Boston University College of Engineering

Course Syllabus – Fall 2013

me360 Product Design

1.0 Course Description

This course emphasizes the profitable conversion of product ideas to attractive products needed by customers. The course consists of a series of analyses of existing product designs plus student created product designs and product improvement ideas. Students will tackle numerous design projects. Exercises include product manufacturing considerations. Use is made of SolidWorks CAD software. Resources for design exercises are presented in working studio sessions.

Prerequisites: me359 Introduction to CAD and Machine Components, or me407 Computer Aided Design and Manufacture. Please talk to the instructor about exceptions.

2.0 Course Outcomes

As an outcome of completing this course, a student will:

- 1. Learn about the creative end of product design and development, and about the other key ends of the business that are required to turn a creative idea into a real commercial product.
- 2. Gain an increased understanding of production and service operations in innovative design and manufacturing companies.
- 3. Develop an increased facility for using major CAD systems to do engineering design.
- 4. Gain experience with product and process design for sheet metal, castings and plastic parts.
- 5. Develop experience with business ideation, demand confirmation and resource specification for manufactured products.
- 6. Gain experience in creating an operations plan for a manufactured product that is balanced in specification of product and process.
- 7. Gain experience and confidence in working in a team environment.
- 8. Gain a facility for producing well-organized and clearly written engineering reports.

3.0 Assignments and quizzes

Below is the list of expected topics. The topics may change somewhat as we get deeper into discussions this semester. The net is that there will be six assignments, with each one typically due within two weeks. In addition there will be two quizzes, each equal to half an assignment of

weight one (this will be clarified the first day of class), plus a design notebook, also equal to one assignment of weight one. The six assignments, plus two quizzes, plus notebook, make up eight graded items for the course. The final grade is based on these eight tasks. Below are the likely six assignments:

- 1. Analysis of a current mechanical product, combined with your redesign. On this assignment, the product will be assigned. (weight 1.0)
- 2. Rapid prototyping of a promotional widget (weight 2.0)
- 3. Product theme design exercise (weight 0.5)
- 4. Product failure analysis and testing for quality (0.5)
- 5. Manufacturing process presentation (weight 0.5)
- 6. Design of innovative new product, plus market analysis (weight 1.5)

The notebook will contain an ongoing work throughout the semester intended to help focus on design and redesign issues. Part of this notebook should contain the work done in-class, while the second part should contain at least 12 innovative product improvements, due at the end of the semester. All of this will be explained in detail at the start of class.

Regarding the two quizzes, they will be based on (1) lectures, (2) readings from articles given out in class, and (3) presentations on products that I will be asking each student to make during the semester. If you miss class, then clearly (1) and (3) will be hard to make up. Consequently, if you miss a lecture, you are responsible for discussing/obtaining the information with a colleague in class. Some lecture material will be posted at our website, but much will occur via discussion, requiring you to take notes.

The quizzes will be given roughly at the midway point and near end of the semester, and will be my attempt at ensuring you read the assigned material, and attend lectures. I will strive to make the lectures relevant for your assignments, and to provide information helpful to your future careers. No quizzes will be a "surprise". The dates of the two quizzes will be posted early in the semester.

Regarding product presentations, which I will explain in more detail in class, please bring in something that you find interesting and exciting. Besides describing the obvious novelty of the product, be prepared to add your thoughts on (1) the virtues of the product (usually the easy part!), (2) where the product could still be improved, and (3) your views on the costs and manufacturability aspects of the product. I am not looking for something in great depth here, but, come in having given at least these points some thought. A mini contest on improvement ideas will be given after each presentation.

Each day a new product will be introduced by a team of students. A fixed time will be allotted to make sure this does not take up too much time. Each day the class will brainstorm to improve on these products. A means for motivating the class to brainstorm will be described in the first day of class. The goal here, which is usually reached, is to have all students greatly improve both their analytical and creative ability with regard to product design.

