PRODUCT DESIGN AND DEVELOPMENT

Course Objectives

The course aims to:

1. Introduce the principles and methodologies of product design and development.
2. Develop skills in identifying customer needs and translating them into engineering specifications.
3. Familiarize students with concept generation, evaluation, and selection techniques.
4. Understand product architecture, prototyping, testing, and manufacturing considerations.
5. Introduce modern tools and strategies for successful product development and innovation.

Course Outcomes (COs)

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

- Understand the complete product development process.
- Identify customer requirements and formulate product specifications.
- Generate and evaluate alternative design concepts.
- Apply design methodologies for developing innovative products.
- Integrate manufacturing, sustainability, and market considerations into product design.
- Develop and present product prototypes and design solutions.

MODULE – I (6 Hours)

Introduction to Product Design and Development

Product development process, characteristics of successful products, product life cycle, role of product design in industry, need identification and opportunity recognition, innovation and creativity in product development, customer needs analysis, Quality Function Deployment (QFD), product planning, market analysis, benchmarking and competitive analysis.

MODULE – II (8 Hours)

Concept Generation and Concept Selection

Product specifications, concept development process, creativity techniques: brainstorming, morphological charts, TRIZ, concept generation methods, screening and scoring methods, concept evaluation and selection, feasibility analysis, risk assessment, decision-making tools in product development.

MODULE – III (8 Hours)

Product Design and Engineering Analysis

Product architecture, modular and integral designs, industrial design considerations, ergonomics and human factors engineering, Design for Manufacturing (DFM), Design for Assembly (DFA), Design for Reliability (DFR), Design for Environment (DFE), material selection in product design, engineering analysis using CAD and CAE tools.

MODULE – IV (8 Hours)

Prototyping, Testing and Product Validation

Prototype development techniques, physical and virtual prototyping, rapid prototyping and additive manufacturing, product testing and evaluation, design verification and validation, reliability testing, failure analysis, value engineering, design optimization, product documentation and technical reports.

MODULE – V (6 Hours)

Product Launch, Sustainability and Emerging Trends

Product economics and cost analysis, intellectual property rights (IPR), patents and design registration, product launch strategies, supply chain considerations, sustainable product development, life cycle assessment (LCA), eco-design, Industry 4.0 in product development, digital twins, smart products, case studies of successful product innovations.

Text Books

1. Product Design and Development, McGraw-Hill Education.
2. Engineering Design: A Systematic Approach, Springer.
3. Product Design and Manufacture, PHI Learning.

Reference Books

1. The Mechanical Design Process, McGraw-Hill.
2. Product Design Techniques in Reverse Engineering and New Product Development, Pearson.
3. Design and Development of Medical Electronic Instrumentation, Wiley.
4. Total Design: Integrated Methods for Successful Product Engineering, Addison-Wesley.