ADDITIVE MANUFACTURING

CourseCode	20ME5501	**Year**	III	**Semester**	I
Course Category	Minor in DM	**Branch**	ME	**Course Type**	Theory
Credits	4	**L – T – P**	3 – 1 – 0	**Prerequisites**	Basic 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

	Statement	Skill	BTL	Units
CO1	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
CO2	Explore the Vat Photo polymerization AM Process and their applications.	Apply, Communication	L2	2
CO3	Select the Extrusion-Based AM Processes, Sheet Lamination AM Processes suitable material and process for fabricating a given product.	Apply, Communication	L2	3
CO4	Identify various Metal Additive Manufacturing process for different products.	Apply, Communication	L2	4,5

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1		2							2		
CO2	3		1		2							2		
CO3	3		1		2							2		
CO4	3		1		2							2		

Syllabus

UNIT	Contents	Mapped COs
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	**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, case studies.	**CO1, CO2**
III	**Material Jetting AM Processes:** Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.	**CO1, CO3**

	Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.	
IV	**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, case studies **Sheet Lamination AM Processes:** Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies.	**CO1, CO4**
V	**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.	**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