GANPAT UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

Programme	Master of Technology	Branch	Mechanical Engineering (Specialization in Additive Manufacturing)
Semester	II	Version	1.0.0.0
Effective from Academic Year	**2025-26**	Effective for the batch Admitted in	**July 2025**
Subject code	**3ME2116**	Subject Name	**Additive Manufacturing – II**

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	2	0	5	Theory	40	60	100
Hours	3	0	4	0	7	Practical	60	40	100

Pre-requisites:

Additive Manufacturing – I, basic material science, fundamentals of CAD and manufacturing processes.

Course Learning Outcomes:

The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:

CO1: Analyze advanced additive manufacturing processes and their governing physics.
CO2: Correlate process parameters with structure–property–performance relationships of AM parts.
CO3: Apply Design for Additive Manufacturing (DfAM) principles for functional components.
CO4: Evaluate post-processing techniques, quality assurance methods, and standards for AM products.
CO5: Develop and assess industrial AM case studies for certification and qualification requirements.

Course Content

Name of UNIT	Content	Hrs
UNIT – I: Advanced Additive Manufacturing Processes	Advanced polymer AM processes, high-performance thermoplastics and elastomers, metal additive manufacturing processes including SLM, DMLS, EBM, DED variants, hybrid manufacturing systems, multi-material and functionally graded AM processes, process capabilities and limitations.	**8**
UNIT – II: Process Parameters and Optimization	Process parameter selection and optimization, energy density concepts, scan strategies, build orientation effects, support structure optimization, defect formation mechanisms (porosity, lack of fusion, distortion), residual stresses, process monitoring and control, introduction to simulation-based optimization.	**8**
UNIT – III: Post-processing, Quality Control, and Standards	Post-processing methods for polymer and metal AM parts, heat treatment, hot isostatic pressing, machining and surface finishing, dimensional accuracy and surface roughness evaluation, mechanical testing of AM parts, non-destructive testing methods, AM standards and certification (ASTM/ISO), qualification of materials and processes.	**8**

UNIT – IV: Design for Additive Manufacturing (DfAM) and Topology Optimization	DfAM principles and constraints, design rules for different AM processes, lattice and cellular structures, lightweighting strategies, topology optimization methods, generative design concepts, integration of simulation with DfAM, case studies in aerospace, automotive, and biomedical applications.	**8**
UNIT-V: Industrial Applications, Case Studies, and Certification	Industrial implementation of AM, supply chain integration, cost modeling and sustainability aspects, qualification and certification workflows, digital thread and data management, industrial and medical AM case studies, future trends in additive manufacturing.	**3**

List of Practical

The practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.

No.	Unit	Name of Practical
1	1	Parameter optimization study on FDM or SLM systems.
2	2	Design and evaluation of support structures for complex geometries.
3	3	Mechanical testing and analysis of AM-fabricated components.
4	4	Dimensional accuracy and surface quality measurement of AM parts.
5	5	Topology optimization and redesign of a component for AM.
6	6	Case study analysis of an industrial AM application.

List of Instruments / Equipment / Trainer Board	
1	Industrial or laboratory-scale AM systems (polymer and/or metal).
2	High-performance CAD/CAM workstations.
3	AM slicing and process planning software.
4	Simulation and optimization software for AM.
5	Mechanical testing and metrology equipment.

List of Reference Books

No.	Title of Reference Books	Authors	Publication
1	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing	Gibson, I., Rosen, D. W., Stucker, B.	Springer
2	Laser Additive Manufacturing of High-Performance Materials	Gu, D.	Springer
3	Standards for Additive Manufacturing Technologies	DebRoy, T.	Willey
4	Rapid Manufacturing: An Industrial Revolution for the Digital Age	Noorani R	John Wiley & Sons
5	Rapid Tooling: Technologies and Industrial Applications	Hopkinson, N., Hague, R., Dickens, P.	CRC Press