Welcome to EMEN 5400 – Product Development & Design, a hands-on, individual project course designed to teach engineering students the principals of product development and design (PD&D) in commercial, high-tech environments.

Whether you are part of a start-up or a Fortune-500 company, the success of your company depends on its ability to deliver commercially successful products, year after year after year. Having, developing, and using good PD&D tools, skills, and experiences will be important factors in your overall value as an engineering manager and leader. In this course, you will learn the basics of PD&D with an emphasis on developing a technical product from concept through the early-prototype stage.

Because this course includes a great deal of student-instructor interaction, I have written this syllabus in the first person singular, where “you” are the student and “I” am your instructor.

1) My Contact Information
   a) Eben Johnson
   b) Lockheed Martin Engineering Management Program
   c) College of Engineering and Applied Science
   d) 433 UCB, ECOT 424
   e) University of Colorado Boulder
   f) Boulder, Colorado, USA 80309-0433
   g) Office: +1 303 492-7519
   h) Mobile: +1 303 775-4932
   i) Email: eben.johnson@colorado.edu

2) Course Information
   a) Course Title: EMEN 5400 – Product Development and Design
   b) Course taught under the Lockheed Martin Engineering Management Program (EMP)
   c) Instructor: Eben Johnson
   d) Course Time and Place: Mondays, 11:00-13:30 MT; ECCS 1B28
   e) Office Hours: Tuesdays and Wednesdays, 9:00-12:00 MT
   f) Course managed through D2L <https://learn.colorado.edu/>
3) Course Goals
   a) To have fun and enjoy the learning experience
   b) To learn the principles of PD&D and how to apply them in high-tech commercial environments
   c) To learn the subtleties behind the principles; through the course materials and interactions with your classmates, me, guest speakers, and others
   d) To develop and apply your growing set of PD&D skills and tools through the course projects
   e) To prepare for later courses and your career

4) Course Structure:
   a) Part seminar part course project
   b) You will apply the session and course materials to your project
   c) With guidance from me and input from classmates, you will choose your own projects
   d) Projects are individual efforts, not team projects
   e) You will deliver a Weekly Contribution (WC), designed to move your project along at a healthy pace; WCs are roughly one-to-two page memos written by you to address the weekly assignment
   f) You will complete weekly quizzes ahead of each session; this is to promote good quality discussions during course sessions

5) General Session Structure

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin items, review, and/or Q&amp;A</td>
</tr>
<tr>
<td>2</td>
<td>Guest speaker – when scheduled</td>
</tr>
<tr>
<td>3</td>
<td>Session topics &amp; project discussions</td>
</tr>
<tr>
<td>4</td>
<td>Next steps and takeaways</td>
</tr>
<tr>
<td>5</td>
<td>A break is included</td>
</tr>
</tbody>
</table>

6) How the Typical Week is Organized

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
<th>Typical Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weekly preparation (readings, videos, etc.)</td>
<td>Before weekly quiz</td>
</tr>
<tr>
<td>2</td>
<td>Weekly quiz</td>
<td>Sunday night</td>
</tr>
<tr>
<td>3</td>
<td>Weekly contribution</td>
<td>Sunday night</td>
</tr>
<tr>
<td>4</td>
<td>Weekly session</td>
<td>Monday day</td>
</tr>
</tbody>
</table>

7) Course Topics – roughly in chronological order
   a) Intros, PD&D Process, Honor Code, Admin
   b) Opportunities & Planning
   c) Identifying Customer Needs
   d) Concept Generation
   e) Concept Selection
f) Concept Testing  
g) Product Specifications  
h) Product Architecture  
i) Industrial Design  
j) Design for Manufacturing and Related Functions  
k) Prototyping  
l) Product Law and Intellectual Property  
m) Economics  
n) Final Presentations  

8) Prerequisites  
a) While not a prerequisite, I strongly encourage you to have completed the following or similar courses before enrolling in this one: EMEN 5010 – Introduction to Engineering Management, EMEN 5020 – Finance and Accounting for Engineering Managers, and EMEN 5090 – Technology Ventures and Marketing  
b) Not having taken these courses, or taking them in parallel, might put you at a disadvantage and may reduce the quality of your interactions with your classmates  
c) If you are not an EMP student, then you need my written permission to take this course  

