GUJARAT TECHNOLOGICAL UNIVERSITY
Program Name: Industry Led Minor/Hons.
Level: UG
Branch: Industrial Additive Manufacturing
Course / Subject Code : BE04IAV011
urse / Subject Name :Fundamental of 3D Modeling for Additive Manufacturing

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Core Courses

Prerequisite:	Basics of mechanical engineering and computer skills. Open for all streams
Rationale:	Learners will design and prepare digital models using CAD tools while understanding geometry, tolerance, and printability concepts—skills directly relevant to product design, prototyping, and manufacturing industries, building a strong foundation for careers in design engineering and advanced manufacturing.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	Develop a mindset that embraces 3D modeling principles as a foundation for modern manufacturing practices.	C
02	Evaluate advancements in AM technologies, materials, and processes driving innovation and industrial transformation.	E
03	Differentiate major AM process categories based on operating principles, material compatibility, and application domains.	N
04	Identify and categorize diverse AM applications across sectors such as aerospace, automotive, biomedical, and consumer products.	R,U
05	Practice 3D modeling to explore the possibilities and limitations of design for manufacturing.	A
06	Demonstrate proficiency in design and simulation tools such as Rhino3D and TinkerCAD for digital model creation and validation.	A,C

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours/week)			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
4	0	2	5	100	0	0	0	100

*Total Lecture Hrs. (L) =60	Total Practical Hrs. (PR) =30.	Total Hours =90 Hrs

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Evolution of Additive Manufacturing • Early development & first AM processes • Shift from prototyping to industrial production • Key technological breakthroughs • Current trends and future outlook	10	10%
2.	Classification and Overview of Additive Manufacturing Technologies • ISO/ASTM seven-process classification • Material-based segmentation (polymers, metals, composites) • Working principles of major AM processes • Comparison of accuracy, cost, and applications	10	10%
3.	Applications of Additive Manufacturing Across Industry Sectors • Automotive, aerospace & defense applications • Healthcare: implants, guides & prosthetics • Consumer goods & customization • Industrial tooling, jigs & fixtures	10	10%
4.	Additive Manufacturing Types of Applications • Rapid & functional prototyping • End-use part production • Mold-making & casting patterns • Repair, refurbishment & low-volume manufacturing	10	10%
5.	Fundamentals of 3D Modeling Using Tinker CAD • Interface & basic tools • Shape creation, grouping & alignment • Scaling, rotation & precision editing • Exporting models for 3D printing	15	10%
6.	Advanced 3D Modeling Techniques for Additive Manufacturing • Design for Additive Manufacturing (DfAM) • Support-optimized & overhang-safe modeling • Tolerances for assemblies & moving parts • Preparing complex models for slicing	35	50%
	Total	**90**	100

Suggested Specification Table with Marks:

Distribution of Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
5	15	25	15	15	25

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

Skill & Practical Activities to be carried out during Semester

Sr. No.	Category of Engagement	Describe the activities to be carried out by students in brief	Expected Frequency & Duration	Mode of Delivery (Online / Offline / Hybrid)	Tools / Platforms / Equipment / Machinery to be Used	Expected major Learning Outcomes
1	Tutorials / Guided Technical Sessions	Introduction to Tinker CAD & Rhino3D; basic	3 sessions × 2 hours each	Offline & Hybrid	TinkerCAD, Rhino3D,	Understand basic CAD commands and interface navigation • Learn how digital models are prepared before printing • Build confidence in creating simple printable models
2	Hands-on Training / Lab Exercises / Tool-Based Learning	Students perform slicing, support generation, and basic print preparation; run supervised print jobs on SLA/FFF machines.	4 sessions × 3 hours	Offline (Lab)	SLA printers (Form 2), FFF Markforged Mark 2, washing/IPA machine, UV curing chamber, slicers	Understand slicing, layer height, supports & material selection • Gain hands-on experience on SLA/FFF printers • Learn workflow: design → slice → print → wash → cure

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3	Equipment Familiarization / Machine Handling	Introduction and safety training for SLS Fuse 1+1, sieving/powder handling, blasting machine, SLA post-processing workflow.	2 sessions × 2 hours	Offline (Lab)	Formlabs Fuse 1+1 SLS system, sieving/powder mixing machine, blasting machine, SLA curing station	Understand machine components, workflow & safety protocols • Learn powder-handling & post-processing operations • Recognize differences between SLA, SLS, FFF technologies
4	Prototype Development / Capstone Build / Hardware Integration	Students create one simple model in TinkerCAD (keychain, small bracket, nameplate); slice and print it using SLA/FFF.	1 project (6–8 hours total)	Offline / Hybrid	TinkerCAD, SLA/FFF printers, slicers, post-processing equipment	• Apply learned CAD skills to create a functional small model • Understand end-to-end AM workflow from design → prototype • Improve creativity & problem-solving using real manufacturing constraints

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