

Branch Name:	Mechanical Engineering
Semester/Year:	Semester VIII / Forth Year
Subject Title:	Non Conventional Machining Processes
Subject Code:	1ET1010805
Pre-requisite:	Manufacturing Processes I & II, Production Technology

Course Objectives:

1. To study need, classification and selection of non-conventional machining processes.
2. To understand the principle, mechanism of metal removal of various non-conventional machining processes.
3. To study various process parameters and their effect on component machined for various non-conventional machining processes.
4. To understand the applications of different processes.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	04	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction to Non- conventional machining, Need for Non-conventional machining process, Comparison between conventional and non- conventional machining, general classification Non-conventional machining processes, classification based on nature of energy employed in machining, selection of non-conventional machining processes, Specific advantages, limitations and applications of non- conventional machining processes.	04	08
2	MECHANICAL ENERGY TECHNIQUES: 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, applications, advantages & limitations of USM. 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. Applications, advantages & limitations of AJM. Water Jet Machining (WJM): Equipment & process, Operation, Parameters influencing metal removal, applications, advantages and limitations of WJM.	10	25

3	ELECTRICAL ENERGY TECHNIQUES: 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 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.	08	20
4	THERMO ELECTRICAL ENERGY TECHNIQUES: 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.	06	14
5	THERMAL ENERGY TECHNIQUES: 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. 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.	10	25
6	Abrasive Flow Machining: Introduction, Equipment and process of material removal, process variables: type of abrasive, work material, flow speed etc. Process Variants: Process characteristics-Material removal rate, accuracy & surface finish. Applications, advantages & limitations of AJM.	04	08

Course Outcomes:

The student shall be able to

1. Understand the need, requirement and selection of Non-conventional machining methods.
2. Understand the principle of working, mechanism of metal removal for various non-conventional machining processes.
3. Identify the process parameters, their effect and applications of different processes.

List of Reference Books:

1. Mishra P. K., Non-Conventional Machining, The Institution of Engineers (India), Text Book Series, New Delhi, 1997
2. Pandey P. C. and Shan H. S., Modern Manufacturing Process, Prentice Hall, New Jersey
3. Jain V. K., Advanced machining processes. Allied publishers; 2009.
4. Amitabha G., & KUMAR, M. A.; Manufacturing science, 1999.
5. Benedict G. F., Non-traditional Manufacturing Processes, Marcel Dekker Publication, New York, 1987
6. Hassan El-Hofy, Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, McGraw-Hill Prof Med/Tech, 2005.

List of Practical:

Laboratory work shall be based on the topics above. At least 8-10 practical must be designed. Experiments with performance/demonstration facility should be given preference.

E-Resources:

1. <https://nptel.ac.in/courses/112107078>
2. <https://nptel.ac.in/courses/112105126/36>
3. <https://nptel.ac.in/courses/112105212/>