9) Confidentiality and Intellectual property:  
a) US intellectual property law generally recognizes that material presented during class or in a course is confidential; this is not a guarantee, and I cannot commit that work developed or presented through this course will be kept confidential  
b) My request and expectation is that you treat your classmates’ work as confidential and only used in the context of this class  
c) No company confidential or similarly proprietary material, information, or projects should be presented or used in this course; work submitted containing confidentiality statements or similar clauses will be returned and considered not-submitted for the purpose of grading (see Late Submissions)  
d) Unless previously agreed to treat material presented as confidential, guests will be asked to leave before material that would reasonably considered confidential is presented  
e) If in doubt about any of this confidential material, please contact the CU Tech Transfer Office at https://www.cu.edu/techtransfer/  

10) Expenses and paid support: the EMP provides no budget for your course project; expenses incurred are your expenses and not reimbursed by the EMP, CU, or other entities; additionally, outside of the classroom, the EMP provides no video-conferencing or related assistance; however, experience suggests that Google Hangouts, Skype, and Zoom work well in places that are not blocked by company or related fire walls; if meeting with me and you give me time to prepare, I can arrange meetings on one of my accounts
11) Required Text

- Additional materials made available by me and located in D2L and other sites on an as-needed basis

12) Guest Speakers: meeting and hearing from guest speakers is an important part of your learning experience; I am working to schedule several speakers; you should take time to research all guest speakers prior to their sessions; I may ask students to introduce our guests

13) Course Projects

a) Early in the course, and with guidance from me and input from classmates, you will submit and choose an idea for a new product to develop (a good or service)
b) You will use the course material to build a working prototype and present your product
c) The WCs are designed to help you develop your product
d) The project is a solo effort, not a team project
e) No confidential or proprietary projects should be proposed or presented

14) General Course Policies and Other

a) Please, while not a requirement for distant students (is a requirement for on-campus students), you should make a very serious effort to attend every session; please do not request permission to miss a session; however, your attendance during the final session is required (final presentations); here is one instance where you should coordinate with other courses, family, and work colleagues now, before your attendance becomes an issue
b) We will use name cards to help identify students; please bring your cards to every session
c) Having a deep and accurate understanding of your industry, market, and customers is critical to successful product development, and to help gain an appreciation of this, your classmates and I might ask you, from time to time, to participate in surveys and similar exercises; your participation is expected
d) On occasion, and in an effort to help teach, I might use submitted or presented work as examples of things to do or not do; in doing so, I might use an individual’s name; I might carry such examples from semester to semester and course to course
e) I have created a Google+ Community Page for this and other courses I teach; a link to this private community is provided through this course’s D2L page
f) In addition to the Addendum section regarding recording EMP sessions, please note that I might, from time-to-time take pictures of students, speakers, or other interesting subjects; these pictures, video recordings, etc. may appear later in class, our D2L page, our Google Community page, or emails to our class list
g) At my discretion, I may upload your submissions to Turnitin.com
h) Access: while participating in office hours should be your first step, I welcome emails and phone calls, and I do what I can within reasonable professional norms to respond as quickly as possible; please make sure your correspondence includes all relevant information

i) Course management website and communication:

i) The course website is managed through D2L (https://learn.colorado.edu/), live distance access through Zoom, and recorded sessions are managed through Be Boulder Anywhere

ii) Communication outside of scheduled sessions will use combinations of D2L, e-mail, in-person meetings, conference and video calls, and our Google Community site; you are responsible for managing your D2L page and e-mail account(s) on a frequent basis; D2L is the official source of information for the course; you should not request separate forms of correspondence as I cannot commit to manage everyone’s personal preferences; phone numbers and electronic correspondence, such as emails, will use the addresses from our CU Course roster; if you do not know your CU addresses or need to update them, then please contact OIT (+1 303 495-HELP); additional information on this topic is included in the addendum

15) Grading

<table>
<thead>
<tr>
<th>Assignments</th>
<th># Given</th>
<th># Graded</th>
<th>% Each</th>
<th>Sub-Total (%)</th>
<th>Total (%)</th>
</tr>
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<tbody>
<tr>
<td>Weekly quizzes(^1)</td>
<td>12</td>
<td>10</td>
<td>3</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Course project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Weekly contributions(^2)</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Final presentation</td>
<td>1</td>
<td>1</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Class participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>D2L profile &amp; community bio</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Student participation(^3)</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

a) Notes

i) 1 best 10 of 12 quizzes; your 2 lowest-graded quizzes will be dropped; quizzes are open book, open notes, individual efforts, timed events that are to be completed on your own time, outside of class

ii) 2 best 10 of 12 contributions; your 2 lowest-graded contributions will be dropped; grading rubric will be provided

iii) 3 professional behaviors such as respect, help to others, and common courtesies are expected; lack of such behaviors is likely to result in a student loosing grade points; examples of improper behavior include the use of laptops and cellphones, conversing with your classmates, being detached and not participating, eating during sessions, and vulgar posts or language will likely result in lost points (especially while guests are attending!)

