Additive Manufacturing

Course Code	23ME2603	**Year**	III	**Semester**	II
Course Category	OE- II	**Branch**	ME	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Material Science and Metallurgy, Manufacturing Processes
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		BL
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

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3		2	2					2		2		
CO2	3		2	2	2				2		2		
CO3	3		2	2	2				2		2		
CO4	3		2	2	2				2		2		
CO5	3		2	2	2				2		2		
Average	3		2	2	2				2		2		

Syllabus		
Unit No.	**Contents**	**Mapped CO**
1	**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

2	**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
3	**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
4	**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
5	**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 Resources
Text books:
1. Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping: Principles and Applications, 3rd Ed., World Scientific publications.2010 2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Ed., Springer, 2015.
Reference books
1. D.T. Pham and S.S. Dimov, Rapid Manufacturing, 1st Ed., Springer,2001 2. Terry T Wohlers, Wohlers Report 2000, 1st Ed., Wohlers Associates,2000 3. Paul F. Jacobs , Rapid Prototyping & Manufacturing, ASME Press,1993 4. C. K. Chua and K. F. Leong., Rapid Prototyping: Principles and Applications, 1st Ed., World Scientific publications.1997
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