ME553 Product and Process Design – Fall 2023

Syllabus and Course Overview

1. General Information

Credit Units	3
Course Instructor	Karthik Ramani, Office ME3176, ramani@purdue.edu , 765-494-5725
Teaching Assistant	ME553 course email: purdueme553@gmail.com Mayank Patel: pate1421@purdue.edu Ananya Ipsita: aipsita@purdue.edu Asim Unmesh: aunmesh@purdue.edu ***Please use slack as primary channel for communication***
Office hours	Thursdays 1-2p here: https://purdue-edu.zoom.us/j/6111514990 or by request
Zoom meeting room	https://purdue-edu.zoom.us/j/6111514990
Course Slack group	https://join.slack.com/t/slack-hgx3786/shared_invite/zt-21l3dq51e-1xqjjFAQ9OfIwP4FCPkOOg
Course Material	Refer to "5. Course Materials"
Course URL	https://engineering.purdue.edu/productdesign
Purdue Brightspace	https://purdue.brightspace.com/
Type of Instruction	Recorded video lectures, homework, discussion board, group project
Prerequisite	BS in Engineering or consent of the instructor
Grading	Refer to "4. Grading Breakdown"

2. Course Overview

This course is as much about design thinking and learning as it is about design innovation, creativity, and doing design. The concepts of product design are addressed from a multidisciplinary perspective that includes opportunity determination through inspiration, ideation, and implementation using a 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 refine your ability to identify product opportunities and develop superior technical & economical product concepts for that opportunity, enabling 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, and 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.
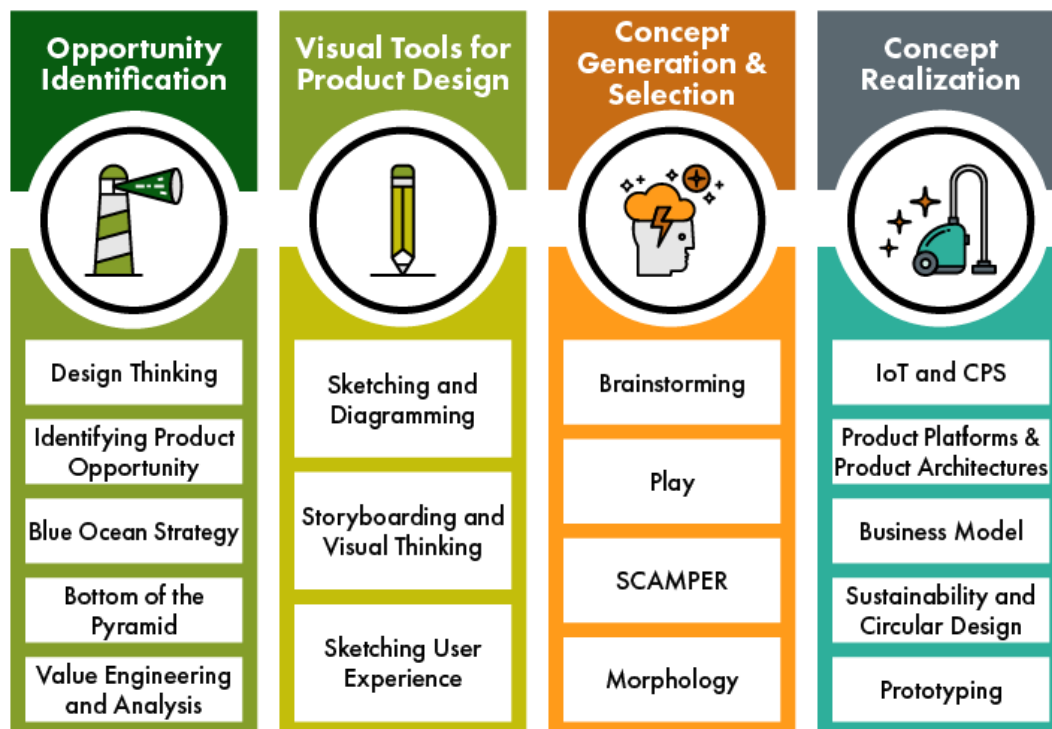

Fig 01 – Course Overview

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.*

3. Homework and Project Overview

The project segment of the course will have **12 homework assignments** and a **semester-long group project**. They will directly draw upon the classroom topics and case studies.

