



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171926

Semester – VII

Subject Name: RAPID PROTOTYPING

Type of course: Professional Elective

Prerequisite: Nil

Rationale:

In present era it is highly essential to be able to prepare final product or its prototypes at the earliest. This is desirable to ensure that all the expected requirement of product are addressed and if required, its performance is also assessed from the prototype. Rapid prototyping offers a convenient option for manufacturing of product or its prototype from the CAD model

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process. Distinction between RP and CNC, other related technologies.	04
2	CAD Modelling and Data Processing for RP: CAD model preparation, Data interfacing: formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), conversation, validity checks, repair procedures; Part orientation and support generation, Support structure design, Model Slicing algorithms and contour data organization, direct and adaptive slicing, Tool path generation.	12
3	RP Processes: Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes. Photopolymerization (Stereolithography (SL), Microstereolithography), Powder Bed Fusion (Selective laser Sintering (SLS), Electron Beam melting (EBM)), Extrusion-Based RP Systems (Fused Deposition Modelling (FDM)), 3D Printing, Sheet Lamination (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), Beam Deposition (Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD)).	22
4	Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS.	04
5	RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.	03



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Total Hours	45
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	25	20	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
5. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer,

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Distinguish RP and other related technology	10
CO-2	Understand and use techniques for processing of CAD models for rapid prototyping.	35
CO-3	Apply fundamentals of rapid prototyping techniques.	25
CO-4	Use appropriate tooling for rapid prototyping process.	20
CO-5	Create component with RP applications	10

List of Experiments:

Experiments based on above contents and should include below mentioned topics.



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- 1) Review of CAD Modelling Techniques and Introduction to RP
- 2) Generating STL files from the CAD Models & Working on STL files
- 3) Processing the CAD data in Catalyst software (Selection of Orientation, Supports generation, Slicing, Tool path generation)
- 4) Fabricating the physical part on a RP machine
- 5) Prepare a CAD model with complex geometry and study effect of slicing parameters on final product manufactured through RP.

Design based Problems (DP)/Open Ended Problem: 1. Write codes to implement slicing algorithm.
2. Compare effect of slicing on quality of final product.

Major Equipment: 1. CAD Tools. 2. Rapid prototyping machine. 3. 3D Printer.

List of Open Source Software / Learning Website:

1. <http://nptel.ac.in/syllabus/syllabus.php?subjectId=112104156>