Course Information
Spring 2015 ENME 371: Product Engineering and Manufacturing

Course Description:
Two hours of lecture and two hours of laboratory per week. Prerequisite: ENES 221 and ENME 392 (or STAT 400). The course provides students with information on a typical product design process with hands-on experience through a team project. Relationship of design to manufacturing, role of statistics in product development, and business aspects of product development will be among the topics that will be discussed. Throughout the semester, you will participate on a product design team; prepare technical reports; and present findings from your activities, testing, analysis and research projects before an audience of peers and instructors.

Course Classification: This is a required course for ENME majors.


Clickers: ENME 371 lectures will be done using “clickers,” a response technology allowing immediate student feedback to questions solicited by the lecturer. Short quizzes will be given in the lectures meetings and students will answer using their clicker technology. Information on clickers is available at http://clickers.umd.edu/. TA Jack Leonard will handle all issues about clicker operation. All students must re-register their clicker devices at https://myelms.umd.edu/courses/1020311.

Meeting Times:
Lecture Sessions (All Sections; Nguyen): MW 11:00 am -11:50 am (EGR 1202)
Lab Discussion Sessions: Beginning in Week on Feb. 2 (EGL 0101)
Wed. 2:00 pm – 4:00 pm (Section 0206): Nguyen
Wed. 4:00 pm – 6:00 pm (Section 0201): Teitelbaum
Thurs. 3:00 pm – 5:00 pm (Section 0202): Roschuni
Thurs. 5:00 pm – 7:00 pm (Section 0204): Cleanthous
Thurs. 7:00 pm – 9:00 pm (Section 0205): Osborne
Fri. 9:00 am – 11:00 am (Section 0203): Nguyen

Instruction Team:
Dr. V. Nguyen (0206, 0203) vince1@umd.edu EGL M0102 Phone: (301) 405-2377
Office Hours: TBD and by appointment.

Mr. G. Teitelbaum (0201) gbaum@umd.edu Phone: (410) 688-0547
Office Hours: TBD and by appointment.

Dr. C. Roschuni (0202) drc@umd.edu EGR 2123 Phone: (301) 405-5328
Office Hours: TBD and by appointment.

Mr. A. Cleanthous (0204) aris.cleanthous@sbdinc.com Phone: (410) 716-2502
Office Hours: TBD and by appointment.

Mr. S. Osborne (0205) Stephen.Osborne@sbdinc.com Phone: TBD and by appointment.

Corporate Partner: Stanley Black & Decker is our corporate partner for this course. They provide student teams with DeWALT DW272 Drywall screw driving for redesigning; host a field trip to their Towson Design Center; provide specialty lectures by their product development engineers and managers; provide guidance to student teams in their redesign projects; provide spare parts to teams; and provide design and manufacturing answers on the tool in response to student inquiries. You will need to sign a confidentiality agreement to be able to participate in the project, for protecting the product information shared with the class.
Teaching Assistants: Mr. Jack Leonard, jeleo@umd.edu
Teaching Fellows: Ms. Sonia Berrada, sbpass@gmail.com
Mr. Daniel Goodley, daniel.goodley@yahoo.com
Mr. Ryan Hegarty, rhegarty15@gmail.com
Mr. Michael Xue, xuem@terpmail.umd.edu
Mr. Alex Verovsky, averovsky@gmail.com
PIRLS Support Staff: Mr. Majid Aroom is the Manager for PIRLS facilities and the Machine Shop area. He is in EGR 0103A (Phone: 301-405-5326; Email: maroom@umd.edu).

DesignME Lab: The resources of the DesignME Lab (0101 EGL) will be available to you at scheduled periods throughout the semester. This Lab includes six computers with engineering software (i.e. Inventor, Creo 2.0 (the new ProE), Solidworks 2013, the new Siemens NX 8.5 package, Matlab, Office 2010, Acrobat Professional) data acquisition systems, and instrumentation useful in product design and manufacturing. You will be provided card access to the DesignME Lab. All students as asked to check their card access as soon as possible and report lack of access with your student ID.

The DesignME Lab is available to students for team meetings, no-load product testing, and experimentation and other types of testing. Lab product testing using limited access equipment (e.g., digital calipers and data acquisition and lab instrumentation) can be performed only in the presence of the Teaching Fellows or instructors. We expect that you will utilize the lab resources with professionalism. Please remember to leave your work space clean, when you leave the Lab. Failure to comply with the policies or safety procedures of the Lab may result in a decrease in grade (up to 10%) and removal of student card access to the Lab.

