GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons.
Level: UG
Branch: Industrial Additive Manufacturing
Subject Code : BE05IAV011
Subject Name :Solid –Based Additive Manufacturing Principles and Applications(FDM/FFF)

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

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	Explain the underlying principles, mechanisms, and workflows of FDM/FFF additive manufacturing systems.	U
02	Analyze the role of process parameters and material properties in determining print quality and mechanical performance.	N
03	Apply design-for-additive-manufacturing (DfAM) principles to create optimized 3D models for FDM/FFF processes.	A
04	Utilize CAD and slicing software to generate, simulate, and prepare models for printing using appropriate toolpaths and G-code.	A
05	Diagnose and troubleshoot common defects in FDM/FFF prints through systematic error analysis and calibration procedures.	E
06	Evaluate post-processing techniques to enhance dimensional accuracy, surface finish, and part functionality.	E

**Revised Bloom's Taxonomy (RBT)*

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons.
Level: UG
Branch: Industrial Additive Manufacturing
Subject Code : BE05IAV011
Subject Name :Solid –Based Additive Manufacturing Principles and Applications(FDM/FFF)

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)	
04	00	02	4	100	00	00	00	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.	Fundamentals of FDM/FFF Additive Manufacturing Processes	5	5%
2.	Structural Architecture and Operating Principles of FDM/FFF Systems	5	5%
3.	Polymer Material Science and Filament Selection Criteria	5	5%
4.	Design for Additive Manufacturing (DfAM) – FDM/FFF Applications	10	10%
5.	CAD Modeling, Slicing Algorithms, and G-code Generation	20	25%
6.	Diagnostics and Calibration of FDM/FFF Systems	10	10%
7	Process Parameter Optimization and Print Quality Enhancement	25	30%
8	Surface Finishing and Post-Processing of Printed Components	10	10%
	Total	90	100

Suggested Specification Table with Marks:

Distribution of Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**10**	**25**	**15**	**25**	**15**

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons.
Level: UG
Branch: Industrial Additive Manufacturing
Subject Code : BE05IAV011
Subject Name :Solid –Based Additive Manufacturing Principles and Applications(FDM/FFF)

Skill & Practical Activities to be carried out during Semester						
Important Note:- Please keep only applicable categories relevant to your offerings in this table and delete not applicable categories“						
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 in 2 or 3 bullet points**
1	Tutorials / Guided Technical Sessions	Introduction to FDM/FFF system workflow; slicing in Cura & Eiger; infill, shell, layer height, supports; G-code path preview & parameter explanation.	3 sessions × 2 hours	Offline	Markforged Mark 2, Cura, Eiger, Smart TV, Computers	• Understand key slicing parameters and their effect on print quality • Learn G-code preview & toolpath understanding • Build capability to prepare FDM-ready files independently
2	Hands-on Training / Lab Exercises / Tool-Based Learning	Students slice and print calibration cubes, tensile samples, and overhang test parts on the Markforged Mark 2; analyze layer adhesion, stringing, bridging.	4 sessions × 3 hours	Offline	Markforged Mark 2, Eiger slicer, Digital caliper (optional), Print removal & cleaning tools	• Gain hands-on experience operating FDM/FFF machines • Identify effects of temperature, speed, infill on print results • Learn print failure diagnosis and preventive tuning

3	Equipment Familiarization / Machine Handling	Orientation to filament handling, bed leveling, nozzle maintenance, cleaning, part removal techniques; demonstration of SLA/SLS differences for comparison.	2 sessions × 2 hours	Offline	Markforged Mark 2, Form 2 (SLA), Fuse 1+1 (SLS), Bed leveling tools, Maintenance kit	• Understand machine components & FDM maintenance protocols • Learn filament loading, purge, leveling, cleaning operations • Compare FDM workflow with SLA & SLS for better understanding
4	Prototype Development / Capstone Build / Hardware Integration	Students design a small functional FDM part (e.g., bracket, enclosure, clamp) using Rhino3D; slice in Eiger/Cura; print & evaluate surface finish; minor post-processing.	1 project (6-8 hours)	Offline / Hybrid	Rhino3D, Eiger/Cura, Markforged Mark 2, Finishing tools (blade, file), blasting unit (optional)	• Apply DfAM concepts to create FDM-optimized designs • Execute complete prototype workflow from design to evaluation • Improve practical understanding of print defects & corrections

* * * * * * *