ADDITIVE MANUFACTURING

Course code	23ME2603	Year	III	Semester	II
Course category	Open Elective - 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: At the end of the course students will be able to

CO's	Statement	Blooms Level	Units
CO1	Explain the Fundamentals and Evolution of AM, principles, classification and liquid-based AM systems.	L2	1,2,3, 4,5
CO2	Understand and apply different types of solid-based AM systems.	L3	1
CO3	Apply powder-based AM systems.	L3	2
CO4	Analyze and apply various rapid tooling techniques.	L3	3
CO5	Understand different types of data formats and explore the applications of AM processes in various fields.	L3	4

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2	2						2		2	3	2
CO2	3		2	2	2					2		2	3	2
CO3	3		2	2	2					2		2	3	2
CO4	3		2	2	2					2		2	3	2
CO5	3		2	2	2					2		2	3	2

Unit	Contents	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, CO6**

Learning Resource
Text books:
TEXT BOOKS: 1.Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications. 2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 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 & Manufacturing / Paul F.Jacobs/ASME Press 4. Rapid Prototyping / Chua and Liou

E-Resources & other digital Material:
1. https://onlinecourses.nptel.ac.in/noc20_me50/preview 2. https://onlinecourses.nptel.ac.in/noc21_me115/preview