

**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) Choose the odd one out.
(a) Micro-EBM (b) Micro-LBM (c) Micro-EDM (d) ECMM.
 - (ii) Diamond Micro Machining uses diamond as a cutting tool material because
(a) Diamond has a high coefficient of friction
(b) Diamond has low hot hardness
(c) Diamond has a crystalline structure which allows to produce a very sharp cutting edges
(d) Diamond has high hot hardness.
 - (iii) Which of the following is a non-conventional machining process machining?
(a) Turning (b) Milling (c) Drilling (d) Laser beam machining process.
 - (iv) What is the standard form of TEM?
(a) Transmission Electron Microscope (b) Transformer Electrode Microscope
(c) Transceiver Electrical Microscope (d) None of the above.
 - (v) The “accelerometer” used in modern automobile air bag safety system, is an example of the following device
(a) MEMS device (b) MEDS device (c) MERS device (d) MECS device.
 - (vi) Which of the following is not a type of lithography?
(a) Photo lithography (b) Ultrasonic lithography
(c) X-ray lithography (b) E-beam lithography.
 - (vii) A decrease in stand-off-distance (SOD) _____ in abrasive Jet micro machining.
(a) increases machining time (b) increases energy consumption
(c) improves surface finish (d) improves accuracy
 - (viii) Laser beam machining process can be used for
(a) conductors (b) insulators (c) metals (d) all of the mentioned.
 - (ix) “Micro-fluidic channels” are examples of the following device
(a) MEMS device (b) MEDS device (c) MERS device (d) MECS device.

- (x) In which of the following micro machining process the mechanical elements are fabricated by etching away unwanted parts in silicon wafer
- | | |
|--------------------------|-----------------------------|
| (a) Bulk micro machining | (b) Surface micro machining |
| (c) Liga micro machining | (d) None of the above. |

Group – B

2. (a) Write two applications and one major problem of micro-drilling in the context of precision engineering. [(CO4)(Apply/IOCQ)]
(b) Define MEMS. Justify the importance of MEMS with example. [(CO2)(Evaluate/HOCQ)]
6 + 6 = 12
3. (a) Demonstrate the steps of surface micro machining with figure. [(CO1)(Apply/IOCQ)]
(b) Explain two properties of Laser beam. Name any two practical lasers used for micro machining. [(CO1)(Understand/LOCQ)]
6 + 6 = 12

Group – C

4. (a) Explain the procedure of micro drilling using electrical discharge machining (EDM). [(CO4)(Understand/LOCQ)]
(b) Discuss briefly on diamond micro turning process. [(CO2)(Understand/LOCQ)]
6 + 6 = 12
5. (a) With neat sketches explain nano plastic forming process in detail. [(CO2)(Apply/IOCQ)]
(b) List down the applications of micro milling and micro grinding process. [(CO2)(Apply/IOCQ)]
6 + 6 = 12

Group – D

6. (a) Illustrate micro-WEDM process with neat sketches. [(CO3)(Apply/IOCQ)]
(b) Differentiate between electrochemical micro-machining (EMM) and conventional electrochemical machining (ECM). [(CO3)(Analyze/IOCQ)]
6 + 6 = 12
7. (a) Explain the influence of process parameters in micro-ECM. [(CO3)(Analyze/IOCQ)]
(b) Identify the problematic areas of abrasive jet micro machining and propose some strategies to reduce those. [(CO3)(Analyze/IOCQ)]
6 + 6 = 12

Group – E

8. (a) Explain the micro fabrication flowchart with suitable diagrams. [(CO5)(Analyze/IOCQ)]

- (b) With a suitable diagram, explain the working principle of Scanning Electron Microscope.
[[CO6)(Remember/LOCQ)]
6 + 6 = 12
9. (a) Write the advantages, limitations and applications of laser micro welding.
[[CO6)(Apply/IOCQ)]
- (b) Develop a Magneto-Rheological Abrasive Flow Finishing (MRAFF) process setup with neat sketches.
[[CO4)(Create/HOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	25	62.5	12.5

Course Outcome (CO):

- After the completion of the course students will be able to
1. Use the micro and nano manufacturing processes in different engineering applications.
2. Explain the conventional techniques used in micro manufacturing.
3. Describe the different types of non-conventional micro-nano manufacturing techniques.
4. Explain the different types of micro and nano finishing processes.
5. Discuss various types of micro and nanofabrication techniques.
6. 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.

