Course Syllabus ME360 Product Design Fall 2019 Bielmeier

Course Information

Time & Location:	9-10:45 pm Tuesday & Thursday, EMA 215			
Professor:	Christie Bielmeier, PhD			
Office hours:	730 Comm Ave (EMA) RM 207. M & W 1-3 pm (By appointment)			
Contact:	E-mail: cmb77@bu.edu			
GST:	Max Mccandless, mdm1024@bu.edu			
Lab Hours:	EMA 215, TR 3:15-6			
Book (Required): Supplies:	na			

- You must own/ bring to class an Arduino. If you do not already own one, I suggest the Arduino Starter Kit, which can be purchased from Amazon for ~\$65.
- You may be required to forage (or purchase) small components and electronics for group projects. The following items would be very useful for you to have: switches, knobs, servos, motors, h-bridge, leds, resistors, metal ruler, x-acto knife, construction paper,and a small toolbox/bag to keep things.

Electronics & Software for Class:

- Every day should bring laptop or tablet for Arduino work and group projects.
- Software knowledge & access to CAD software (Solidworks or Creo) is required.

Course Description

Focuses on the use of engineering principles, simulation and physical models in product design. Hands-on exercises allow students to propose solutions to practical problems and to develop their ideas through the construction and testing of physical prototypes. Topics include Arduino sensing and control, mechanical metrology, principles of efficient mechanical design, manufacturing techniques, CAE tutorials for product simulation and prototype testing. 4 cr. Prerequisites by topic:

• Physical behavior and computer simulation (CAD), Prototyping, and Design for manufacture and assembly

Goal:

- Apply engineering concepts, principles and tools to the design of products and devices comprised of mechanical and electrical components.
- Identify the relationship between design decisions and product cost, ease of use, manufacturability, reliability and functionality.

Course Learning Outcomes:

Upon completing this course, students will be able to:

- 1. Design mechanical components & joints with correct dimensions and tolerances to provide different types of fit.
- 2. Convey their ideas through sketches and other graphical means.
- 3. Systematically investigate design alternatives for both function and morphology
- 4. Apply human factors data to the dimensioning and shaping of objects.
- 5. Follow best practice 3D printing guidelines for the design of mechanical components.
- 6. Identify the main components and common applications of standard types of mechanism.
- 7. Design a mechanism using CAE tools.
- 8. Use stress distributions for the correct shaping of mechanical components
- 9. Integrate electrical and mechanical components in the design of a product
- 10. Organize the activities of a team for a design project.
- 11. Test physical prototypes to verify their compliance with design specifications.
- 12. Document and communicate a design process in written and oral form.
- 13. Estimate the manufacturing cost of a product.

Course Assessment

Grading (Total 100%): Homework 35% Journal Entry 20%

Projects 35% Class Participation 10%

Homework

• Homework is due on Tuesday at the start of class. You will submit via blackboard and bring soft or hard copy to class. No late home work is accepted.

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• Student solutions should be original. Plagiarism will not be tolerated.

Weekly Journal Entries

Journal Entries can explore any idea, concept, or design method related to product design. Journal entries do not have to be about what we discussed in class, but an in-class topic may spark an idea. Journal entries must be your thoughts and words, but should include references to source material when applicable (links are okay for citing for journal entries). Please do not vent about problems or grades in journal entries. Outstanding journal entries may be shared with the class. Journal entries are Due Sunday at 9 pm via blackboard

- 1 paragraph should explain what you did this week for your group project and how you contributed.
- 1-3 paragraph should be about a Design Topic (see below)
- 1+ pictures or sketches that support your idea or topic

Potential Design Topics:

- Here's a SCAMPER, Morph or Pugh Chart for a new/existing product I was thinking about.
- I am the best! I solved this tricky problem using this method.
- I'm interested in the new material, manufacturing technique....and here's what I learned.
- I have an idea for a new mechanism.
- I wonder how this product was made?

- I created a simplified CAD version of this product and here's what I learned.
- Here's how I would make this product better.
- We talked about this in class and I wanted to know more. Here is what I learned.
- Here is a design project I'm working on for fun.

Projects

- A semester long group project will be completed to complement theory and application presented in the course.
- Projects must be completed in groups of 4-5 people and will be assigned. Projects from individuals will not be accepted. Milestones will be submitted throughout the semester. No late projects are accepted.
- All project requirements will be detailed in a project assignment sheet and most follow the layout described within the project assignment sheet.
- All projects must have cited references (IEEE or MLA is strongly encouraged).

Drawings & Prints

- Throughout the semester you will be asked to bring in prints.
- Prints should be no smaller than a B size (11x17") paper.
- The BU print service, MyPrint, does not print B size paper. You MAY NOT tape together prints.
- Prints can be printed at FedEx Office Print & Ship Center, Boston University, 115 Cummington Mall, Boston, MA 02215 US <u>https://local.fedex.com/ma/boston/office-5012/</u> B-size prints are self-serve and cost normal print charges (~0.50). Larger prints take longer and are more costly (~\$5).

Attendance & Class Participation

- Attendance is mandatory. If you are late, you are absent.
- Class participation is based on your professional, active and constructive participation in the solution of the example problems in class, responses to general questions and your regular attendance of the class lectures.
- Absences for extenuating circumstances will be considered on a case-by-case basis and email notification prior to the absence is requested.
- You MUST act in a professional manner to all students while in the classroom and for all group projects. Class
 discussions can be passionate and opinionated, but should never make other students feel poorly. Bullying or
 belittling will not be tolerated. Attack the idea, not the person. Being able to take and give criticism is a skill and it will
 be developed in this class.
- BU's academic Conduct Code: <u>http://www.bu.edu/academics/policies/academic-conduct-code</u>

Course Schedule

Week	T Date	Торіс	Ind. HMWK	Group Project	
			(Due T)	(Due R)	
1	09/03	Introduction, Ideation, SCAMPER		Discussion & Intro Teams	
2	09/10	Design Process, Prototyping & Report Writing	A1: Dishwasher		
3	09/17	Reverse Engineering & Good Writing		GP1: ReqDoc	
4	09/24	GD&T & 3D Printing Crash Course	A2: Grabber	GP2: SRR Pres	
5	10/01	Arduino & Digital IO	A3: Grab Draw		
			A5A: Arduino A		
6	10/07	Mechanism Design	A5B: Arduino B	GP3: PDR Pres	
7	10/17 R	4-bar Simulations	A4: 3D Print		
8	10/22	FEA Analysis Simulation	A6: 4-bar mech	GP4: PDR System Proto	
9	10/29	Materials Selection & Adhesives	A7: FEA	GP5: PDR BOM & timeline	
10	11/05	Bearing Mounting & Costing		GP6: CDR proto	
11	11/12	Controlled Motion	A8: Bearing	GP7: CDR drawing	
12	11/19	Design for Quality & Manufacturing with Metals &	A9: Whistle	GP8: TRR Pres Slides	
		Plastics			
13	11/26 T				
Thanksgiving					
14	12/03	Final Pres Group Project & Demo		GP9: PRR Pres & Proto	
15	12/10 T				
16	12/17	No final Exam, but final report		GP10: PRR Report	