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. The multidisciplinary team (consisting of typically 3-5 members) will be formed by the coaching team to ensure diversity for 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) final presentation,
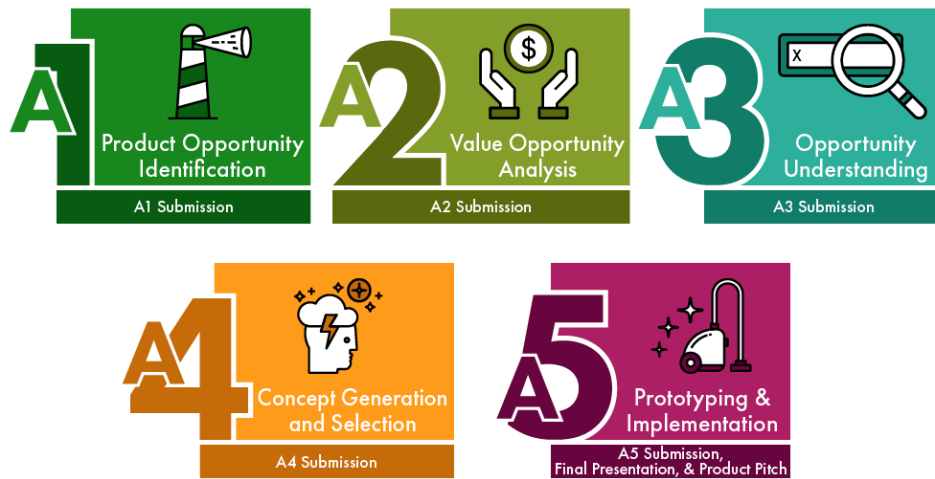 (c) design report, and
  (d) product video/pitch.

Fig 02 – Project Overview

4. Grading Breakdown

Homework Assignments		**25%**
Good Bad Design Assignment		**3%**
Group Project Assignments [breakdown below]		**63%**
A1: Opportunity Identification	P/F	
A2: Value Opportunity Analysis	5%	
A3: Opportunity Understanding	5%	
A4: Concept Generation	10%	
A5: Prototyping	20%	
Final Presentation	15%	
Final Deliverable: 6 min Video	8%	
Participation – Discussion Board Assignments & Case study interaction		**9%**

NOTE:
- *Final grade allocation is subject to change.*
- *The creative and flexible nature of the course results in many high grades. For this reason, our letter grade cutoffs are typically higher than many other Purdue courses. To be fair to all students, letter grades cutoffs are dependent on class distribution.*
- *P/F stands for Pass/Fail.*

5. Course Materials

5.1 Reference books

There are no prescribed textbooks for this course. The following reference books will aid in enhancing your understanding of the course material.

#1: The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems by *Michael Lewrick*, *Patrick Link*, and *Larry Leifer*, ISBN: 978-1119467472. (Approximate Cost: Paperback $22.35 / Rent $19.17)

#2 Value Proposition Design: How to Create Products and Services Customers Want by *Alex Osterwalder, Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadakos (designer)* ISBN-10: 1118968050. (Approximate Cost: Paperback $ 20.99)

#3: Product Design and Development [Sixth Edition] by *Karl T. Ulrich* and *Steven D. Eppinger*, ISBN: 978-0078029066. (Approximate Cost: Hardcover $94.26 / Rent $32.22)

5.2 Harvard Business Review (HBR) Case Study Articles – **Required to Purchase ($8.95 Each)**

- **Sweet Water:** https://hbr.org/product/sweetwater/695026-PDF-ENG
- **Cirque du Soleil:** https://hbr.org/product/cirque-du-soleil/403006-PDF-ENG
- **Note:** These two are **the only HBR articles you are required to purchase** as HBR has different dissemination rules for Case Studies. All others used in the course can be found per instructions below.

5.3 Other HBR Articles, Reading Materials, and Videos

- Some will be posted on Brightspace.
- For others, please refer to the instruction posted on Brightspace in the "Start Here" module to view and download.
- **Note:** Many can be found more easily by searching the title.

5.3 Stationery for workshops

Our class exercises usually involve sketching, drawing, using Sticky Notes, etc.

Note: The following are suggested materials commonly used during the design and communication process. Sketches can be done on paper or with digital drawing tools.

1. One Watercolor Pencil (Preferably blue). The University Bookstore has these pencils in a pen-holder with the ME444 label.

Amazon Link or similar

Fig 04: Watercolor Pencils

2. Two Sharpies with different stroke width (preferably fine and ultra-fine). We recommend you buy the twin-tip Sharpie that has both the fine and ultra-fine tips on the same pen.

Amazon Link or similar

Fig 05: Sharpies

3. Post-it notes (preferably 3''x3'') – **Note:** These are essential for ideation, organization and classification of ideas and workflows. You may Use **Google Jamboard** for virtual post-it notes if your meetings are remote.

Fig 06: Post-it Notes

6. Type of Instruction

6.1 Weekly Lectures

All course materials are available on Brightspace. The Brightspace is set to release the contents for the next two weeks ahead at **5PM EST on Friday**.

