



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Mechanical Engineering (Production)

Course / Subject Code : ME01000551

Course / Subject Name: Unconventional Manufacturing Technology

w. e. f. Academic Year:	2024-25
Semester:	1 st Semester
Category of the Course:	PEC

Prerequisite:	Nil
Rationale:	Unconventional Manufacturing Processes, also known as Non-Traditional machining or advanced machining methods, offer innovative and highly specialized ways of shaping, forming, or modifying materials. This makes it possible to work on challenging or impossible materials to machine using traditional methods.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Identify the need for Unconventional Manufacturing processes.
02	Classify the Unconventional Manufacturing Processes
03	Performance on Unconventional Manufacturing Processes and Process Parameter analysis
04	Comparison of Unconventional Manufacturing Processes for Economics in Machining.
05	Demonstrate recent development on Unconventional Manufacturing Processes.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to Unconventional Manufacturing: Need for Unconventional Manufacturing processes, Comparison between Conventional and Unconventional Manufacturing, general classification Unconventional Manufacturing processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations, and applications of Unconventional Manufacturing.	04	10
2.	Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, Economics of Machining, applications, advantages & limitations of USM.	06	15
3.	Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics-Material removal rate, Nozzle wear, accuracy & surface finish. Economics of Machining, Applications, advantages & limitations of AJM.	06	15
4.	Electrochemical Machining (ECM): Introduction, Principle of electro chemical machining, ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish. Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials. Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages, and application of ECG, ECH. Chemical Machining (CHM): Elements of the process, Resists (maskants), Etchants. Types of	09	20



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	chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process. Economics of ECM and CHM.		
5.	Electrical Discharge Machining (EDM): Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM. Plasma Arc Machining (PAM): Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations. Economics of EDM and PAM.	09	20
05	Laser Beam Machining (LBM): Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations. Electron Beam Machining (EBM): Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations. Economics of LBM and EBM.	04	10
06	Unconventional Welding Processes: Laser Beam Welding, Electron Beam Welding, Ultra-Sonic Welding, Plasma Arc Welding, Explosive Welding, Under Water Welding, Micro Welding Processes.	02	05
07	Recent developments in Unconventional Manufacturing Processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of Unconventional Manufacturing processes.	03	05
	Total	45	100

Suggested Specification Table with Marks (Theory):



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Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	20	30	20	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Non-Conventional Machining by P. K. Mishra, Narosa Publishers.
2. Fundamentals of Machining Processes, H. El-Hofy (2007), CRC Press, Taylor and Francis Group
3. Automation, Production Systems and Computer Integrated Manufacturing by Groover, Prentice Hall.
4. Production technology HMT McGraw Hill Education India Pvt. Ltd 2001
5. New Technology Dr. Amitabha Bhattacharyya The Institute of Engineers (India) 2000
6. Benedict G.F., "Non Traditional Manufacturing Processes", 1st ed., Marcel Dekker Publication, 1987.
7. V. K. Jain, "Advanced Machining Processes", 2nd ed., Allied Publisher Bombay, 2010.
8. Hassan, E.L.-HOFY, "Advanced Machining Process - Nontraditional & Hybrid Machining Process", 1st ed., Tata Mc Graw Hill, 2005.
9. P. C. Pandey, "Modern Machining Processes", 1st ed., Tata Mc Graw Hill, New Delhi, 2009.
10. Ghosh and Malik, "Manufacturing Science", 1st ed., EWP Private Ltd., 2008.

(b) Open source software and website:

- 1.
2.

Suggested Course Practical List: If any

List of Laboratory/Learning Resources Required:

Suggested Project List:

1. Performance and parameter analysis on USM, AJM, ECM
2. Performance and parameter analysis on CHM, EDM, PAM, LBM



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3. Numerical on above Unconventional Manufacturing Processes to Understand the application and analysis.
4. Comparison study on above Unconventional Manufacturing Processes.
5. Report and Analysis on Recent developments in Unconventional Manufacturing Processes

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