



## Integral University, Lucknow

<b>Effective from Session: 2024-2025</b>							
<b>Course Code</b>	ME601	<b>Title of the Course</b>	ADVANCED MANUFACTURING PROCESSES	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>II</b>	<b>Semester</b>	<b>III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	None	<b>Co-requisite</b>	None				
<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. To understand the fundamentals and advanced techniques related to manufacturing processes.</li> <li>2. To analyze the applied aspects of manufacturing processes, and to evaluate a sound analytical basis these advanced manufacturing processes.</li> <li>3. To build a foundation of capability for the solution, analysis and synthesis of a wide variety of manufacturing problems.</li> <li>4. Create analytical approaches in conjunction with applied case studies based practical's, learning to control a manufacturing process for optimal production.</li> <li>5. Understand the principles and concepts of smart and digital manufacturing, including their architecture, technologies, and applications in modern industrial settings.</li> </ol>						

Course Outcomes	
<b>CO1</b>	Classify the various unconventional machining processes and Demonstrate the Mechanical energy based unconventional machining processes.
<b>CO2</b>	Demonstrate the Chemical and Electrical energy based unconventional machining processes.
<b>CO3</b>	Demonstrate the Thermal energy based unconventional machining processes.
<b>CO4</b>	Classify the various hybrid unconventional machining techniques and Demonstrate the unconventional welding processes
<b>CO5</b>	Develop skills in implementing AM and digital twin technology for product design, optimization, and prototyping.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	<b>Introduction to Advanced Machining processes</b>	Classification of advanced machining processes; consideration in process selection. <b>Mechanical Metal Removal Process:</b> Basic principles; mechanism of metal removal; variables governing the processes; tool design and economic consideration; applications and limitations, of Ultrasonic machining, Abrasive Jet and Abrasive Water Jet Machining	8	CO1
2	<b>ECM and EDM Machining Process</b>	<b>Electro-chemical Process:</b> Fundamentals of the ECM and ECG techniques; mechanism of metal removal; design of tooling; choice of process parameters; surface finish and accuracy; economic aspects of ECM; electro-chemical deburring; and honing. <b>EDM PROCESS:</b> Classification; general principles, applications advantages and limitations of EDM processes, mechanism of metal removal in EDM, selection of EDM pulse generator, tool electrode and dielectric; machining accuracy, surface finish and surface damage in EDM; process parameters, wire EDM.	8	CO2
3	<b>EBM, PAM and LBM Machining Process</b>	EBM, PAM and LBM Processes: Classification; general principles, applications advantages and limitations of processes. Generation and control of electron beam for machining in EBM. Generation and application of plasma for metal cutting in PAM, plasma torches. Basics of laser beam machining; thermal phenomenon due to laser work surface interaction; cutting speeds and accuracy of cut; applications and limitations. Improving the efficiency of laser machining process. Process details of ion beam machining and its applications.	8	CO3
4	<b>Hybrid machining, Metal forming and welding processes</b>	Introduction to hybrid unconventional machining processing like ECDM, ECAM, Abrasive EDM, etc. <b>Metal Forming</b> Theory and application of Contour roll forming, stretch forming explosive forming etc. <b>Unconventional Welding:</b> Theory and applications of electron beam welding, Laser beam welding, Ultrasonic welding, Solid state diffusion and explosive welding process.	8	CO4
5	<b>Additive and digital manufacturing</b>	<b>Digital Twin Technology,</b> Concept of digital twin and its applications in manufacturing, Use of digital twins in product development, Case studies on digital twin implementations in industry <b>Additive Manufacturing (AM),</b> Overview of AM technologies and their applications, AM materials and their properties, Introduction to Various machines viz., FDM,SLA & SLS, Emerging trend in AM. Understanding 3D printing, Application of tolerances and fitments considering 3D printing processes. Understanding process algorithm of slicing software and slicing techniques, Different Applications like- Functional prototypes, Health care products etc.	8	CO5

<b>Reference Books:</b>
Non Traditional Machining Processes, R. K. Springborn, American Society of Tool and Manufacturing Engineers, 1967.
Advance Machining Processes, V.K. Jain, Allied Publishers Pvt Limited, 2009.

Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, Hassan Abdel-Gawad El-Hofy, McGraw Hill LLC, 2005.

Digital Manufacturing The Industrialization of "Art to Part" 3D Additive Printing, Elsevier, 1st Edition, 2022,

Digital Manufacturing for SMEs, Jack C Chaplin, Claudia Pagano, Santi Fort, ERASMUS+ project Digit-T: Digital Manufacturing Training System for SMEs (2017-1-UK01-KA202036807)

Digital Twin: A Complete Guide For The Complete Beginner, Vijay Raghunathan, Santanu Deb Barma, Kindle store, 2017

Building Industrial Digital Twins: Design, develop, and deploy digital twin solutions for realworld industries using Azure Digital Twins, Shyam Varan Nath, Pieter van Schalkwyk, Packt Publishing; 1st edition,2021

**e-Learning Source:**

[https://www.youtube.com/watch?v=N81fnQZY1TQ&list=PLWCscP8J8VQ5RRhLPvLOBGCdzdjQ0-\\_5S](https://www.youtube.com/watch?v=N81fnQZY1TQ&list=PLWCscP8J8VQ5RRhLPvLOBGCdzdjQ0-_5S)

[https://www.youtube.com/watch?v=\\_TEBKq9i9a4&list=PLFW6IRTa1g81r7obROdMofsKqWz2Z-mLw](https://www.youtube.com/watch?v=_TEBKq9i9a4&list=PLFW6IRTa1g81r7obROdMofsKqWz2Z-mLw)

<https://www.youtube.com/watch?v=D2Z6kHFuG0Y>

<https://www.youtube.com/watch?v=JODN00i57SE>

<https://www.youtube.com/watch?v=pyNBEJbQ5yA>

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	1	-	2	-	3	2	3	3	3
CO2	3	3	3	3	3	1	1	-	2	-	3	2	3	3	3
CO3	3	3	3	3	3	1	1	-	2	-	3	2	3	3	3
CO4	3	3	3	3	3	1	1	-	3	-	3	3	3	3	3
CO5	3	3	3	3	3	2	1	-	3	-	3	3	3	3	3

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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