Syllabus

IE 6405
INTEGRATED PRODUCT DEVELOPMENT
(4 credits)
Fall Semester

Instructor: Dr. Kyoung-Yun "Joseph" Kim
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Class Hours: Tuesday 5:30 PM to 7:20 PM and Thursday 5:30 PM to 7:20 PM

Classroom: Rm. 2062, Manufacturing Engineering building

Office hours: Tuesday 1:00 PM to 2:00 PM
Or by appointment

Course Website: http://blackboard.wayne.edu

Course Description:

The aim of this course is to familiarize students with the current principles and philosophies of product development and realization. Modern industries cannot cope with the traditional over-the-wall method of product development. The goal is to achieve a more integrated and seamless development environment. This course will educate students about the importance of concurrent and collaborative engineering in a global economy and how to realize a true collaborative design environment. Students will learn how to operate effectively in a highly integrated, multidisciplinary environment.

Topics covered in the course will span product specification and conceptual design through detailed and domain specific design, including manufacturing process development. By covering such topics, students will learn the principles of system and quality engineering and value of capturing product information and implications explicitly. In addition, cutting-edge technologies and tools will be introduced to students to give them hands-on experience with a true collaborative engineering and design environment that supports product development processes including conceptual design, customer-oriented product design, multi-disciplinary design, design for X, product architecture, virtual prototyping and simulation, design decision making, and intellectual property and patent related issues.
Upon completion of the course, students are expected to use the product development standard process and procedures to set final specifications based on customer needs. They will be able to generate detailed CAD drawings for all components and sub-assemblies comprising a product, showing all key dimensions, tolerances, other critical details, such that the detailed product design conforms to standard criteria for high-quality industrial designs for manufacturing and assembly as well as a production launch plan with complete documentation for each production process.

**Course Objectives:**

- Develop the competence with a set of tools and methods for product design and development.
- Understand the processes involved in creating a new product or modifying an existing product.
- Awareness of the role of multiple functions in creating a new product (e.g., marketing, finance, industrial design, engineering, production)
- Awareness of the importance of system, process, and information integration in product development
- Develop the ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective of launching a new product.

**Learning Outcomes:**

Upon completion of the course, students will be able to:

- Remember the systematic concept development process
- Construct customer needs by using the Quality Function Deployment process
- Determine product features through gathering product information, decomposing product, identifying product features, and conducting product benchmarking study
- Determine target specification to satisfy customer needs
- Construct concepts to address the customer needs
- Determine the most promising concepts for further consideration
- Explain the need of product architecture
Text Book:
2. Class handout

References:

Grading:

- Term Projects: 30%
- Homework, quiz, and class participation: 30%
- Paper review and criticism: 10%
- Mid-term and final Exams: 30%

- Individual projects, exams, and homework might be curved.
- All exams will be closed book and notes.
- Project reports and special assignment reports have to be typed.
- Each student team will need to present a research paper. All other students will need to read the same paper and submit one-page summary with their paper review and criticism.
- Homework late by one class will be evaluated at 90% and more than one class at 70%.

Class Preparation and Participation:
Reading assignments are given for each class session. You are expected to come to class prepared to discuss the readings and the suggested questions. Your individual class participation grade will be based upon your in-class remarks during discussions.
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<th>Term Project</th>
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<td>Overview of integrated product development</td>
<td>Choose Project Groups</td>
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<td>Week 2</td>
<td>Product design and development processes</td>
<td>Report Project Groups</td>
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<td>Week 3</td>
<td>Product planning and global product development case study</td>
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<td>Week 4</td>
<td>Customer need identification</td>
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<td>Week 5</td>
<td>Customer need identification II &amp; product specification</td>
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<td>Week 6</td>
<td>Concept generation and inventive problem solving</td>
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<td>Concept generation and TRIZ integration</td>
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<td>Week 8</td>
<td>Product architecture &amp; guest lecture (Industrial design and decision making)</td>
<td>Report Design Specifications and Investigation Process</td>
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<td>Week 9</td>
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<td>Intermediate Project Presentation (Oct 23)</td>
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<td>Week 10</td>
<td>Design structure matrix and project management</td>
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<td>(Oct 30 &amp; Nov 1)</td>
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<td>Project day and paper presentation</td>
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<td>Week 12</td>
<td>Design decision impacts</td>
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<td>Week 13</td>
<td>Prototyping</td>
<td>Concept validation and prototyping</td>
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<td>(Nov 20)</td>
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<td>Week 14</td>
<td>Intellectual property issues &amp; product development economics</td>
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<td>(Nov 27 &amp; 29)</td>
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<td>Week 15</td>
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<td>Final project Presentation (Dec 6)</td>
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<td>Week 16</td>
<td>Final Exam</td>
<td>Final Project Report Due (Dec 13)</td>
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Term Project Guideline

