# MDP 494
## Fall 2025

## Midterm Exam Blank Sheet

*Prof. Samy J. Ebeid*

## Mid Term: Examination – Fall 2025

| Course Code | Course | | Duration: | 60 min |
|---|---|---|---|---|
| **MDP 494** | **Advanced Manufacturing Technology & Prototyping** | | **Date:** | **Nov 2025** |
| **Instructor** | **Prof. Samy J. Ebeid & Dr. Moustafa M. Sayed** | | **Total Marks:** | **25 Marks** |
| **Student Name** | | | **ID:** | |

*General Instructions:*
- *Please read the examination paper carefully.*
- *Brief answers with suitable drawings are preferred.*
- *Please assume any missing data in a logical manner.*

## Question 1: (9 Marks)

**1.1** State and explain in detail the main process parameters of the USM process and then add a neat sketch for this process. **(4 Marks)**

A, f, force, pressure, contact area, abrasive size

**1.2** In a tabular form compare and explain the differences between AJM and AWJM using suitable clear sketches. How does the addition of abrasive particles enhance the cutting process in waterjet machining? State some typical applications of waterjet machining in various industries. **(5 Marks)**

MRR, hrd + sft, thickness

Automotive, mining, aerospace

Paint removal, surgery, frozen meat, peeking

## Question 2: Choose the correct answer. (4 Marks)

| | |
|---|---|
| F | Both oil and water pass through the WJM accumulator. (T or F) |
| A | CAM is the inter-relationship between: (A) design & manufacturing (B) design & planning (C) design & marketing (D) design & drawing |
| F | During USM, the material is removed by arcing. (T or F) |
| F | Kerosene is one of the preferred solutions for WJM operations. (T or F) |
| F | Parts cut by WJM are affected by thermal distortion. (T or F) |
| F | Sodium nitrate is one of the preferred solutions for USM operations. (T or F) |
| C | The abrasive material in USM could be: <br> a. carbon fibers   b. polymers   c. SiC |
| F | The function of the WJM accumulator is to purify the water from impurities. (T or F) |
| D | The integration of CAD and CAM is termed:  (A) Computer Aided Design   (B) Computer Aided Engineering  (C) CAE/CAM   (D) Computer Integrated Manufacturing |

| | |
|---|---|
| F | The material removal from the workpiece in AJM is through melting. (T or F) |
| C | The most expensive part of a WJM unit is the:<br>    a. machining bed    b. accumulator    c. intensifier    d. nozzle |
| F | USM is a thermoelectric energy process. (T or F) |
| F | USM processes are applicable only for electrically conducting materials. (T or F) |
| 3 | What type of materials is USM particularly effective for?<br>1 Ductile materials   2 Soft metals   3 Hard and brittle materials    4 All types of materials |
| F | WJM processes use a gaseous medium. (T or F) |

## Question 3:   (7 Marks)

**3.1** List some benefits of CIM. **(2 Marks)**

Lead time      R&D

   Qu

**3.2** Explain the benefits of using CAD/CAM in industry and then explore what MasterCAM is.  **(2 Marks)**

Documentation

 Iteration

 Product database

Better product quality

Lower lead time

Increase designer productivity

Production scheduling

MasterCAM: generates GM code for tool path using 3D CAD and CNC machining parameters
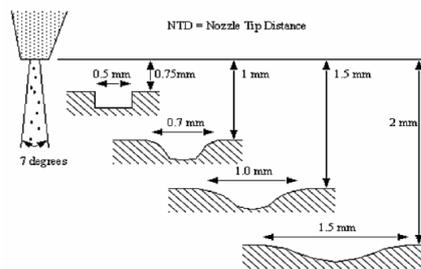
**3.3** Compare between CNC machines and conventional machine tools and then state some industrial applications of CNC machines. **(3 Marks)**

Conventional

– Lower accuracy (manual)
– Slower time (speeds)
– Low quality (manual)
– Lower initial cost
– Lower speeds (GB)
– Lower surface finish
– Depends on worker

Non-conventional

– Higher accuracy (computer)
– Faster time (higher speeds)
– Higher quality (computer, speeds)
– Better repeatability (computer)

## Question 4:   (5 Marks)

**4.1** Explain the meaning of the stand-off distance and show its effect on the produced workpiece shape in AJM processes (a clear sketch is required). **(3 Marks)**

**Stand off distance**



NTD = Nozzle Tip Distance

0.5 mm   0.75mm   1 mm   1.5 mm   2 mm   0.7 mm   1.0 mm   1.5 mm   7 degrees

P

Q

**4.2** Water jet machines are usually equipped with intensifiers and not centrifugal pumps, explain the reason. **(2 Marks)**