	Unpublished	Unpublished
Notebook Grade 2	2	Indiv.	Unpublished	Unpublished
Notebook Grade 3	2	Indiv.	Unpublished	Unpublished
Teamwork/Professionalism (assessed throughout the semester)	7	Indiv.		
Take-Home Reading Quizzes	3	Indiv.	See schedule	See schedule