Objective:

Your challenge in the project portion of this course is to design and to produce a prototype version of it. The goal of this exercise is to learn principles and methods of product development in a realistic context. Most product development professionals work under tremendous time pressure and do not have an opportunity to reflect on the development process. In this course, the project stress level will be low enough that there will be time to experiment and learn. Guidelines and requirements for reasonable projects are given below. The project proposal process is explained in the course schedule.

Project Teams:

In the second week of the course, we will form project teams on the basis of expressed student preferences. Teams will consist of about two or three students. Once you are assigned to a project team, we expect you to stay in the course for the entire term.

Guidelines for Projects:

While special cases will be considered, you are strongly encouraged to choose a project satisfying all of the following constraints:

▪ There should be a demonstratable market for the product in five years. One good way to verify a market need is to identify existing products that attempt to meet the need. Your product need not be a variant of an existing product, but the market need addressed by your product should be clearly evident. The product does not need to have a tremendous economic potential, but should at least be an attractive opportunity for an established firm with related products and/or skills. Design and development process should be justified in the context of the potential market.

▪ Most products developed in this class are material goods (discrete products) and not services. While many of the ideas in the course apply to services and software products, many do not (e.g., design for assembly). Nevertheless, the faculty are willing to hear project proposals from students interested in developing software, services, and internet-based enterprises.

▪ The product should have a high likelihood of containing fewer than ten parts. Although you cannot anticipate the design details, it is easy to anticipate that an electric drill will have more than ten parts and that a wine opener can have fewer than ten.

▪ The product should require no basic technological breakthrough. (Yes, a more compact airbag would be a nice, but can you do it without
inventing a new chemical?) You do not have time to deal with large technological uncertainties.

- The product must be user-driven. You should have access to more than five potential lead users (focus group) of the product (more than 20 would be nice).
- The final project report and presentation is required. The final report should be no more than 40 pages.

A few more hints:

- Save any highly proprietary ideas for another context; we will be quite open in discussing the projects in class and do not wish to be constrained by proprietary information.
- Most successful projects tend to have at least one team member with strong personal interest in the target market.
- Most products are really not very well designed. This is evidenced by the seemingly poor quality of common consumer products (e.g., wine opener, garlic presses, and ice cream scoops). The experience in this class is that if you pick almost any product satisfying the above project guidelines, you will be able to develop a product that is superior to other products currently on the market. A book titled “The Design of Everyday Things” by Donald A. Norman ( Doubleday, 1990) discusses good and bad examples and provides principles and guidelines for good design.
- Just because you have used a lousy product, it doesn’t mean that a better one doesn’t exist. Do some thorough research to identify competitive products and solutions. If any existing competitive ones are found in later stage of your project, it can be very problematic and will affect your design and prototype.
General Policy:

Student Conduct:

It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge. In this regard, cheating will not be tolerated. Cheating includes (but is not limited to) any communication (written or oral) during examinations and sharing of work, such as using the same models or computer programs or copying work. All homework and projects must be an individual effort unless specifically noted. STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE. Therefore, avoid all appearance of improper behavior! Students who witness cheating should report the incident to the instructor as soon as possible. Students are also welcome to discuss any concerns related to cheating with the Chair of Industrial & Manufacturing Engineering.

Educational Accessibility Services:

If you feel that you may need an accommodation based on the impact of a disability, please feel free to contact me privately to discuss your specific needs. Additionally, the Office of Educational Accessibility Services (EAS) coordinates reasonable accommodations for students with documented disabilities. The office is located in the Student Center Building, Room 583, Phone: 313-577-1851 (Voice)/577-3365(TTY).

Policy on Classroom Attendance:

All students are expected to attend all lectures, quizzes, and examinations with enthusiasm. Although classroom attendance does not mathematically contribute to the final course grade, active class participation is expected of all students and may help to boost up the course grade in those “borderline” cases” between failing and passing.