

7 th Semester	RME7D006	Micro and Nano Machining	L-T-P 3-0-0	3 Credits
--------------------------	----------	--------------------------	----------------	-----------

Module-I:**(12 hours)****Introduction**

Introduction, Basic elements of molecular dynamics modelling, Design and requirements for state-of-the-art MD cutting process simulations, Capabilities of MD for nanoscale material removal process analysis, Advances and recent developments in material removal process simulation, Summary.

Ductile Mode Cutting of Brittle Materials

The mechanism of ductile mode cutting of brittle materials, The chip formation in cutting of brittle materials, Machined surfaces in relation to chip formation mode

Diamond Tools in Micromachining

Diamond technology, Preparation of substrate, Modified HFCVD process, Nucleation and diamond growth, Deposition on complex substrates, Diamond micromachining.

Module-II: (8 hours)**Conventional Processes: Micro-turning, Micro-drilling and Micro-milling**

Introduction, Micro-turning, Micro-drilling, Micro-milling, Product quality in micromachining

Micro-grinding and Ultra-precision Processes

Introduction, Micro and nanogrinding, Nanogrinding tools

Module-III:**(8 hours)****Non-Conventional Processes: Laser Micromachining**

Introduction, Fundamentals of lasers, Laser microfabrication, Laser nanofabrication.

Evaluation of Subsurface Damage in Nano and Micromachining

Destructive evaluation technologies, Non-destructive evaluation technologies

Module-IV:**(10 hours)****Micro and Nano Finishing Processes**

Need for Nano finishing, Magnetic abrasive Finishing, Magnetorheological Finish, Elastic Emission Finishing, Magnetic Float Polishing, Ion Beam finishing.

Micro Joining

Challenges, Micro Resistance welding, Ultrasonic welding, Micro TIG, Applications.

Applications of Nano and Micromachining in Industry

Typical machining methods, Applications in optical manufacturing, Semiconductor and electronics related applications.

Books:

- [1] J. Paulo Davim, Mark J. Jackson Nano and Micromachining, John Wiley & Sons, 2013
- [2] Mark. J. Jackson, Micro and Nano-manufacturing, Springer, 2006.
- [3] Mark. J. Jackson, Micro-fabrication and Nano-manufacturing - Pulsed water drop micromachining CRC Press 2006.
- [4] Nitaigour Premchand Mahalik, Micro-manufacturing and Nanotechnology, 2006.
- [5] V.K. Jain, Micro-manufacturing Processes, CRC Press, 2012.
- [6] Yi Qin, Micro-manufacturing Engineering and Technology, William Andrew, 2015