b) Weekly contributions are graded using the rubric provided in D2L
c) Due dates and late submissions:
   i) Assignment due dates are posted in D2L; assignments delivered late receive a score of zero; the submitted date and time of record is defined by the D2L-time-stamp; the assignment must be readable and posted in the correct Dropbox for it to be considered “submitted”
   ii) All due dates and associated times are US Mountain Time (Boulder, Colorado); be sure to understand if and how D2L has converted due dates to match your time zone
   iii) Absences, sickness, and related topics: as noted above, D2L will drop one or more of your lowest-scored assignments and quizzes; this feature of your grading scheme is to help you manage this course within the context of “life”; therefore, use your drops wisely, and, for example, do not waste a drop, if, weeks later, you suddenly find yourself with a nasty case of the flu and are unable to complete an assignment; please do not write to me asking for additional time, exceptions to grading schemes, permission to miss class, trying to explain late submissions, etc.; if something happens such that you will likely miss an assignment or not do well (e.g. sickness or business travel), then take the “drop” and move on; should you send me such requests, I might reduce your class participation grade

d) There is no final exam and no opportunities for additional or make-up work for course credit

e) Quality
   i) We are expected to perform at high levels of quality; this includes in-class behaviors plus written and oral work; points are subtracted from assignments when students fail to meet these standards; guidance documents to help you with written and oral assignments will be included with this course
   ii) Grading for all assignments, even pass/fail assignments, will consider the submission’s conformance to guidelines and specifications, inclusion of supporting information (such as dates, titles, and page numbers), layout and aesthetics, spelling, grammar, table formats, and proper citations; should I receive an assignment that I believe has not been adequately proof-read, I might return it ungraded and marked as not submitted, at which point it may be late
   iii) Submissions are to be in the requested formats; all work is to submitted in the correct D2L folder; submissions that can’t be opened, are not located in the correct D2L folder, are the wrong assignment, or marked “confidential” will receive a grade of zero

f) Percent to letter-grade conversion:

<table>
<thead>
<tr>
<th>Percent Grade</th>
<th>Letter Grade</th>
<th>Percent Grade</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥94%</td>
<td>A</td>
<td>≥74% to &lt;77%</td>
<td>C</td>
</tr>
<tr>
<td>≥90% to &lt;94%</td>
<td>A-</td>
<td>≥70% to &lt;74%</td>
<td>C-</td>
</tr>
<tr>
<td>≥87% to &lt;90%</td>
<td>B+</td>
<td>≥67% to &lt;70%</td>
<td>D+</td>
</tr>
<tr>
<td>≥84% to &lt;87%</td>
<td>B</td>
<td>≥64% to &lt;67%</td>
<td>D</td>
</tr>
<tr>
<td>≥80% to &lt;84%</td>
<td>B-</td>
<td>≥60% to &lt;64%</td>
<td>D-</td>
</tr>
<tr>
<td>≥77% to &lt;80%</td>
<td>C+</td>
<td>&lt;60%</td>
<td>F</td>
</tr>
</tbody>
</table>
1. **Positive Learning Environment**

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at [http://hr.colorado.edu/dh/](http://hr.colorado.edu/dh/)

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran’s status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at [http://www.colorado.edu/policies/classbehavior.html](http://www.colorado.edu/policies/classbehavior.html) and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

2. **Academic Integrity, Plagiarism, and the EMP Honor Code Quiz**

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Information on the CU Honor Code can be found at [http://www.colorado.edu/policies/honor.html](http://www.colorado.edu/policies/honor.html) and at [http://honorcode.colorado.edu](http://honorcode.colorado.edu).
The faculty of the Engineering Management Program (EMP) believe that a culture of integrity is essential to both the long-term, personal success of our students and to the economies and countries in which they live and work. Therefore, EMP has created an Honor Code Violation Policy that specifies a program-specific, academic consequence for a second violation of the CU Honor Code:

**EMP HONOR CODE VIOLATION POLICY**

Any and all violations of the CU Honor Code in EMP classes will be reported to the Honor Code Council. As per CU’s policy, the faculty member will determine the academic sanction for an offense. The CU Honor Code Council will determine any additional, non-academic sanctions. *This portion of EMP’s policy is a restatement of the Honor Code policy approved by the CU Board of Regents.*

A second violation of the CU Honor Code by any Engineering Management graduate student will result in the academic sanction of dismissal from the Engineering Management graduate program.

