

**B.TECH/ME/7<sup>TH</sup> SEM/MECH 4122/2021**  
**MICRO AND NANO MANUFACTURING**  
**(MECH 4122)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A**  
**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Thermal effects in Diamond turning are minimised due to (CO2)  
(a) low thermal conductivity of Diamond tool  
(b) low coefficient of friction, and low thermal conductivity of Diamond tool  
(c) high coefficient of friction, and high thermal conductivity of Diamond tool  
(d) low coefficient of friction, and high thermal conductivity of Diamond tool.
- (ii) Choose the odd one out. (CO3)  
(a) micro- EBM  
(b) micro-AJM  
(c) micro-EDM  
(d) micro-LBM.
- (iii) Laser beam machining process can be used for (CO3)  
(a) Conductors  
(b) Insulators  
(c) Metals  
(d) All of the mentioned.
- (iv) Which of the following is a conventional process of machining? (CO2)  
(a) Electro chemical machining  
(b) Electron beam machining  
(c) Micro-Drilling  
(d) Laser beam machining process.
- (v) Micro Machining has ability to produce features with the dimensions as small as (CO1)  
(a) 1nm to 999nm  
(b) 1µm to 999µm  
(c) 1mm to 100mm  
(d) 100µm to 9999µm.
- (vi) Diamond micromachining is of particular interest for the (CO1)  
(a) Optical and electronics industries  
(b) Glass industries  
(c) tyre industries  
(d) cement industries.
- (vii) MRF is used for finishing of (CO4)  
(a) brittle materials  
(b) ductile materials  
(c) both brittle and ductile  
(d) none of them.

- (viii) Which one of the following is not used to characterize the topography of the surface? (CO6)
- (a) Scanning electron microscope (SEM)
  - (b) Atomic Force Microscope (AFM)
  - (c) Scanning Tunnelling Microscope (STM)
  - (d) Profile projector.
- (ix) Scanning electron produces \_\_\_\_\_ image. (CO6)
- (a) 2-dimensional
  - (b) 3-dimensional
  - (c) Scattered
  - (d) Bitmap.
- (x) The base of the micro drill is (CO2)
- (a) light
  - (b) heavy
  - (c) very light
  - (d) none of the mentioned.

**Group - B**

2. (a) Describe the principle of electron beam nano lithography with figure. [(CO5) (Understand/LOCQ)]
- (b) Define MECS. Write two applications of MECS. [(CO1) (Apply/IOCQ)]
- 6 + 6 = 12**
3. (a) Demonstrate the steps of bulk micro machining with figure. [(CO5) (Apply/IOCQ)]
- (b) Write briefly on space micro-propulsion. [(CO1) (Understand/LOCQ)]
- 6 + 6 = 12**

**Group - C**

4. (a) Explain the micro-drilling process using micro drill bits. [(CO2) (Remember/LOCQ)]
- (b) What is a precision grinding process and how would you achieve it? [(CO2) (Evaluate/HOCQ)]
- 6 + 6 = 12**
5. (a) With neat sketches explain about diamond micro turning process. [(CO2) (Remember/LOCQ)]
- (b) Propose a Roller Imprinting setup for fabrication a micro fluidic channel. [(CO2) (Create/HOCQ)]
- 6 + 6 = 12**

**Group - D**

6. (a) Explain the working principle of Water Abrasive Jet Micro Machining (WAJMM) Process with the help of suitable diagrams. [(CO3) (Analyze/IOCQ)]
- (b) Differentiate between Micro-EDM and conventional EDM. [(CO3) (Analyze/IOCQ)]
- 6 + 6 = 12**

7. (a) With a suitable diagram, explain the working principle of Micro LBM process. [(CO3) (Remember/LOCQ)]  
 (b) Identify the problematic areas of Micro-EDM and propose some strategies to reduce those. [(CO3) (Create/HOCQ)]

**6 + 6 = 12****Group - E**

8. (a) Explain the steps involved in basic chip making process. [(CO5) (Understand /LOCQ)]  
 (b) With neat sketches explain electron beam micro welding process. [(CO6) (Understand/LOCQ)]
9. (a) Develop a magneto-rheological abrasive flow finishing (MRAFF) process setup with neat sketches. [(CO4) (Create/HOCQ)]  
 (b) Write short notes about the mechanical, physical properties and application of carbon nanotubes. [(CO1) (Apply/IOCQ)]

**6 + 6 = 12****6 + 6 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75%	31.25%	25%

**Course Outcome (CO):**

After the completion of the course students will be able to

<b>CO 1</b>	Use the micro and nano manufacturing processes in different engineering applications.
<b>CO 2</b>	Explain the conventional techniques used in micro manufacturing.
<b>CO 3</b>	Describe the different types of non-conventional micro-nano manufacturing techniques.
<b>CO 4</b>	Explain the different types of micro and nano finishing processes.
<b>CO 5</b>	Discuss various types of micro and nanofabrication techniques.
<b>CO 6</b>	Identify different techniques used in micro joining and the metrology tools in micro and nano manufacturing.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

<b>Department &amp; Section</b>	<b>Submission link:</b>
ME	<a href="https://classroom.google.com/c/NDA1MjExMjY0ODEy/a/NDY0NDg4NDQxMDcz/details">https://classroom.google.com/c/NDA1MjExMjY0ODEy/a/NDY0NDg4NDQxMDcz/details</a>