4.0 Textbooks

No book will be assigned. The book we previously used was by Ulrich and Eppinger below, with supplemental material from the book by Deiter and Schmidt below. I have decided for this year to provide a different set of material, largely articles.

- * Ulrich, K. and Eppinger, S. "Product Design and Development" (5th Ed.), McGraw-Hill 2011 (ISBN-10: 0073404772, ISBN-13: 978-0073404776). (Incidentally, this book, now costs about \$154 at Amazon, and it is not that big of a book!)
- * Deiter, G. and Schmidt, L., "Engineering Design" (5th Ed.), McGraw-Hill 2012 (ISBN-10: 0073398144, ISBN-13: 978-0073398143). (Incidentally, this books also is above the same cost.)

There are a number of books related to design, all of which contain various degrees of helpful information. I will present information to you based on several of these texts, plus from my own viewpoints. Some of the texts that I will be drawing on, besides the two above, are:

- * Jensen, C., Helsel, J. D. and Short, D. R., "Engineering Drawing and Design" (7th Edition), McGraw-Hill, 2008 (ISBN 978-0-07-352151-0)
- * Haller, L. and Cullen, C. D., "Design Secrets: Products 2," Rockport Publishers, Inc., 2004.
- * The 3rd edition of, "Engineering Design: A Project Based Introduction," by Clive L. Dym and Patrick Little.

5.0 Grading

Grades for this course will be computed as follows. On each assignment (six of them), on the notebook, and on the two quizzes, you will receive a number grade. I will average the two quiz grades to get one grade. This will result in eight grades: six for the assignments with appropriate weights already mentioned, plus one for the two quizzes, plus one for the notebook. These will then be averaged together to give one final course grade. This grade will then be converted into a "letter" course grade in the following way: 80=>83.33 would be a B-, 83.34=>86.66 would be a B, and 86.67=>89.99 would be a B+, and likewise for the other ranges of 70=>79.99, 90=>99.99, etc.

Let w_1 , w_2 , w_3 , w_4 , w_5 , w_5 , w_6 , be the weights of the six assignments. For example, $w_1=1$, $w_2=2$, $w_6=1.5$, where the weights have been based on my estimate of the amount of relative work. Let g_1 , ..., g_6 be the numerical grades of the six assignments. Also, let Q_1 and Q_2 be the two quiz grades, and N be the numerical grade for the notebook. The final numerical grade then becomes:

 $G = (w_1g_1 + w_2g_2 + w_3g_3 + w_4g_4 + w_5g_5 + w_6g_6 + 0.5(Q_1 + Q_2) + N)/(w_1 + w_2 + w_3 + w_4 + w_5 + w_6 + 0.5 + 1)$

6. Course Web Site and Web Links

Posted me360 material, including slides shown in class, will be available on blackboard at

http://blackboard.bu.edu

I expect to be sending you emails regularly from this course info site, so make sure you are using your bu email accounts. I will also post information regularly at this site, under the announcement section of blackboard.

The following Internet sites, provided as links on the course web site, may well be referred to at various points in this course:

Concord Camera	Fraunhofer CMI	3M	Cole's Research Site
Corning	Husky Molding Systems	Lean Institute	SME:mic.com
Design Continuum	Kohl's	Nypro Plastics	Ulrich & Eppinger
DME	Kurt Manufacturing	Plast. Tech. Mag	U.S. Patent Office

Our course web site will soon have links to these internet sites.

7. 0 Contact Information

Professor Dan Cole Office: 15 Saint Mary's Street, Room 133

My office is fairly close to the ME Computer lab, ECL. If unfamiliar, go into 15 Saint Mary's (directly opposite from the Saint Mary's entrance to Photonics), bear right, go down the long narrow corridor, past double doors, past ECL on the left, and my office, #133, is on the left.

Telephone: 617-353-0432

email: dccole@bu.edu

Office Hours: Wed. 1:00 pm – 2:30 pm, Th. 9-10:30 am.

dcc: 8/9/2013