ME 310 - Syllabus Fall 2014

1. Specific Course Information

Course Name: Engineering Design Introduction
Course Number: ME 310
Instructor: Julian Guy Espinoza
Semester: Fall 2014
Meeting Times: Lecture MW 1:00-1:50 PM; Lab W 9:00-11:50am
Meeting Place: Lecture: AH - 2108; Lab: GMCS - 301
Schedule #: By Master Plan Sign off in Mechanical Engineering Dept. Office
Course Prerequisites: ME 102, ME 202( on web says 203), and EM 220

2. Course Description:

Professional approach to engineering design problems. Problem definition, information gathering, feasibility studies, analysis, final design and communication. Several design studies and projects are completed.

This course presents a professional approach to engineering design and multidisciplinary problem solving processes that support it. There are two main activities in the course: Lecture and lab, with the material roughly organized as:

a. The Design Process: from problem definition through information gathering, followed by concept development, evaluation, final selection & implementation. (Primarily in lecture).

b. Case Studies and guest lectures: Covering successful design exercises from industry (in lecture).


d. Student Design Projects: Three projects, ranging from
   1) a relatively simple but challenging design/build task
   2) an intermediate design/build that includes electronic actuation
   3) a complex design/build effort involving math and devices from several disciplines

   Work done both in lab and outside of class

   All projects will be performed by student teams of 3-5 (preferably 4) members each. Peer evaluations among team members will be factored into individual team members’ grades.

Homework: Ungraded engineering analysis problems (solutions provided) to support study for project work.
3. Resources:
Additional Resources on Linkages:
   *Slocum, Alexander, FUNdamentals of Design, MIT Press* - selections from free downloadable courseware: [http://web.mit.edu/2.75/fundamentals/FUNdaMENTALS.html](http://web.mit.edu/2.75/fundamentals/FUNdaMENTALS.html)
Instructor’s Notes: Various topics in engineering design and analysis, posted on blackboard
Fabrication Facility: aka Machine Shop will be open to students to use the machines for projects.
Laser Cutter: Students will have limited access to using the laser cutter that is located in room E300A

4. Contact with Instructor
Name: Julian Guy Espinoza
e-mail: jespinzoa@mail.sdsu.edu
office: office-less at the moment, but can be found in E-300A.
Office hours: Tuesday & Thursday from 10am till 12PM in room E301 or by Appointment.

5. Design Process Topics
   1. The Design Process
   2. Customer needs, customer specifications and engineering specifications
   3. Concept generation (including brainstorming), evaluation and selection
   4. Prototype design
   5. Value Engineering
   6. Intellectual Property and Patents
   7. Design for manufacture and assembly
   8. Human factors, safety, and reliability

6. Engineering Analysis Topics
   1. Basics of engineering analysis: FBD’s, continuity, Newton’s 2nd law, etc.
   2. Kinematics applied to the position, velocity, and acceleration analysis of linkages
   3. Kinematics of gears, belts, and chains
   4. Elementary applications of stress and deflection analysis: strain energy devices
   5. Energy Principles: Sources, transformation and transmission
   6. Application of Tolerancing with respect to fabrication
   7. DC electric motors
   8. Amplifier circuits to drive motors (uni- and bi-directional, also via comp. actuation)
7. Objectives: (skills mastered, application demonstrated)
   To acquire:
   A. An understanding of the mechanical design method (see 5. “Design Process Topics”, above)
   B. An understanding of a broad spectrum of engineering devices and systems
   C. An understanding of the mathematical tools used to analyze the devices listed in “6. Engineering Analysis Topics” above)
   D. Increased ability to create models using sketching, CAD, mathematical analysis, as well as familiarity with shop tools, common materials & components.
   E. Increased understanding of a holistic approach to mechanical design, as well as electro-mechanical actuation.
   F. An ability to document the design process with a well organized design notebook
   G. An ability to create and present a design report.

