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**Question Paper Code : 40798**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth/Sixth Semester

Mechanical Engineering

CME 387 — NON-TRADITIONAL MACHINING PROCESSES

(Common to Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ( $10 \times 2 = 20$  marks)

1. Identify the need for non-traditional machining processes.
2. What is the effect of abrasive grain size on the machining rate in Ultrasonic Machining (USM)?
3. List the various steps involved in the chemical machining process.
4. What are the process parameters that can be controlled in Electro Chemical Machining. (ECM)?
5. What are the basic requirements of electrode materials used in Electric Discharge Machining (EDM) process?
6. List the advantages of plasma arc machining.
7. Name any two common applications of Abrasive Flow Machining (AFM) in materials processing.
8. How does altering the abrasive concentration affect the surface quality in magnetorheological abrasive flow finishing (MRAFF)?
9. Differentiate between conventional machining process and hybrid non-traditional machining process.
10. What are the advantages of combining Abrasive Water Jet Machining (AWJM) with Abrasive Flow Machining (AFM) in hybrid machining processes?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the factors that should be considered during the selection of an appropriate non-traditional machining process for a given job. (7)
- (ii) Classify non-traditional machining processes on the basis of type of energy used. (6)

Or

- (b) Elucidate the differences between the Water Jet Machining (WJM) and the Abrasive Water Jet Machining (AWJM) processes with neat illustrations.
12. (a) Discuss about electrochemical machining and electrochemical honing with suitable sketches.

Or

- (b) Explain the working principle of electrochemical grinding and discuss the process capabilities, advantages, limitations and applications.
13. (a) Explain the construction and working principle of wire EDM with neat diagram. Also discuss the various process parameters and their role in increasing MRR.

Or

- (b) Explicate the production of laser beam and working principle of LBM. Also list the process parameters, advantages and limitations.
14. (a) Describe the process steps involved in Chemo-Mechanical Polishing (CMP) for semiconductor manufacturing. Also discuss the advantages and limitations of CMP in the context of semiconductor device fabrication.

Or

- (b) Explain the construction and metal removal mechanism of Magnetic Abrasive Finishing (MAF). Also discuss the role of magnetic field strength in controlling the surface quality of material processed by MAF.
15. (a) Explore the significance of process parameters in hybrid non-traditional machining processes. Provide examples of key parameters and explain their roles in shaping the machining outcomes.

Or

- (b) Identify the limitations and challenges associated with the implementation of hybrid non-traditional machining processes. Explain how these limitations can be mitigated through technological advancements in hybrid process.

PART C — (1 × 15 = 15 marks)

16. (a) Examine the role of advanced unconventional machining techniques, such as Laser Beam Machining (LBM) and Electron Beam Machining (EBM), in high-precision applications like aerospace and medical device manufacturing. Discuss how their unique characteristics contribute to the success of these applications.

Or

- (b) Analyze the environmental sustainability of nano finishing processes, considering their impact on resource usage, waste generation and energy consumption. Provide examples of how these processes can be made more eco-friendly and discuss their potential implications on the manufacturing industry.
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