The development of the Internet has provided students with historically unparalleled opportunities for conducting research swiftly and comprehensively. The availability of these materials does not, however, release the student from citing sources where appropriate; or applying standard rules associated with avoiding plagiarism. Specifically, the instructor will be expecting to review papers written by students drawing ideas and information from various sources (cited appropriately), presented generally in the student's words after careful analysis, synthesis, and evaluation. An assembly of huge blocks of other individuals' existing material, even when cited, does not constitute an appropriate representation of this expectation. Uncited, plagiarized material shall be treated as academically dishonest. If the student is confused as to what constitutes plagiarism, s/he should review the CU Honor Code on this topic, and refer to the following excellent resources:

http://www.northwestern.edu/uacc/plagiar.html and

http://owl.english.purdue.edu/owl/printable/589/

Students agree that by taking this course all required papers may, at the discretion of the instructor, be subject to submission for a Textual Similarity Review to Turnitin.com for the detection of plagiarism. All submitted papers will be added as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers in the future.

Finally, the Engineering Management Program faculty have established a policy whereby all students enrolled in an EMP course must, at the beginning of each semester, take and pass a basic quiz about the CU Honor Code. Each student must take the quiz once each semester, regardless of how many courses they are taking in the department. You must receive 100% on the quiz in order to pass the exam. **The instructions and quiz will be made available on D2L when the student enrolls for any EMEN course or any course cross-listed, co-listed or co-located with an EMEN course.**

### 3. Disability Services
If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see Temporary Medical Conditions: Injuries, Surgeries, and Illnesses guidelines under Quick Links at Disability Services website and discuss your needs with your professor.

If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website and discuss your needs with your professor.

4. Religious Observances

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or class attendance. Students for whom religious observances conflict with class schedules should contact the instructor no later than two weeks before the potential conflict to request special accommodations. See full details at http://www.colorado.edu/policies/fac_relig.html.

5. Class Attendance for On-Campus Students

Unfortunately, some on-campus students have used the availability of the lecture videos to stop attending classes, and rely instead on the videos to learn the material. In the opinion of the faculty, this choice often results in a significant reduction in the quality of the educational experience for both on-campus and distance students; therefore, EMP has established the following policy for all on-campus students registering for an EMEN course:

Class attendance for all on-campus students is expected and required. Unexcused absences may incur a penalty against the student’s final grade.

6. Access to Recorded Course Lectures

The lecture videos are available for streaming and downloading via Desire2Learn (D2L) by all students registered for their respective EMEN course; whether they are on-campus or distance students. This improves the quality of the educational experience for all students, enabling any student to review each lecture as many times as needed to master the material. If you have difficulties accessing the video, FIRST check Technical Help / FAQ at: https://cuengineeringonline.colorado.edu/distance-delivery/technical-help-faq. If you are still experiencing difficulties, please contact: caete@colorado.edu.

7. E-mail Account
You are expected to use your CU student e-mail account. All of your e-mail from professors and the university will be sent to your CU e-mail account. You can choose to redirect your CU email to an alternate (work/personal) email account. For assistance in activating your email account and forwarding email, contact the Help Desk at 303-735-HELP or Help@colorado.edu.

8. Recording of EMP classes

Please note that students attending EMP classes live, whether on-campus or via teleconferencing, may be recorded.

9. Proper Use of Copyrighted Materials

The Engineering Management Program (EMP) has a large distance learning population and, as such, many copyrighted materials are offered electronically to students. EMP has the responsibility to comply with the copyright law regulating distance education for a non-profit, state institution, i.e., the Technology, Education and Copyright Harmonization (TEACH) Act of 2002. It’s the student’s responsibility to comply with U.S. copyright law with respect to the use and sharing of the electronic materials (this includes the videos of class lectures) provided within the program.

10. Appropriate Classroom Use of Laptops

Although having a laptop in class opens up new learning possibilities for students, sometimes students utilize it in ways that are inappropriate. It is easy for your laptop to become a distraction to you and to those around you. Therefore, please refrain from instant messaging, e-mailing, surfing the Internet, playing games, writing papers, doing homework, etc. during class time. Acceptable uses include taking notes, following along with the instructor on PowerPoint, and other directed class activities, as well as working on assigned in-class activities, projects, and discussions that require laptop use.

Change Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 Dec 2015</td>
<td>initial release</td>
</tr>
<tr>
<td>20 Dec 2015</td>
<td>Misc. cleanup, added project description</td>
</tr>
</tbody>
</table>