Each week has 2 to 3 lecture folders, and each lecture folder will contain-

- **Pre-Class Preparation Materials:** Required and Optional reading materials and videos are listed under *Preparation*. Reading and Videos under *required* category are compulsory and are needed for the video lectures and to pass the pre-lecture quiz. It is highly recommended that you go through the materials under the *optional* category.
- **Pre-Class Quiz:** Each quiz has about 4 to 8 questions based on the *required* materials. A maximum of three attempts is allowed to complete the quiz. A score of ***75% or higher*** is required to unlock the rest of the lecture contents.
- **Video Lectures**: The full content of each lecture is modularized into multiple Video Lectures.
- **Homework Assignment:** Homework download and submission link are provided in each lecture folder if applicable. While most of them are individual submissions, you are allowed to work amongst your project groups for some of them; such homework could have a group submission. Refer to the assignment handout for further instructions, deadline, and submission format.
- **Discussion Board**: *Discussion Board* link is provided in each lecture folder if applicable. Participation in the *Discussion boards* is graded. You are not only expected to post your work, but also comment/participate by sharing your ideas/opinions/views on other students' posts. The coaching team will also actively participate in discussions and mediate if necessary.

6.2 Case Study Sessions

- There are two Harvard Business Review case study sessions - **Sweet Water (Saturday 09/02 or Sunday 09/03) and Cirque du Soleil (Saturday 09/16 or Sunday 09/17).**

- Students are recommended to join the case study sessions held by Professor Ramani. These sessions will be highly interactive; prior preparation/reading of the HBR is compulsory for participating in the case study discussion.
- The recorded version of the live session will be posted on the Brightspace for the people that could not attend the class.
- The location of the sessions will be posted as Announcement on Brightspace.

<u>6.3 Project Review Sessions</u>

- There one introductory meeting and two project review sessions for the group project part of this course. Each group is required to make time for one 15-minute intro meeting and two review meetings (about 30 mins each) with Professor Ramani to discuss/update the progress of the group project.
- Team intro meeting: **Friday 09/08, Saturday 09/09 and Sunday 09/10.**
- The first project review sessions will happen on **Friday 10/06, Saturday 10/07 and Sunday 10/08.** During this session, Professor Ramani will provide feedback and approve the Product Opportunity selected by the team.
- The second project review session will happen on **Friday 11/03, Saturday 11/04 and Sunday 11/05**. During this session, Professor Ramani will review the proposed conceptual design and give approval for final product prototyping.
- The coaching team will reach out to the teams for scheduling these sessions 1 week prior.

<u>6.4 Final Project Presentation</u>

On either **Friday 12/08, Saturday 12/09 or Sunday 12/10**, each group will give a final project presentation. The coaching team will reach out to the teams for scheduling these sessions. Please refer to the Brightspace Announcement to schedule the final presentation. The presentations are scheduled prior to exam week to reduce the stress of submissions and presentations from your week.

7. Course Policies
<u>7.1 Pace of Work and Regularity</u>

- <u>Students are expected to be regular and consistent in completing the coursework on a weekly basis.</u>
- You are allowed a <u>lag of one week at the maximum</u>. If you are lagging by more than a week, you should bring this to the notice of the coaching team and catch up to the pace immediately. It is strongly advised that you do not have any lag as this will not only affect your grade due to late submissions but also adversely affect your group project work.
- You can <u>stay ahead of the schedule by a week at the maximum</u> if you prefer to do so. The Brightspace is set to release the contents for the next two weeks ahead at **5PM EST of Friday**.

- Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or long-absences can be anticipated, such as for work-related activities, religious/cultural observations, the student should inform the instructor of the situation as far in advance as possible and take the permission for absence.

7.2 Submission and Due Date

- Due dates for all deliverables & submissions are important but are subject to change. All submissions are due at *11:59PM EST* on the due date.
- All assignments turned in more than 5 minutes after due will be considered late. **A late penalty of up to 10% may be deducted from your final submission score for each 24-hour period.**
- All submissions must have your first name, last name and PUID.
- For the team project assignments, please add the team number per the following format: **Assignment Name_Section_Team# (Ex: A5_EPE8 or A4_ONC_TEAM3)**
- All submissions will happen on Brightspace. Do not email your submissions.

7.3 Communication

- **Slack is the main communication channel**. All the individual questions and team communications will be managed through this platform for simplicity and to encourage discussion.
- The Questions to TAs through Slack or email will be answered from Monday to Friday.
- Please send course-related emails to purdueme553@gmail.com. This mailbox is checked regularly by all the members of our team, which means that you can expect a faster response from this mailbox. The coaching team prefers not to use personal mailbox for course-related correspondence. **Additionally, please avoid using Prof. Ramani's institutional email for course-related communication as it can get lost among his many daily emails.**
- When sending us course-related email the subject on email communication should have - **"ME553 Fall 2023 ONC [Your Full Name]: actual subject"**
- When the groups are formed and you are sending emails regarding the group projects- "ME553 Fall 2023 ONC [Your Full Name] Group [#]: actual subject"

7.4 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

7.5 Emergencies

In the event of a major 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. <u>You are expected to read your purdue.edu email on a frequent basis.</u>