

Design Course for Open Elective

L: Lecture, T: Tutorial, P: Laboratory, S: Studio, CH: Contact Hours, CR: Credit

Course Number:	Open Elective Course	L	T	P	S	CH	CR
Course Name:	Basics of engineering product design	2	0	0	1	4	3

Course Objectives:

1. The course aims to provide an overview of the basics of product design and train students on analyzing customer needs and develop design concepts.
2. The course will briefly cover design principles related to concept generation, selection and development when designing engineering products.
3. The concept development tools and importance of considering sustainability and environmental issues and their impact on product design will be covered.

Course Outcomes/Learnings

- **CO1** – Understand the various stages and phases of product design.
- **CO2** – Students will develop concepts and design products based on user needs.
- **CO3** – Students will develop creative ideas/ concepts based on design principles.
- **CO4** – Students will be design products following a systematic approach.

Syllabus:

- **INTRODUCTION:** Importance of engineering design – types and phases in design-total lifecycle-regulatory and social issues-product design- types of products- product and process cycles-organization for product development-markets and marketing-technological innovation.
- **PROBLEM DEFINITION & NEED IDENTIFICATION:** Identifying, gathering and classifying of customer needs - establishing engineering characteristics- competitive benchmarking- quality function deployment-, product design specification.
- **CONCEPTUAL DESIGN:** Creativity in design- creativity and problem solving- creative thinking methods-conceptual decomposition- morphological methods-TRIZ (Theory of Inventive Problem Solving)- Decision making and concept selection-decision theories-concept screening and evaluation.
- **EMBODIMENT DESIGN:** Product architecture- steps in developing product architecture-configuration design-industrial design- human factors, product design-prototyping – rapid prototyping, IoT aspects in product design and testing
- **PRODUCT ECONOMICS & RELATED ISSUES:** Risk, reliability and safety- failure mode & effects analysis-concept of total quality- robust design- economic decision making- time value of money-profitability of investment- cost estimation-design to cost. Consideration of ergonomics and aesthetics in product design. Importance of sustainability and environmental impact in product design.

Textbooks:

- Otto K. and Wood K. *Product Design: Techniques in Reverse Engineering and New Product development* (Pearson, 2001).
- Ulrich K. and Eppinger S. *Product Design and Development* (McGraw-Hill Education, 2011).
- Jamnia A. *Introduction to Product Design and Development for Engineers* (CRC Press, 2018).

Reference Books:

- Baxter M. *Product design - Design Toolkits* (CRC Press, 1995).
- Morris R. *The fundamentals of product design* (Bloomsbury Publishing, 2017).
- Dieter G. E. and Schmidt L. C. *Engineering design*. (McGraw-Hill Education, 2012).
- Petroski H. *Invention by design: How engineers get from thought to thing* (Harvard University Press, 1998).

Approach:

- The course comprises lectures, studio sessions and case studies to train students in the aspects of systematic product design.

Evaluation Criteria:

- Students will be evaluated based on their performance in assignments (group /individual), sessional tests, final project outcomes (e.g., problem areas, the scope of improvements and design concepts, report, and presentation), and mid / end-semester examinations.

Program Outcomes

PO1 – An ability to independently carry out research /investigation and development work to solve practical problems.

PO2 – An ability to present the outcomes/deliverables in the form of a design portfolio or write and present a substantial technical report/document.

PO3 – Students will gain the knowledge and skillset to create innovative solutions to the emerging problems of society while working at the intersection of Design, Technology, and People.

PO4 – Students will develop the skillset in creative problem solving and critical thinking.

PO5 – The skill set and in-depth knowledge to demonstrate mastery in creating innovative design solutions in following specialized areas:

1. Technology-based Design
2. Life-centered Design
3. Inclusive Design

4. Integrated Design
5. Community-based Design
6. Sustainable Design

Mapping of Course Outcomes (CO's) with Program Outcomes (PO's)

Course Outcomes/Learnings	PO1	PO2	PO3	PO4	PO5
CO1	-	-	1	1	-
CO2	-	-	2	2	1
CO3	-	2	1	2	1
CO4	-	-	3	2	1

3 = Strong mapping

2 = Moderate mapping

1 = Gentle mapping

0 = Negligible/Very weak mapping