GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical Engineering / Mechanical (CAD/CAM) / Mechatronics / Automobile Engineering / Fabrication Technology

Subject Code: DI05000311

Subject Name: Product Design and Development

w. e. f. Academic Year:	2026-27
Semester:	5th
Category of the Course:	MOPEC-02

Prerequisite:	Students should have a basic understanding of various engineering materials, their properties, and common manufacturing processes such as casting, machining, moulding and welding. Additionally, the fundamental knowledge of engineering drawing, basic awareness of metrology, tolerances, and production methods will support better understanding of the product design considerations.
Rationale:	The subject Product Design and Development is designed to introduce the diploma students to the systematic approach of transforming ideas into functional and manufacturable products. In today's competitive industrial environment, successful products require not only functionality but also considerations of cost, manufacturability, reliability, ergonomics and sustainability.

Course Outcome:

After completion of the course, the student will be able to:

No	Course Outcomes
CO1	Utilize product design fundamentals and value engineering concepts to evaluate product functions and cost.
CO2	Use QFD to develop product concept based on customer needs.
CO3	Apply product design tools including CAD and concurrent engineering in the product design process.
CO4	Apply DFX and DFMA principles to design manufacturable, reliable and cost-effective products.
CO5	Apply ergonomics principles and prototyping techniques to realize product concept.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA (I)	ESE (V)	
3	0	0	3	70	30	00	00	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Product Design Fundamentals & Value Engineering** **Product Design Fundamentals** 1.1 Product design – definition, need and importance 1.2 Product development process – stages and overview 1.3 Difference between product design and product development process 1.4 Product Life Cycle (PLC) 1.5 Product policy of organization 1.6 Selection of profitable product 1.7 Introduction to Intellectual Property / Patents 1.8 Product analysis (with suitable examples) 1.9 Case studies of successful / unsuccessful product development **Value Engineering** 1.10 Introduction to Value Engineering 1.11 Value = Function / Cost concept 1.12 Types of functions: Primary, Secondary, Unnecessary 1.13 Functional analysis (FAST – basic idea) 1.14 Advantages and applications of Value Engineering	**09**	**20%**
2.	**Customer Needs & Concept Development** 2.1 Customer needs identification methods 2.2 Quality Function Deployment (QFD) / House of Quality 2.3 Pugh Concept Selection Matrix	**09**	**20%**

	2.4 Market survey and benchmarking 2.5 Product specifications 2.6 Concept generation: Brainstorming, SCAMPER, Morphological analysis 2.7 Concept selection methods		
3.	**Product Design Methods and Tools** 3.1 Introduction to product design tools 3.2 Role of CAD in product design 3.3 Introduction to Robust Design 3.4 Introduction to FMEA (Failure Mode and Effect Analysis) 3.5 Modular vs. Integral architecture 3.6 Concurrent Engineering: Concept, Applications and advantages 3.7 Reverse Engineering: Concept, Applications and advantages 3.8 Introduction to Use of AI in product design and Development	**08**	**18%**
4.	**DFX Principles & DFMA Guidelines** 4.1 Introduction to Design for X (DFX): DFM, DFA, Design for Cost, Design for Reliability, Design for usability and user experience (UX), Design for Sustainability / Green Design, Design for Recycling / Disassembly, 4.2 DFMA – concept and importance 4.3 General design guidelines (reduce parts, standardization, simplification) 4.4 Design for casting, machining, injection molding, welding 4.5 Design for manual assembly and efficiency metrics 4.6 Material selection for manufacturability 4.7 Case studies and DFMA applications 4.8 Basic cost considerations: Product costing and pricing basics	**10**	**22%**
5	**Ergonomics, Prototyping & Product Realization** 5.1 Industrial design basics 5.2 Aesthetics in product design 5.3 Ergonomics and anthropometry	**09**	**20%**

	5.4 Design for safety and comfort 5.5 Proof of Concept, Need and types of prototyping 5.6 Rapid prototyping – concept, advantages and applications 5.7 Working principle of FDM, SLA, SLS 5.8 Design testing and validation		
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	40	10	00	00	00

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

Sr. No	Title of Book	Author	Publication
1	Product Design and Development	Karl Ulrich, Steven Eppinger and Maria C. Yang	McGraw Hill Publication
2	Product Design and Manufacturing	A.K.Chitale, R.C.Gupta	PHI Learning Pvt. Ltd.
3	Engineering Design	George Dieter , Linda Schmidt	McGraw Hill Publication
4	Fundamentals of Product Design	Richard Morris	Bloomsbury Visual Arts Publication
5	The Design of Everyday Things	Donald A. Norman	MIT Press
6	Change by Design	Tim Brown	Harper Business
7	Design for Manufacturability	David M. Anderson	Productivity Press,
8	Universal Principles of Design	William Lidwell	Rockport Publishers
9	The Laws of Simplicity	John Maeda	MIT Press

Open source software and website:

i. https://onlinecourses.nptel.ac.in/noc21_me83/preview
ii. https://nptel.ac.in/courses/112107217
iii. https://www.freecad.org
iv. https://www.blender.org
v. https://openscad.org
vi. https://www.thingiverse.com
vii. https://www.ideo.com

Suggested Activities for Students:

Other than the traditional classroom teaching and learning, following are the suggested student-related ***co*-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course. The students should perform the following activities in groups and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

- Select industrial components (approved by teacher) and list the design factors.
- Conduct a mini market-survey and prepare a QFD chart for a chosen product.
- Apply DFMA principles to redesign a given component — count parts, suggest simplification.
- Prepare a prototype model (even from paper or cardboard) of a simple product and document it.
- Perform a "Product Aesthetics Makeover" by evaluating an existing product and redesigning it to enhance the visual appeal and user experience.

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