Subject Code	Subject Title	L	T	P	C	H
BME4109	Product Design and Development, Generative Design	2	1	0	3	3
Prerequisite	Engineering Drawing, Manufacturing Processes, Computer-Aided Design (CAD)					

Course Objective:

- To understand the fundamental principles of product design and development.
- To learn various methods for identifying customer needs and translating them into engineering specifications.
- To gain proficiency in human-machine interface design principles and prototyping techniques.
- To explore the application of generative AI in product design and development.
- To develop skills in utilizing Large Language Models for product design tasks.

Modules	Lec.
Module-I: Introduction Need for product development, Engineering design types, Design process, Product lifecycle, Design codes and standards, Societal considerations, Generic product development process, Market research and segmentation.	**6**
Module II: Product Design and Development Identifying customer needs (VOC), Affinity diagrams, House of Quality, Product design specifications, Competitive benchmarking, Case studies.	**6**
Module-III: Human Machine Interface Industrial design, Human factors design, Design for serviceability, Design for environment, Prototyping, Cost evaluation, Costing methods (activity-based costing, value analysis).	**7**
Module-IV: Generative AI Introduction to Generative AI, Use cases, Lifecycle of a Generative AI project, Prompt engineering, Opportunities and risks.	**6**
Module-V: Large Language Models Core concepts of LLMs, Prompt engineering best practices, LLM APIs and applications.	**5**
Total Hours	**30**

COURSE OUTCOMES

CO1	Explain the stages of the product development lifecycle and the significance of various design considerations.
CO2	Apply Quality Function Deployment (QFD) and other techniques to translate customer needs into product specifications.
CO3	Analyze human factors and ergonomics in designing user-friendly interfaces and develop cost-effective design solutions.
CO4	Evaluate the potential of generative AI and LLMs in enhancing product design efficiency and identify potential risks.
CO5	Design and prototype a product using generative AI tools and LLMs, documenting the design process and justifying design choices.

CORRELATION OF COS WITH POS

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	2			1							2
CO2	2	3	3										2
CO3	2	2	3				1						1
CO4	2				3	2		1					3
CO5	2		3		3							1	3
Avg.	2.2	2.2	2.6		3.0	1.3	0.2	0.2				0.2	2.2

Text book:

- George E. Dieter, Linda C. Schmidt, “Engineering Design”, McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9.
- Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development “, 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9.
- Joseph Babcock and Raghav Bali, “Generative AI with Python and Tensor-Flow 2”

Reference book:

- Yousef Haik, T. M. M. Shahin, “Engineering Design Process”, 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141.
- Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7

Evaluation scheme

Internal Assessment	MID Semester Exam	End Semester Exam
30%	20%	50%
Assignment, MCQ, Report Submission, Quiz, Class Test, Presentation	MCQ or Theory Paper	Theory Paper

Subject Code	Subject Title	L	T	P	C	H
BME4112	Product Design and Development, Generative Design Lab	0	0	2	1	2
Prerequisite	Engineering Drawing, Manufacturing Processes, Computer-Aided Design (CAD)					

List of Practicals

1. Conduct a market survey to identify customer needs for a specific product.
2. Develop a House of Quality matrix to translate customer needs into product design specifications.
3. Create a 3D model prototype of a product using CAD software.
4. Analyze the ergonomics of an existing product and suggest improvements.
5. Conduct a life cycle assessment of a product to evaluate its environmental impact.
6. Explore a specific generative design software and create simple design variations.
7. Apply constraints and optimization parameters in generative design for a given problem.
8. Practice prompt engineering techniques to refine generative design outputs.
9. Use an LLM to research and select appropriate materials for a product design.
10. Estimate the manufacturing cost of a prototype and perform a value analysis exercise.

Evaluation scheme

Continuous Evaluation	End Practical Exam
50%	50%
Lab report Submission+ Attendance+ Internal evaluation	Written exam + Performance + Viva