ME53 Product and Process Design

Syllabus and Course Overview

General Information

| Credit Units | 3 |
| Meeting Time | 1200-1315 hrs, Tue & Thu, ME2004 |
| Course Instructor | Karthik Ramani, Office ME3176, ramani@purdue.edu, 765-494-5725 |
| Teaching Assistant | Pawan Rao, Office ME3164, rao81@purdue.edu |
| Teleconference Number | (641) 715-0660 Access Code: 931630 |
| International Dial-In | (641) 715-0660 Access Code: 931630 |
| Engineering Professional Education | 765-494-7015 877-598-4233 (toll-free, US only). Email: proed@purdue.edu |
| Course Notes | Harvard Business Reviews and other papers will be posted on Blackboard. PDF version of lecture presentations will be available for download. List of supplemental reference materials will be posted on Blackboard. |
| Course URL | https://engineering.purdue.edu/productdesign |
| Purdue Blackboard | https://mycourses.purdue.edu |
| Design WIKI | On Blackboard |
| Type of Instruction | Lecture, Homework Assignments, Projects: one individual design assignment and one group project (No Exams) |
| Prerequisite | BS in Engineering or consent of the instructor. |
| Grading | Individual Design Assignment (30%), Group Project (50%), Participation (10%), Homework (5%) and Design Based Exercises (5%) |

Course Overview

This course is as much about Design Thinking and learning as it is about design innovation, creativity, and doing design. The focus is on learning to design and about the design processes. The concepts of product design are addressed from a multidisciplinary perspective that includes opportunity determination through inspiration, ideation, and implementation using design thinking framework.

The classroom segment of the course focuses on the aspects of Design Thinking and the Product Design Process. You will first be introduced to the powerful habit of Design Thinking that will transform the way you will develop products, services, and processes. Next, we start delving deeper into topics of product design beginning with Problem (opportunity) Identification and Evaluation. Here, you will be introduced to elements of value engineering, empathy-based design, blue-ocean strategy etc. for identifying and assessing product opportunities for new products and services. Further, we move on to the topics of Concept Generation/Conceptual Design through the topics of Visual Thinking, Brainstorming, SCAMPER etc. concluding with methods of Concept Selection and Prototyping. The methodologies covered in the course will practice identification of product opportunities, development of superior-technical & economical product
concepts for the identified opportunity for production of globally competitive products and services.

In addition to the elementary topics of product design, you will also learn the significance of creativity & innovation, product platforms & product architectures, business & service models in the design of successful products. The mode of instruction and learning is ensured to be hands-on, interactive with hand-picked case-studies and articles from the Harvard Business Review (HBR). Further, there will be workshops and guest lectures from eminent industry experts to bolster concepts learned in the class.

**Project Overview**

The project segment of the course will have a *design assignment (individual)* and a *semester-long group project*. The projects will directly draw upon the classroom topics and case studies. In the individual design assignment, you will work towards designing a product for a given technical problem statement (mechanical/electromechanical). The final deliverable of the individual project will be a comprehensive design report that will detail the design process followed to solve the given technical problem.

For the group project, you will be working in multidisciplinary teams to apply the product design tools learned on a specific design problem chosen by your team (or a design problem given by ME553 industry partner). The multidisciplinary team (consisting of typically 4-5 members) will be formed by the coaching team to ensure diverse and superior design thinking, collaboration, creativity and innovation. The final deliverables of the group project will include (a) comprehensive product definition with either (or both) a physical or a digital prototype, (b) classroom presentation, (c) design report and (c) product video.

**Grading Breakdown**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework Assignments</td>
<td>5%</td>
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<tr>
<td>Design Based Exercise</td>
<td>5%</td>
</tr>
<tr>
<td>Individual Design Assignment</td>
<td>30%</td>
</tr>
<tr>
<td>Group Project [breakdown below]</td>
<td>50%</td>
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<tr>
<td>A1: Opportunity Identification [Individual]</td>
<td>P/F</td>
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<tr>
<td>A2: Value Opportunity Analysis [individual]</td>
<td>5%</td>
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<tr>
<td>A3: Opportunity Understanding</td>
<td>5%</td>
</tr>
<tr>
<td>A4: Concept Generation</td>
<td>10%</td>
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<tr>
<td>A5: Prototyping</td>
<td>13%</td>
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<tr>
<td>Final Presentation</td>
<td>10%</td>
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<tr>
<td>Final Deliverable: 6 min Video</td>
<td>7%</td>
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</tbody>
</table>
Participation (Personal Wiki, Attendance, Class participation, Discussion Board etc.)  10%

NOTE: Final grade allocation is subject to change.

Overview of Topics Covered
- Product Development Process
- Design Thinking
- Exploring the Design Spaces
- Product Planning Methods
- Product Opportunity Identification
- Value Engineering and Value Analysis
- Product Opportunity Understanding:
  - Market Research Techniques
  - Value Mapping
  - Functional Decomposition
  - Lean-QFD
- Concept Generation:
  - Visual Thinking
  - Storyboarding
  - Brainstorming
  - SCAMPER
  - Morphology
- Concept Selection and Decision Making
  - Morphology
  - Weighted Matrix
- Innovation and Creativity
- Product Platforms and Product Architectures
- Business Models
- Business Model Generation and Design
- Environmental Issues: Sustainability and Circular Design
- Internet of Things (IoT), Cyber-Physical Systems (CPS) and Collaborative Intelligence
- Fast and High-Fidelity Prototyping Techniques

NOTE: The above-list is meant to give a bird’s-eye view of the course content. Refer to the Course Calendar document for the detailed list of the topics covered with the class schedule.

Course Policies
1. Attendance

Students are expected to be present for every meeting of the class. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible and take the
permission for absence. Note that class participation and attendance carries some weight in the final grading, the coaching team will make a note of attendance for each class meeting.

2. Submission and Due Date

- Due dates for all deliverables & submissions are important but are subject to change. All submissions are due at 2359hrs EST on the due date.
- All assignment turned in more than 5 minutes will be considered late. A late penalty of up to 20% may be deducted from your final submission score for each 24-hour period.
- All submissions must have your name and PUID.
- All submissions will happen on the Blackboard unless asked explicitly to submit via other methods.

3. Email Communication

- When sending us course-related email the subject on email communication should have:
  - Off-campus “ME553_OFF_Full Name: actual subject”
  - On-campus “ME553_ON_Full Name: actual subject”
- When the groups are formed and you are sending emails regarding the group projects:
  - Off-campus “ME553_OFF_Full Name_G#: actual subject”
  - On-campus “ME553_ON_Full Name_G#: actual subject”
- We appreciate all course-related emails to be sent to purdueme553@gmail.com. This mailbox is checked regularly by all the members of the coaching team, which means that you can expect faster response from this mailbox. The coaching team prefers not to use personal mailbox for course-related correspondence.

3. Academic Integrity

Academic dishonesty will not be tolerated in any form. Specifically, you must do your homework and assignments yourself, on your own, unless specifically stated otherwise in the assignment. You may discuss the homework with anyone and use any reference material, provided you do not copy any other person's work, either in whole or in part. Penalties will be severe. For further details - https://www.purdue.edu/odos/osrr/academic-integrity/index.html

4. Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted on the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.