8. Student Learning Outcomes (SLOs):
   Upon Completion of this course the student will be able to:
   SLO 1: The ability apply math, and engineering to the analysis of basic devices and systems.
   SLO 2: The ability to apply the design process, including the formal method plus analytical tools, to create, assess, and implement several engineering designs.
   SLO 3: Identify, formulate, and solve introductory machine engineering problems using both hand and computer methods.
   SLO 4: Work cooperatively on an engineering design team, developing necessary skills of organization, planning, teamwork, communication (both interpersonal and formal).
   SLO 5: Apply their broad background of skills to synthesize, analyze, and design engineering solutions to a given problem.
   SLO 6: Use the broad techniques, skills, and modern engineering tools necessary to analyze and design engineering solutions.
   SLO 7: apply design processes, principles of engineering, basic science, and mathematics (including multivariate-calculus and differential equations) to model, analyze, design, and fabricate engineering solutions for whole systems and/or components for a given system.

9. ME 310 Fall 2013 Lecture and Lab Schedule: Printed Separately.
10. Grade Breakdown (tentative list and grade weights)

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Material</th>
<th>% of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>Various Topics</td>
<td>10</td>
</tr>
<tr>
<td>Quizzes</td>
<td>Two, 1 hour quizzes, open book &amp; notes; covering material delivered in lecture and associated with projects</td>
<td>10</td>
</tr>
<tr>
<td>Project 1</td>
<td>Mechanism: analysis, design, fabrication, test, &amp; report</td>
<td>10</td>
</tr>
<tr>
<td>Project 2</td>
<td>Mechanism: dynamic analysis, optimization, &amp; report</td>
<td>30</td>
</tr>
<tr>
<td>Project 3</td>
<td>Electro-Mechanically guided mechanism: analysis, design, fabrication, test, &amp; report</td>
<td>40</td>
</tr>
</tbody>
</table>

As this class evolves, changes in scheduling may occur and will be announced both in class and on BB. Students are obligated to keep all test & performance dates open, and to email prior obligations to me.

11. Students with disabilities
Students who need accommodation of their disabilities should contact the instructor, privately, to discuss specific accommodations for which they have received authorization. If a student needs accommodation due to a disability, but has not yet registered with Student Disability Services at (619) 594.6473 (Calpulli Center, Suite 3101), please do so before making an appointment to see the instructor.

12. Additional expectations and thoughts
1. That you’ll act grown up. That means: act like a professional person. Take responsibility for your learning.
2. That you will bring your “A Game”, all semester
3. That in fact, you all stand on the shoulders of giants. But, compared to your forebears, you have much better tools– so get good at using them, keep them sharp, and you’ll achieve even more than the giants did. That’s important today, more than ever before.

Other Advice:
1. Don’t come late or leave early.
2. Ask questions: it’s part of your job to ask questions. It’s part of my job to slow down and answer any questions or concerns you may have.
3. Check the announcements on Blackboard every day.
4. Note these content prerequisites: also this course assumes you understand the Taylor
5. Review all course notes, PowerPoint’s, solutions, source codes and archives. Make time to provide you with answers. Series in Calculus. Finally, brush up your spreadsheet skills.
6. All HW solutions will be posted. Read the document list before asking questions on the HW. Balance your workload. Don’t put HW off until the night before a quiz or exam.
7. All project grades will be posted. However, the last Project and Final exam scores will not be posted until after the semester ends.

13. Program Outcomes

PO 1: The ability to apply knowledge of mathematics, science, and engineering.

PO 3: The ability to design a system, component, or process to meet desired needs.

PO 5: The ability to identify, formulate, and solve engineering problems.

PO 6: An understanding of professional and ethical responsibility.

PO 7: The ability to communicate effectively.

PO 8: The broad education necessary to understand the impact of engineering solutions in a global/societal context.

PO 9: A recognition of the need for, and an ability to engage in lifelong learning.

PO 10: A knowledge of contemporary issues.

PO 11: The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PO 12: The ability to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes.

PO 13: The ability to work professionally in both thermal and mechanical systems areas.

Prepared by: Julian G. Espinoza
Date: August 17th, 2014