**FF No. : 654**

**ES1044: Product Design & Development**

**Course Prerequisites: None**

**Course Objectives:**

1. Give a 360° understanding of the Engineering field to the student.
2. Apply the tools of creative problem solving and design decision making.
3. Learn the Human aspects of Design - like ergonomics and UI-UX.
4. Apply the techniques of Visualisation and Technical Communication.
5. Learn the various methods of manufacturing of products & Product lifecycle
6. Learn important skills needed for innovative product design and development needed for any branch engineering students.

**Credits: 03 Teaching Scheme Theory: 02**  Hours/Week

**Tut: 0**  Hours/Week

**Lab**: **2** Hours/Week

**Course Relevance:** The course can help the students to prepare for learning important skills for new Product design & Development and creativity in all areas of Engineering. (e.g. physical products, process equipments. Electronic circuits/ gadgets, Software Apps for various platforms) and also get hands on experience on these skills and tools

| **SECTION-1** |
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| 1. **Creative Problem Solving Process and Tools -** Introduction to Creative Engineering Problem Solving across Disciplines / Branches - TRIZ, 8D, and other Creative thinking tools etc. 2. **Product Lifecycle Management :** Creative Product Design, development, Manufacturing, and Life-cycle Management Process. Reverse Engineering   Software Product Life Cycle Management   1. **Human Centric UI-UX Design :** Introduction to Aesthetics, and Human factors in Engineering Design - Ergonomics, UI- UX for Software Apps, Interface / HMI / HCI design for Controls in Engineering Products / Electronic gadgets, Industrial equipments, etc. Differently-abled Users, Usability studies |
| **SECTION- II** |
| 1. **Design Thinking & DFX :**   Design Thinking, Development Stages-TRL, MRL, IRL aspects, Concepts of Quality & Reliability in product design & Development, House of Quality, Quality Function Deployment (QFD), Failure Modes & Effects Analysis (FMEA), Types of FMEA, Robust Design, Case studies Other DFX areas from various fields (IT, Instru., Elex, etc.)   1. **Introduction to Product Visualisation and Communication** -   Tools and Techniques - Sketching, Drawing, Data Visualization, Standardization, Drafting, Wireframe design of Software Apps / Industrial Products,Prototyping,   1. **Product Viability & Cost Analysis** - Practical aspects like Industrial Organization, Management and Economics related to New Product Development. Sustainable / Green aspects of Product Development. Case studies. |
| **List of Lab. Experiments : (Any eight)**   1. Reverse Engineering of a simple machine / Toy / gadget / PC . 2. Real life Creative Engg. problem solving - Using TRIZ / other techniques 3. Case studies based on Interdisciplinary product development & PLM. 4. Design and Develop a web or mobile app or an industrial control panel / HMI making use of the effective UI , UX , Human Centric Design principles 5. Experiments on various manufacturing tools / processes for hands-on experience. 6. Lab.-Experiment based on DFX / QFD - Quality Function Deployment / FMEA- Failure Modes and Effects Analysis 7. Lab.-Experiment based on Assignment based on Design Visualization and communication using Tools like Tableau, Canva, Autodesk Sketchbook, etc. 8. Product Development Project management, Team work planning and costing on the course project using modern techniques like Agile and SCRUM. 9. Case study on Software Product Design 10. Case study product Design for differently-abled users 11. Methods of Prototypes & Utility 12. User Surveys for Product Performance Improvement 13. Product Costing analysis for a physical/ Software/ service Product 14. Value Engineering analysis of a physical / Software/ service Product |
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| **List of Course Projects:**   1. TRIZ: Concept & Methodology 2. Design by evolution 3. Design by Innovation 4. Brainstorming 5. Types of Feasibility Study : Characteristics 6. Role of tolerances in design 7. SDLC 8. Market Readiness Index (MRI) 9. Software Reverse Engineering 10. Role of 3 S in Product design 11. Golden Rules in HCI Product Design 12. Product design for Differently-abled Users 13. Three Pillars of Product Design |
| **Suggest an assessment Scheme:**  As per the common F.Y. Structure |
| **Text Books: *(As per IEEE format)*** |
| 1. Ulrich, Karl T., Eppinger, Steve D., and Yang, Maria C., Product Design and Development. 7th ed., McGraw-Hill Education, 2020. 2. Kevin N. Otto, Kristin L. Wood · Product design: techniques in reverse engineering and new product development, 2001, Prentice Hall 3. Anil Mital & et al, Product development : a structured approach to consumer product development, design, and manufacture, 2008. 4. Liu, Carl, Innovative Product Design Practice, 2015 5. Product Design and Manufacturing , Chitale A K & Gupta R C, PHI |
| **Reference Books: *(As per IEEE format)*** |
| 1. Industrial Designers Society of America, Design Secrets: Products: 50 Real-Life Product Design Projects, 2001. 2. Beno Benhabib, Manufacturing: Design, Production, Automation, and Integration (Manufacturing Engineering and Materials Processing), 2003 3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, Bloomsbury Publishing India |
| **Moocs Links and additional reading material:**   1. <https://www.pdd-resources.net/resources.html> |
| **Course Outcomes:**  **The student will be able to :**   1. Have a 360° understanding of the role of an engineer in society. 2. Apply the understanding of Product life cycle phases & their Characteristics. 3. Interpret & apply the Human & user centric aspects of Design and UI-UX. 4. Understand the contemporary principles of design thinking, DFX etc 5. Apply the techniques of Visualization and Modeling. 6. Understand and apply sustainability aspect of product design and development . |
| **CO PO Map** |
| **CO attainment levels**  **CO1- 4, CO2- 4, CO3- 4, CO4- 4, CO5- 4, CO6- 4** |
| **Future Courses Mapping:**  NA |
| **Job Mapping:**  To help the students to prepare for jobs in Product design and development related tasks and jobs, needed in the various areas of knowledge, science and technology. |