

ADDITIVE MANUFACTURING

Course Code	20ME4703B	Year	IV	Semester	I
Course Category	Professional Elective-V	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
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

	Statement	Skill	BTL	UNITS
CO 1	Understand the working principle and process parameters of different AM processes and Design and develop a product for AM process.	Understand Communication	L2	1,2,3,4,5
CO 2	Explore the Vat Photo polymerization AM Process and their applications.	Apply, Communication	L3	2
CO 3	Select the Extrusion-Based AM Processes, Sheet Lamination AM Processes suitable material and process for fabricating a given product.	Apply, Communication	L3	3
CO 4	Identify various Metal Additive Manufacturing process for different products.	Apply, Communication	L3	4,5

**Contribution of Course outcomes towards 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	1		2							2	3	1
CO2	3	2	1		2							2	3	1
CO3	3	2	1		2							2	3	1
CO4	3	2	1		2							2	3	1

Syllabus

UNIT	Content	Mapped COs
I	Introduction to Additive Manufacturing (AM): Need for Additive Manufacturing, Generic AM process, Distinction between AM and CNC, Classification of AM Processes, Steps in AM process, Advantages of AM, Major Applications	CO1
II	Vat Photopolymerization AM Processes: Stereolithography (SL), Materials, Process Modeling, SL resin curing process, SL scan patterns, Micro-stereolithography, Mask Projection Processes, Two-Photon vat photopolymerization, Process Benefits and Drawbacks, Applications of Vat Photopolymerization, Material Jetting and Binder Jetting AM Processes.	CO1, CO2
III	Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications.	CO1, CO3
IV	Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and	CO1, CO4

	ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.	
V	Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structure-properties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes.	CO1, CO4

Learning Resources

Text Books

1. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, Springer, 2015.
2. Patri K. Venuvinod and Weiyin Ma, “Rapid Prototyping: Laser-based and Other Technologies”, Springer, 2004.
3. Chua Chee Kai, Leong Kah Fai, “3D Printing and Additive Manufacturing: Principles & Applications”, 4th Edition, World Scientific, 2015.

Reference Books

1. Neil Hopkinson, Richard Hague, Philip Dickens - Rapid manufacturing_ an industrial revolution for the digital age (2006, Wiley) - libgen.lc.

E- Resources & other digital material

1. https://onlinecourses.nptel.ac.in/noc20_me50/preview
2. https://onlinecourses.nptel.ac.in/noc21_me115/preview