ADDITIVE MANUFACTURING
(Open Elective-II)

Course code	23ME2603	Year	III	Semester	II
Course category	Open Elective - II	Offered Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre requisites	Material Science And Metallurgy, Manufacturing Processes
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes: At the end of the course students will be able to

CO's	Statement	BTL
CO1	Explain the Fundamentals and Evolution of AM, principles, classification and liquid-based AM systems.	L2
CO2	Understand and apply different types of solid-based AM systems.	L2
CO3	Apply powder-based AM systems.	L3
CO4	Analyze and apply various rapid tooling techniques.	L4
CO5	Understand different types of data formats and explore the applications of AM processes in various fields.	L2

Contribution of Course outcomes towards achievement of programme outcomes &Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3		2	2					2		2	3	2
CO 2	3		2	2	2				2		2	3	2
CO 3	3		2	2	2				2		2	3	2
CO 4	3		2	2	2				2		2	3	2
CO 5	3		2	2	2				2		2	3	2

SYLLABUS		
Unit	**Contents**	**Mapped CO**
I	**INTRODUCTION**: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process. **LIQUID-BASED RAPID PROTOTYPING SYSTEMS**: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	**CO1 CO2**

II	**SOLID-BASED RAPID PROTOTYPING SYSTEMS**: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modelling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	**CO1** **CO3**
III	**POWDER BASED RAPID PROTOTYPING SYSTEMS**: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	**CO1** **CO4**
IV	**RAPID TOOLING**: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting process. Direct rapid tooling: Direct AIM, LOM Tools, and Direct Metal Tooling using 3DP.	**CO1** **CO5**
V	**RAPID PROTOTYPING DATA FORMATS**: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, and Newly Proposed Formats. **RP APPLICATIONS**: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, RP medical and bioengineering applications: customized implants and prosthesis, forensic sciences.	**CO1** **CO5**

Learning Resource

Textbooks:

1. Rapid Prototyping: Principles and Applications – C. K. Chua, K. F. Leong, and C. S. Lim, World Scientific Publishing.
2. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing – Ian Gibson, David W. Rosen, and Brent Stucker, 2nd Edition, Springer, 2015.

Reference books

1. Rapid Manufacturing – D. T. Pham and S. S. Dimov, Springer.
2. Wohlers Report 2000 – Terry T. Wohlers, Wohlers Associates.
3. Rapid Prototyping and Manufacturing – Paul F. Jacobs, ASME Press.
4. Rapid Prototyping – C. K. Chua and K. F. Leong.

E-Resources & other digital Material:

1. *Additive Manufacturing* – NPTEL (ME50) https://onlinecourses.nptel.ac.in/noc20_me50/preview
2. *Advanced Manufacturing Processes* – NPTEL (ME115) https://onlinecourses.nptel.ac.in/noc21_me115/preview