DESIGN FOR ADDITIVE MANUFACTURING

CourseCode	20ME5601	Year	III	Semester	II
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	Illustrate the need of design for additive manufacturing and represent synthetic curves and surfaces using mathematical models	Understand Communication	L2	1
CO2	Apply design for additive manufacturing guidelines in designing of mass customized products	Apply, Communication	L2	2,3
CO3	Discuss design for minimal material, functionality lattice structures using topology optimization	Apply, Communication	L2	4
CO4	Identify methods of powder handling and standards related to Additive Manufacturing	Apply, Communication	L2	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		
CO2	3		1									2		
CO3	3		1									2		
CO4	3		1									2		

Syllabus

UNIT	Contents	Mapped COs
I	**Introduction to Design for Additive Manufacturing (DfAM):** Introduction to geometric modelling, Modelling of Synthetic curves like Hermite, Bezier and B-spline, Parametric Representation of freeform surfaces, Design freedom with AM, Need for Design for Additive Manufacturing (DfAM), CAD tools vs. DfAM tools, Requirements of DfAM methods, General Guidelines for DfAM, The Economics of Additive Manufacturing, Design to Minimize Print Time, Design to Minimize Post-processing.	CO1
II	**Design Guidelines for Part Consolidation:** Design for Function, Material Considerations, Number of Fasteners, Knowledge of Conventional DFM/DFA, Assembly Considerations, Moving Parts, Part redesign, Opportunities for part consolidation, challenges with part consolidation.	CO2
III	**Design for Improved Functionality:** Multi scale design for Additive	CO3

	manufacturing, Mass customization, Biomimetics, Generative design, Design of multi-materials and functionally graded materials	
IV	**Design for Minimal Material Usage:** Topology Optimization, Modelling of Design space, defining design and manufacturing constraints, performing analysis for weight reduction, maximize stiffness, minimize displacement, Post-processing and Interpreting Results, Applications of Topology Optimization, Topology Optimization Tools, Design of cellular and lattice structures, Design of support structures.	**CO 3**
V	**Other AM Considerations:** Designer Machine Operator Cooperation, Health and Safety, Material Exposure, Gas Monitoring, Gas Exhaust, Material Handling, Risk of Explosion, AM Part Standardization and Certification.	**CO1, CO4**

Learning Resources
Text books
1.A Practical Guide to Design for Additive Manufacturing, Diegel, Olaf, Axel Nordin, and Damien Motte, Springer, 2020. 2.The 3D Printing Handbook: Technologies, Design and Applications, Redwood, Ben, Filemon Schoffer, and Brian Garret, 3D Hubs, 2017.
Reference books
1.Design for Advanced Manufacturing: Technologies and Process, Laroux K, Gillespie, McGrawHill, 2017. 2.Additive Manufacturing Technologies, Gibson, Ian, David W. Rosen, Brent Stucker, and Mahyar Khorasani, Springer, 2021.
E- Resources & other digital material
1.https://courses.gen3d.com/courses/enrolled/988400 2.https://markforged.com/resources/blog/design-for-additive-manufacturing-dfam