

Branch Name:	Mechanical Engineering
Semester/Year:	Semester VIII / Forth Year
Subject Title:	Rapid Prototyping and Tooling
Subject Code:	1ET1010806
Pre-requisite:	Zeal to learn the Subject

Course Objectives:

1. Generating a good understanding of Rapid Prototyping history, its development and applications.
2. To expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	04	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction: Historical development, definition of RPD, product development cycle, components of RPD, fundamentals of rapid prototyping, classification of rapid manufacturing Processes: Additive, subtractive, formative, generic RP process, advantages of rapid prototyping. Issues in RP and emerging trends, traditional prototyping vs. rapid prototyping, rapid prototyping applications.	04	10
2	CAD Modeling and Data Processing for RP: CAD model preparation, data requirements, data formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), data interfacing, part orientation and support generation, support structure design, model slicing and contour data organization, direct and adaptive slicing, tool path generation.	04	10
3	RP Processes: Process physics, tooling, process analysis, material and technological aspects, applications, limitations and comparison of various rapid manufacturing processes. Photo polymerization (Stereolithography (SL), micro Stereolithography), powder bed fusion (selective laser sintering (SLS), electron beam melting (EBM)), extrusion-based RP Systems (fused deposition modeling (FDM)), 3D Printing, sheet lamination (laminated object manufacturing (LOM), ultrasonic Consolidation (UC)), beam deposition (laser engineered net shaping (LENS), direct metal deposition (DMD)).	20	45
4	Reverse Engineering: Basic concept, Digitization techniques, Model Reconstruction, Data Processing for Rapid Prototyping, Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development.	06	15
5	Computer Aided Process Planning: Methodology, evaluation, types, CAD/CAM integration and CAPP features rapid prototyping: dawn of slice age, benefits, applications, important issues and popular RP process	04	10

6	Rapid Tooling (RT): Introduction to RT, indirect RT processes - Silicon rubber molding, epoxy tooling, spray metal tooling and investment casting; direct RT processes- laminated tooling, powder metallurgy based technologies, welding based technologies, direct pattern making (quick Cast, full mold casting); emerging trends in RT.	04	10
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Course Outcomes:

The student will be able to

1. To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields.
2. Understand and use techniques for processing of CAD models for rapid prototyping.
3. Understand and apply fundamentals of rapid prototyping techniques.
4. Use rapid prototyping techniques for reverse engineering.

List of Reference Books:

1. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
2. Ghosh Amitabha,. "Rapid Prototyping-A Brief Introduction." Affiliated East-West Press Pvt Ltd, New Delhi, India (1997).
3. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.
4. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
5. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
6. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.

List of Practical:

1. Review of CAD Modeling 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. To study the Stereo lithography process- A case study.
5. Fabricating the physical part on a RP machine.
6. To study the Laminated object manufacturing process- A case study.
7. To study the Three dimensional printing processes- A case study.
8. Prepare a CAD model with complex geometry and study effect of slicing parameters on final product manufactured through RP.
9. Prepare any one case study on Rapid Prototyping processes.
10. Preparation of any prototyping model.

E-Resources:

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