Teaching Fellows (TF) will hold office hours in the DesignME Lab (EGL 0101). An office hour schedule will be posted online and at the entrance to the EGL0101. The lab is not available during scheduled ENME 371 lab times and at times priority may be extended to ENME 472 labs that are in session.

| Office Hours in DesignME Lab & Computer Lab (EGL 0101) as of 1/27/2014 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Monday          | Tuesday         | Wednesday       | Thursday        | Friday          | Saturday        | Sunday          |
| 8-9             |                 |                 |                 |                 |                 |                 |                 |
| 9-10            |                 |                 |                 |                 |                 |                 | 371 Lab Section 0203 |
| 10-11           |                 |                 |                 |                 |                 |                 |                 |
| 11-12           | 371 Lecture     | 371 Lecture     |                 |                 |                 |                 |                 |
| 12-1            |                 |                 |                 |                 |                 |                 |                 |
| 1-2             |                 |                 |                 |                 |                 |                 |                 |
| 2-3             |                 |                 |                 | 371 Lab Section 0206 |                 |                 |                 |
| 3-4             |                 |                 | 371 Lab Section 0206 |                 | 371 Lab Section 0202 |                 |                 |
| 4-5             |                 |                 | 371 Lab Section 0201 |                 | 371 Lab Section 0204 |                 |                 |
| 5-6             |                 |                 | 371 Lab Section 0201 |                 | 371 Lab Section 0204 |                 |                 |
| 6-7             |                 |                 |                 |                 |                 |                 |                 |
| 7-8             |                 |                 |                 |                 |                 | 371 Lab Section 0205 |                 |
| 8-9             |                 |                 |                 |                 |                 |                 |                 |
General Course Logistics:

CANVAS: ENME 371 will be using the Canvas course environment this semester. Students can login to their course(s) by going to http://elms.umd.edu/page/student-support. A University online identity and password are required to access Canvas. Information on your University password is available at http://www.it.umd.edu/password/. Canvas offers many choices for notification about course activities. It is each student’s responsibility to set their communication preferences for their Canvas accounts. Information posted on Canvas will govern course operation.

Course Objectives

ABET requirement for contribution of course to meeting the professional component: This course is the first of the two design courses in the curriculum and is required for all ME students. It provides the students with a fundamental understanding of the product development process and hands-on-experience in theoretical modeling and experimental analysis of product and subsystem performance and manufacturing. The fundamentals of the product design process, the tools, methods, software and strategies involved, are taught through lectures by faculty and industry experts. At the same time the students are dissecting, benchmarking and performance testing a product designed and manufactured by Stanley Black & Decker. Students will continue to study the engineering design and manufacture of the products by focusing (in teams) on a single subsystem to understand the design decisions made to achieve the subsystem and overall product performance and suggest possible changes in the subsystem to improve corporative objectives for the tool. Student teams will present the results of this focused study to peers, faculty, and engineering professionals and prepare and submit a formal technical report.

Relationship of course to Mechanical Engineering program outcomes (H: high; M: Medium; L: Low):

This course helps to satisfy the following learning outcomes of the ME program:

1. The ability to design a subsystem or component for a product to meet customer needs and address contemporary social issues (H).
2. The ability to work in teams effectively to address practical engineering problems (H).
3. The ability to communicate effectively in presentations and in writing (M).
4. The ability to design and conduct experiments and to interpret data and generalize from the results (H).
5. The recognition of the contemporary social issues that motivate engineering activities and the societal impact of engineering practice (L).
6. The ability to apply mathematics, science, and engineering knowledge to solve mechanical engineering problems (H).
7. The ability to use state-of-the-art engineering software, computers, and instrumentation as tools to solve engineering problems (H).
8. The recognition that engineers must maintain ethical and professional standards and an appreciation of these standards (L).

Major course Topics:

- Steps of a typical product design process
- Performance benchmarking
- Product design specification
- Concept generation, selection, and testing
- Detail design topics, including behavior of materials under mechanical and thermal loading as is common in most products,
- Material selection, mechanical design of components (as applicable to the tool being examined)
- Selection of manufacturing process and design for manufacture and assembly, failure modes and effects analysis (in brief),
- Tolerancing
- Applications of statistics in product design and testing for development and performance
- Product economics
<table>
<thead>
<tr>
<th>Student Learning Outcomes from Course Activities</th>
<th>Lectures, Readings, Quizzes &amp; Exams</th>
<th>Peer Evaluations</th>
<th>Guided Inquiry and Experimentation-Based Lab Activities</th>
<th>Subsystem Manufacturing and Design Change</th>
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</thead>
<tbody>
<tr>
<td>Each Learning Outcome is shown with the ME program outcomes that the activity contributes to and the course activities that are opportunities to assess the outcome.</td>
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<tr>
<td>Learn the Product Development Process and practice tools &amp; methods to make and justify design decisions (1,6,7)</td>
<td>X</td>
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<td>Experience use of power tools, testing equipment and data acquisition (7)</td>
<td>X</td>
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<tr>
<td>Learn product dissection technique and mechanical system identification and representations (1,7)</td>
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<td>X</td>
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<td>Create an experiment to collect and analyze technical data on the tool (4)</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Link technical performance to CTQ customer needs (1)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Link technical performance to design decision made by SB&amp;D (1,6,7)</td>
<td>X</td>
<td>X</td>
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<td>Identify and apply appropriate legal, regulatory, professional, and ethical standards to the product development process (5,8)</td>
<td>X</td>
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<td>Identify appropriate theoretical models for heat transfer, vibration, force, torque and power prediction (6,7)</td>
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<td>X</td>
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<td>Understand the validity and limitations of theoretical models of mechanical behavior (6)</td>
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<td>Understand the limitations and factors that contribute to variations inherent in small sample experimental data (4,6)</td>
<td>X</td>
<td>X</td>
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<td>Develop competence in collection and analysis of experimental data (4,6)</td>
<td>X</td>
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<td>X</td>
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<td>Learn about sustainability issues in SB&amp;D tool production case (1,5)</td>
<td>X</td>
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<td>Identify feasible manufacturing scenarios for a subassembly, identify and describe understand the decision tradeoffs (e.g., cost, quality) (1,6,7,8)</td>
<td>X</td>
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<td>Develop experience with team work (2,3)</td>
<td>X</td>
<td>X</td>
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<td>Prepare and present formal oral report (2)</td>
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<td>X</td>
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<td>Prepare informal group technical reports (2)</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Prepare formal group technical report (2, 3)</td>
<td>X</td>
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<td>X</td>
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Grading Policy:
Grade Weighting for Lecture Activities- 35% of Course Grade
• 5% Lecture Participation The class participation grade is affected by your participation in lecture, 
• 10% Quizzes: There will be at least 13 quizzes in Lecture period done usually with clickers. 
• 10% Mid-term Exam I 
• 10% Mid-term Exam II
* No Final Exam
* All students must score at least 65% in this portion of the class in order to pass.

Grade Weighting for Lab Activities – 65% of Course Grade
• 35% Lab Reports
  Product Dissection Lab Report
  Product Performance Benchmarking Report
  Power Lab Report
  Thermal Lab Report
  Measurements Lab
  DFM Lab Report
• 7% Subsystem Manufacturing and Design Oral Presentation
• 13% Subsystem Manufacturing and Design Formal Final Report
• 10% Individual Contribution to group work
  One evaluation per report
  Group consensus for contribution %’s
  Grade scaled off of report grade

NOTE ON All Assignments: Assignments that are submitted between 1 minute and 24 hours late will receive 75% of the credit. Assignments that are more than 24 hours late will receive 0% of the credit. Exceptions will be made in accordance with University policy regarding these major grading events.

Attendance Policy:
Regular attendance (at lectures, at lab periods, and at established team meeting times) is expected. Each student is responsible for inquiring about and obtaining course material delivered in their absence (from course colleagues).

University policy excuses the absences of students for illness (self or dependent), religious observances (http://www.president.umd.edu/policies/i3510a.html), participation in University activities at the request of University authorities, and compelling circumstances beyond the student's control. Students must submit the request in writing and supply appropriate documentation, e.g. medical documentation. Students with written, excused absences are entitled to a makeup exam (or assignments if applicable) at a time mutually convenient for the instructor and student. For more information, see UMD's policy on medically necessitated absences from class.

University wide Honor Code:
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating on exams, cheating on clicker quizzes in lecture, fabrication, facilitation, and plagiarism. Copying work done by another is considered an act of academic dishonesty and will be reported according to University policy. Please review the Code of Academic Integrity and the University’s policy on academic dishonesty at http://www.jpo.umd.edu/ and http://www.shc.umd.edu

Note that no form of plagiarism will be tolerated. All work presented to the instructor is assumed to be the
original work of the course participant(s). Words, diagrams, figures, or original contributions of anyone other than a student must be referenced when included in a student’s work. The course instructor may use plagiarism checking software and/or request evidence of references for any submitted work. A useful website on avoiding plagiarism is found at the Purdue Online Writing Lab (http://owl.english.purdue.edu/owl/).

To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all examinations and assignments: “I pledge on my honor that I have not given or received any unauthorized assistance on this examination (assignment).” Questions about the pledge can be found online at http://www.shc.umd.edu/SHC/HonorPledgeUse.aspx.

**Online Course Evaluation**

Students can go directly to the website (www.courseevalum.umd.edu) to complete their evaluations. They will be alerted via their official University e-mail account about the dates of the evaluation period and provided more information closer to that time. Students who complete evaluations for all of their courses in the previous semester (excluding summer), can access the posted results via Testudo’s CourseEvalUM Reporting link for any course on campus that has at least a 70% response rate.