



SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology
Bachelor of Technology



Mechanical Engineering Department
B. Tech. Semester VII

Course Name : **Rapid Prototyping** **Course Code: BTME19722**
Type of course : **Honors – CAD/CAM**
Prerequisite : Computer Aided Design
Rationale of course : This course is a step in this direction to bolster their skills in advanced technologies by learning design, development, and manufacturing using Rapid Manufacturing technologies.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
2	0	4	4	60	25	15	60	40	200

CA1: Continuous Assessment (assignments/projects/open book tests/closed, book tests.) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self, learning attitude/solving advanced problems. **TEE:** Term End Examination. **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course). **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in the course.

Content:

Sr. No.	Content	Total Hrs	Module Weightage
1	Introduction and Basic Principles: Prototype fundamentals, historical development, engineering design process, fundamentals of rapid prototyping, advantages of rapid prototyping, classifications of rapid prototyping system, virtual and rapid prototyping in product development, distinction between RP and CNC, other related technologies, reverse engineering, scanning method, data processing for surface reconstruction, additive manufacturing application in various field.	4	15%
2	Rapid Prototyping Process Chain: Classification of rapid prototyping processes: solid; liquid and powder based rapid prototyping systems, guidelines for process selection, materials selections and product prototyping, product and prototype cost estimation, direct and indirect methods for rapid tool	6	20%



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	production, technical characteristics and technological capabilities of rapid prototyping systems.		
3	CAD Modelling and Data Processing for RP: Conceptualization and CAD, GUI of CAD software tools, common CAD files types, design for Additive Manufacturing (AM), data interfacing, three and two dimensional translators, GUI of slicing software tools, parameter setting, exporting G-code file, transfer to AM machine and STL file manipulation.	10	30%
4	Rapid Prototyping Process Optimisation: Factors influencing accuracy, data preparation, part building, part finishing, and selection of part build orientation, Errors in pre-processing, processing and post-processing operation.	3	10%
5	3D Printing Technology: Basic Components of 3D Printer, machine setup, removal and clean-up, troubleshooting of 3D Printer, checking and preparing, tools for post processing, support material removal, surface texture improvements, aesthetic improvements, property enhancements using thermal and non-thermal techniques.	7	25%

Percentage Distribution of Marks as per Revised Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of 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, **E:** Evaluate, **C:** Create and above Levels

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.



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Reference Books:

Sr. no.	Title of book /article	Author(s)	Publisher	Publication Year	Publication Edition
1	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David Rosen, Brent Stucker	Springer Nature	2014	2 nd
2	Rapid Prototyping: 3D Printing and Additive Manufacturing Principles and Applications	Chua, Chee Kai & K F Leong	World Scientific	2019	5 th
3	Introduction to rapid prototyping: Additive Manufacturing	Shashidhar GS	Gajanana publications	2020	1 st
4	Rapid Prototyping and Engineering applications: A tool box for prototype development	Frank W. Liou	CRC Press	2017	1 st
5	Rapid Manufacturing	D. T. Pham and S.S. Dimov	Springer	2011	1 st

Course Outcomes (CO's):

CO No.	CO Statement After learning this subject, students will be able to	Marks % Weightage
CO-1	Distinguish Rapid Prototyping and other related technology.	15
CO-2	Analyze the operation of various techniques and recommend an appropriate process for a given material and application.	20
CO-3	Integrate design concepts with CAD for geometry preparation for rapid prototyping of part.	30
CO-4	Apply fundamentals concept of optimization in product development.	10
CO-5	Create component with rapid prototyping technology.	25



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Mapping of CO's with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1
CO-2	1	1	2	2	1	2	1	1	2	1	1	1	1	2	2
CO-3	2	2	3	2	3	2	2	2	2	3	2	1	2	3	3
CO-4	2	2	3	2	3	2	2	1	2	2	2	2	2	3	3
CO-5	2	1	2	2	3	2	2	1	2	2	2	2	1	2	3
Rationale *	8	7	11	9	12	9	8	6	9	9	9	7	7	12	12

Rationale - Mapping of CO's with PO's and CO's with PSO's:

According to CO and PO mapping, this course will give basic understanding of design and development of solutions by using modern tool usage with real life problems.

According to CO and PSO mapping, students will able to design and analyze mechanical systems using modern computing and apply their technical, managerial and other soft skills in research-innovation work, startups and higher studies to become a responsible technocrat and excel in their professional life.

This course highly maps with PO 3, 5 and PSO 2, 3. It states that the course will develop Design / development of solutions, Modern tool usage. This Course also focuses on Engineering knowledge, Problem analysis, Conduct investigations of complex problems, The engineer and society, Environment and sustainability, Ethics, Individual and teamwork, Communication, Project management and finance, Life-long learning.

List of Experiments:

- 1) To study of Rapid Prototyping and CAD Modelling Techniques.
- 2) Case study of Additive Manufacturing processes and materials for product development.
- 3) Part coding using computer aided process planning for a given product.
- 4) To analyze processing the CAD data in Catalyst software.
- 5) Prepare a CAD model geometry using 3D modeling software tools.
- 6) Demonstration of the various Additive Manufacturing process.
- 7) Development of physical part using FDM Printer.
- 8) Case study report for a final physical part development process.



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Major Equipment:

1. Computational Facility
2. 3D Printer

List of Open learning website:

1. <https://archive.nptel.ac.in/courses/112/104/112104265/>
2. <https://archive.nptel.ac.in/courses/108/108/108108115/>

List of Open Source Software:

- 3D Modeling and simulation Software