

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING RAPID PROTOTYPING SUBJECT CODE: 2181914 SEMESTER: 8

Type of course: Undergraduate

Prerequisite: Zeal to learn the Subject

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)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process.	4	10%
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	30%
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)).	25	55%
4	Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS.	3	5%

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 Outcome:

On completion of this course students will be able to:

1. Understand and use techniques for processing of CAD models for rapid prototyping.
2. Understand and apply fundamentals of rapid prototyping techniques.
3. Use appropriate tooling for rapid prototyping process.
4. Use rapid prototyping techniques for reverse engineering.

List of Tutorials:

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. Learning techniques for fabricating an assembly
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>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.