Roll. No. | | | | | | | | | | | | |

ADDITIONAL CONTROLLER OF EXAMINATIONS ★ AU CHENNAI 600 025

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, Nov / Dec 2024

MANUFACTURING ENGINEERING
SIXTH SEMESTER
MF5651 - NON-TRADITIONAL MACHINING PROCESSES
(Regulation 2019)

Time: 3 hrs Max. Marks: 100

CO 1	To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
CO 2	To differentiate chemical and electro chemical energy based processes.
CO 3	To describe thermo-electric energy based processes
CO 4	To explain nano finishing processes.
CO 5	To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analyzing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1.	What is the need for non-traditional machining processes?	2	CO 1	L2
2.	Which machining process is commonly used for micromachining or working with materials with high hardness such as ceramics? a) Laser Beam Machining b) Water Jet Cutting c) Ultrasonic Machining d) Electrochemical Machining	2	CO 1	L3
3.	Explain the role of the electrolyte in Electrochemical Machining (ECM) and how it affects material removal.	2	CO 2	L2
4.	What types of materials are best suited for processing using Chemical Machining (CHM)?	2	CO 2	L3
5.	What is the primary mechanism in Laser Beam Machining (LBM) for material removal? a) Mechanical cutting b) Chemical reaction c) Melting and vaporization d) Electrochemical dissolution	2	CO 3	L2
6.	What are the limitations of Plasma Arc Machining (PAM)?	2	CO 3	L2
7.	What are the key process parameters in Magnetorheological Finishing (MRF)?	2	CO 4	L2
8.	What makes Chemo-Mechanical Polishing (CMP) effective for achieving ultra-smooth surfaces in semiconductor manufacturing?	2	CO 4	L2
9.	A company is machining complex aerospace components made from Inconel using Electrochemical Abrasive Machining (ECAM). What are the benefits of using this hybrid process for such materials?	2	CO 5	L2
10.	Why is the working environment (vacuum, air, or inert gas) significant in the comparison of different non-traditional machining processes?	2	CO 5	L3

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PART - B (5 × 13 = 65 Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	Explain the principle and working of Abrasive Water Jet Machining (AWJM), detailing its equipment and process parameters like water pressure and abrasive size. Discuss how these parameters affect material removal rate and surface finish.	13	CO1	L2
	OR			
11 (b)	Describe the principle and working of Ultrasonic Machining (USM) with a neat sketch. Analyze the influence of parameters like vibration frequency and amplitude on machining performance.	13	CO1	L2
12 (a)	Discuss the role of process parameters such as etchant type, masking materials, temperature, and process time in chemical machining.	13	CO2	L2
	OR			
12 (b)	Explain the working of Electro-Chemical Grinding (ECG) and how electrolytes and grinding wheels help in material removal. Discuss where it is used, its benefits, and its drawbacks, especially for hard and brittle materials.	13	CO2	L2
13 (a)	Explain the principle of Electrical Discharge Machining (EDM) and how parameters like current and pulse duration affect the process, along with its applications and limitations.	13	CO3	L2
	OR			
13 (b)	Compare laser beam machining (LBM) and electron beam machining (EBM) in terms of their working principles, energy sources, material interaction mechanisms, process parameters, and suitability for various materials.	13	CO3	L2
14 (a)	Describe the working of Abrasive Flow Machining (AFM), focusing on how abrasive media achieves precision finishing under pressure. Discuss its role in improving surface quality and dimensional accuracy.	13	CO4	L2
	OR			
14 (b)	Explain the working principle, process mechanics, and key parameters of Magneto-Rheological Abrasive Flow Finishing (MRAFF).	13	CO4	L2
15 (a)	Describe the types of parts that would be suitable for hybrid machining. Consider one such part and make a preliminary sketch for a hybrid machine to produce that part.	13	CO5	L2
	OR			
15 (b)	How does the type of workpiece material influence the selection and comparison of different non-traditional machining processes? Illustrate with case studies.	13	CO5	L2

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

16	An aerospace firm is considering plasma arc machining to process titanium alloys for aircraft components. Evaluate the feasibility of Plasma Arc Machining for this application, considering material properties, surface quality, and operational efficiency.	**15**	**CO3**	**L3**

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