

**M. E. PRODUCTION ENGINEERING FIRST YEAR SECOND SEMESTER
EXAMINATION 2025**

ADVANCED MACHINING PROCESSES

Full Marks:100

Time: Three Hours

Answer any FIVE Questions.

1. a) Classify mechanical energy based advanced machining processes.
 b) What are the types of abrasives used in abrasive jet machining?
 c) What do you mean by hybrid machining?
 d) Compare ordinary light and Laser light.
 e) What are the types of Laser beam recommended for machining?
 (3 x 5)
- f) Match the following: (1X 5)

Process	Medium
Electrical Discharge Machining	NaCl and Water
Electrochemical Discharge Machining	De-ionized Water
Electrochemical Machining	NaOH and Water
Wire-cut Electrical Discharge Machining	Vacuum
Electron Beam Machining	Paraffin oil

2. a) Match the following: (1X 5)

Process	Material Removal Mechanism
Electrical Discharge Machining	Brittle fracture and fatigue failure
Ultrasonic Machining of ceramics	Anodic dissolution
Electrochemical Machining	Mechanical Erosion
Abrasive Jet Machining	Ablation
Ultra short pulsed Laser Beam Machining	Melting and Vaporization

[Turn over

- b) During ECM drilling of aluminium workpiece , the current density is 100 A/cm^2 . The cross sectional area of each electrode is 3 cm^2 . The current efficiency is 85 %. Gram atomic weight, valency and density of aluminium are 27, 3 and 2700 kg/m^3 respectively. Consider the value of "F" as 96500 Coulomb. Determine volumetric material removal rate in mm^3/min . Derive the expressions of MRR and feed rate in ECM from Faraday's Laws of Electrolysis. (7+8)

3. a) Match the following:

(1X 5)

Process	Applications
Water Jet Machining	Cutting of Fiber Reinforced Plastics
Ultrasonic Machining	Cutting of Diamond
Electrochemical Machining	Cutting of asbestos sheet
Abrasive Water Jet Machining	Triangular hole on glass
Laser Beam Machining	Turbine Blade profile cutting

- b) A laser beam with a power intensity of 10^5 W/mm^2 is used to drill holes on tungsten sheet of 6 mm thickness. The drilled hole diameter is 150 microns. If $3 \times 10^4 \text{ Joules/cm}^3$ are required to vapourize tungsten , then calculate the time needed to perform a through hole. The power conversion efficiency is taken as 10 %. (10)

- c) What are reasons for suitability of Laser beam for micromachining applications? (5)

4. a) Match the following:

(1X 5)

Process	Process Parameters
Electrochemical Grinding	Abrasive Slurry Concentration
Ultrasonic Machining	Electrolyte Concentration
Electrochemical Discharge Machining	Wheel Rotational Speed
Plasma Arc Machining	Beam Current
Electron Beam Machining	Traverse Speed

- b) Discuss the following machining process with respect to working principles with sketch and applications: i) Electrochemical Grinding and ii) Electrochemical Discharge Machining.

(7+8)

5. a) Discuss on various elements of Abrasive Water Jet Machining (AWJM) System with sketch.

b) Distinguish between AJM and AWJM.

c) What are the applications and limitations of WJM?

(10+4+6)

6. a) Distinguish between Transferred Arc and Non-Transferred Arc PAM with sketch?

b) Describe about Tool Vibration Unit of USM with sketch.

c) Distinguish between rotary USM and stationary USM with sketch?

(6+8+6)

7. Discuss on **any two** of the following machining processes with sketch.

a) Electron Beam Machining ; b) Fiber Laser Beam Machining; c) Nd:YAG Laser Beam Machining .

(10+10)

8. a) Why is EDM suitable for Die making?

b) Why is Kerosene not used as Dielectric in WEDM?

c) What are the process parameters and machining criteria involved in WEDM?

d) What are the advantages and limitations in EDM?

e) Mention four applications of WEDM.

(4 x 5)