Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B Tech)

Subject: Advanced Manufacturing Process – BETME15315

Type of course: Professional elective courses

Prerequisite: Manufacturing Process, Engineering Materials

Rationale: This course equips students with cutting-edge knowledge of modern production methods used in automotive, aerospace, biomedical, and high-tech industries. Special emphasis is given to Industry 4.0, which is revolutionizing manufacturing with IoT, automation, and AI-driven process optimization.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No	Course content	Hrs.	% Weightage
1	**Unconventional Machining Processes** Mechanical Energy-Based: Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM). Electrical Energy-Based: Electric Discharge Machining (EDM), Wire EDM. Chemical & Electrochemical-Based: Chemical Machining (CHM), Electrochemical Machining (ECM), Electrochemical Grinding (ECG). Thermal Energy-Based: Laser Beam Machining (LBM), Plasma Arc Machining (PAM), Electron Beam Machining (EBM).	15	35

2	**Rapid Prototyping & Additive Manufacturing** Introduction to Additive Manufacturing (AM): Evolution, need, and benefits. Processes: Stereo Lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Solid Ground Curing (SGC), 3D Printing. Applications & Industrial Impact.	10	20
3	**Advanced Materials & Manufacturing for High-Performance Applications** Glass Science & Processing: Glass compositions, raw materials, melting techniques, furnace types, forming methods, and applications. Composite Materials: Classification, properties, and manufacturing methods – Spray Lay-Up, Wet/Hand Lay-up, Vacuum Bagging, Filament Winding, Pultrusion, Resin Transfer Moulding (RTM), Resin Film Infusion (RFI).	10	20
4	**Process Optimization & Industry 4.0 in Advanced Manufacturing** Optimization of Process Parameters in Unconventional Machining: Material Removal Rate (MRR), Surface Finish, Tool Wear, Energy Consumption. Industry 4.0 in Advanced Manufacturing: Smart manufacturing, IoT, AI-based process control, real-time monitoring, predictive maintenance, and sustainability in advanced manufacturing.	10	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Research Study on Unconventional Machining** Research and create a comparative report on any two unconventional machining process assigned by faculty and upload it on a GMIU web portal.	10
2	**Material Analysis of Composites** Faculty will allocate different composite to the students individually and students will prepare and present the analysis for manufacturing and mechanical properties of a real-world composites and submit presentation on GMIU web portal.	10
3	**Industry 4.0 Application in Manufacturing** Visit physical/virtual AI-based process control & IoT-enabled predictive maintenance in the industry and share the technical observations in pdf format on GMIU web portal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	25%	25%	30%	10%	10%	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Explain the fundamentals and applications of unconventional machining processes.
CO2	Describe and apply rapid prototyping & additive manufacturing techniques.
CO3	Evaluate glass & composite material processing for industrial applications.
CO4	Optimize machining parameters and integrate Industry 4.0 concepts.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	Demonstration study of Unconventional Machining (EDM, WJM, ECM).	1	4
2	Demonstration study about Water Jet Machining (WJM) and Influence of pressure on cutting efficiency.	1	2
3	Demonstration study about Laser Beam Machining (LBM) with Experimentation on metal & non-metals.	1	4
4	To study about Additive Manufacturing: 3D Printing of a Simple CAD Model (FDM Process)	2	4
5	To study about Analysis of Mechanical Properties of Composite Laminates.	3	2
6	To study about Process for Composite Manufacturing.	3	2
7	Demonstration about Vacuum Bagging & Pultrusion Experiment.	3	2
8	To study about Surface Finish Analysis in Advanced Manufacturing Processes.	4	4
9	Demonstration study about IoT & AI-based Process Optimization in Smart Manufacturing.	4	2
10	To study about testing a mechanical property (Tensile, Flexural) of a Composite Material.	4	4
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory. The internal evaluation will be done on the basis of Active Learning Assignment. Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] "Manufacturing Science" – A. Ghosh & A. K. Mallik

[2] "Advanced Machining Processes" – V. K. Jain

[3] "Additive Manufacturing Technologies" – Ian Gibson, David W. Rosen

[4] "Fundamentals of Modern Manufacturing" – Mikell P. Groover

[5] "Industry 4.0: The Industrial Internet of Things" – Alasdair Gilchrist