

ADDITIVE MANUFACTURING

Course Code	19ME4601C	Year	III	Semester	II
Course Category	Program Elective-II	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		Level
Upon successful completion of the course, the student will be able to		
CO1	Summarize the working principle and process parameters of AM processes and Design and develop a product for AM process.	L3
CO2	Discuss the Vat Photo polymerization AM Process and their applications.	L2
CO3	Illustrate the Extrusion-Based AM Processes, Sheet Lamination AM Processes suitable material and process for fabricating a given product.	L3
CO4	Outline various Metal Additive Manufacturing process for different products.	L2

	Contribution of Course Outcomes towards achievement of Program Outcomes													
	Strength of correlations (3: High, 2: Moderate, 1: Low)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1	1			1		2	3	1
CO2	3	2	1			1	1			1		2	3	1
CO3	3	2	1			1	1			1		2	3	1
CO4	3	2	1			1	1			1		2	3	1

Syllabus		
Unit No	Contents	Mapped CO s
I	INTRODUCTION TO ADDITIVE MANUFACTURING: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM. GUIDELINES FOR PROCESS SELECTION: Introduction, Selection Methods for a Part, Challenges of Selection, Example System for Preliminary Selection, Process Planning and Control.	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 photo polymerization, Process Benefits and Drawbacks, Applications of Vat Photopolymerization, Material Jetting and Binder Jetting AM Processes.	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.	CO3

	SHEET LAMINATION AM PROCESSES: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications.	
IV	POWDER BED FUSION AM PROCESSES: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.	CO4
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.	CO5

Learning Recourse(s)
Text Book(s)
<ol style="list-style-type: none"> 1. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, Springer, 2015. 2. Chua Chee Kai, Leong Kah Fai, “3D Printing and Additive Manufacturing: Principles & Applications”, 4th Edition, World Scientific, 2015.
Reference Book(s)
<ol style="list-style-type: none"> 1. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006. 2. Patri K. Venuvinod and Weiyin Ma, “Rapid Prototyping: Laser-based and Other Technologies”, Springer, 2004.
e-Resources & other digital material
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/110/106/110106146/ 2. https://nptel.ac.in/courses/112/104/112104265/