GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code : ME02000491

Subject Name : Additive Manufacturing Processes

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Nil
Rationale:	The idea of building a three dimensional object using two dimensional cross sections is done by Rapid Prototyping (RP). Rapid Prototyping is present demand of Industry that defined as a group of techniques used to quickly fabricate a scale model of a part or assembly using three-dimensional computer aided design (CAD) data. Many designers and companies use prototypes and models for the purpose of product and functionality testing of new designs they can also be used to obtain customer feedback for new products. This subject helps students to visualize product and its features and analysis for new product development.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Able to Understand virtual prototyping and testing of technology.	Understand
2	Able to understand the importance of Physical Prototyping,	application
3	Able to understand Rapid Manufacturing technologies and Synergic Integration Technologies in the present technological era	create

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 / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**INTRODUCTION**	10	20

	Overview – History - Need-Classification -Additive Manufacturing Technology in product development- Materials for Additive Manufacturing Technology – Tooling - Applications.		
2.	**CAD & REVERSE ENGINEERING –** Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.	10	22
3.	**LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS** Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object	10	24
4.	**POWDER BASED ADDITIVE MANUFACTURING SYSTEMS** Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.	10	24
5.	**MEDICAL AND BIO-ADDITIVE MANUFACTURING** Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies	05	10
	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**
--	**10**	**30**	**20**	**20**	**10**

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

References/Suggested Learning Resources:

(a) Books:

(1) Rapid Product Development- Synergic integration of time-compression technologies K. P. Karunakaran, V. P. Bapat, Sreenath Babu Akula P. D. Solanki Gaurav Gupta, V.R. Prasanth, Saket Anand, Arnab Sarkar and S. Venkatkrishnan

(2) Manufacturing Processes for Engineering Materials Serope Kalpakjion and Steven R. Schmid- Pearson Education
(3) Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
(4) Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
(5) Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

(b) Open-source software and website:

1. The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester.
2. NPTEL
3.https://en.wikipedia.org/wiki/Rapid_prototyping
4. http://www.factoryoffactories.com/rapidprotot.htm

Suggested Course Practical List: NIL

Basic Experiments with Material Extrusion (FDM)

- **Print with different infill patterns:**

Compare the strength and weight of objects printed with various infill patterns like lines, grids, and honeycomb structures.

- **Optimize layer height:**

Experiment with different layer heights to observe how it affects print quality, surface finish, and build time.

- **Material compatibility testing:**

Test the adhesion of different filament types when printed together to create multi-material objects.

Powder Bed Fusion Experiments (SLS, SLM)

AS per available facility

List of Laboratory/Learning Resources Required:

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