



**National Institute of Technology Meghalaya**  
An Institute of National Importance

**CURRICULUM**

Programme	<b>Bachelor of Technology in Mechanical Engineering</b>	Year of Regulation	<b>2018</b>
Department	<b>Mechanical Engineering</b>	Semester	<b>VII</b>

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
<b>ME 413</b>	<b>MECHANICAL MICRO-MACHINING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>200</b>

Course Objectives	To develop the student's ability to understand the issues and challenges in mechanical micro-machining.	Course Outcomes	CO1	Able to interpret the basic concept of mechanical micro-machining, applications, difference between macro- and micro-machining, mechanisms of material removal, etc. (Understanding)
	To develop the student's ability to identify the different components of machine tools, error in machine tools.		CO2	Able to identify the various components of machine tools, error in machine tools, etc. (Understanding)
	To develop the student's ability to understand the sensors used in micro-machining process.		CO3	Able to develop the different cutting tools for micro-machining of wide range of materials. (Application)
			CO4	Able to explain the application, material removal mechanisms, etc. of diamond turning process. (Understanding)
			CO5	Able to identify the different sensors and measurement techniques used in micro-machining. (Analysis)

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	2	0	0	0	0	0	0	0	0	0	0	3	2	0
2	CO2	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0
3	CO3	3	2	2	0	3	0	0	0	0	0	0	0	3	2	0
4	CO4	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0
5	CO5	3	2	0	0	3	0	0	0	0	0	0	0	3	2	0

**SYLLABUS**

No.	Content	Hours	COs
I	<b>Introduction</b> Why Miniaturization? Applications of Mechanical Micro-Machining, Classifications of Micro Manufacturing Processes, Things to Remember while Operating Micro Machine, and Scaling Laws	<b>02</b>	<b>CO1</b>
II	<b>Difference between Macro and Micromachining</b> Size Effects, Effect of Cutting-Edge Radius and Uncut Chip Thickness, Different Mechanism of Material Removal, Influence of Size Effect on Material Removal, Effect of Depth of Cut and Blunt Tool, Effect of Material Anisotropy, Specific Cutting Energy, Burr Formation, Burr Formation and Reduction Strategies, Surface Roughness, and Surface Roughness Measurement Instruments	<b>7</b>	<b>CO1</b>
III	<b>Components of Machine Tools</b> Sub-systems of Machine Tool, Requirements of Machine Tool, Accuracy, Repeatability and Resolution, Structural Configuration of Machine Tool, Structural Loop Stiffness, Construction Material for Machine Tool, Material Selection Criteria, Use of Granite and Polymer Concrete for Machine Tool Structure, Linear Guideways, Hydrostatic Guideways, Aerostatic Guideways, Air Bearings, Linear Drive, Rotary Encoders, Linear Encoders, Belt Driven Spindle, Integral Motor Spindle, Angular Contact Ball Bearing, Preloading of Bearing, Aerostatic Spindles, Hybrid Ceramic Bearings, and Tool Holders	<b>8</b>	<b>CO2</b>
IV	<b>Errors in Machine Tools</b> Straightness, Flatness and Smoothness, Orthogonality in X, Y and Z Directions, Examples of Orthogonality Errors in X, Y and Z Directions, and Motion Errors in Linear and Rotational Directions	<b>05</b>	<b>CO2</b>
V	<b>Micro Cutting Tools and Micro Machines</b> Micro Tool Fabrication Processes, Reasons for Tool Breakage, Advantages of Micro Machines, and Examples of Micro Machines	<b>05</b>	<b>CO3</b>
VI	<b>Diamond Turning</b> Introductions and Applications, Classifications, Material Removal Mechanisms and Cutting Tool, Slow Tool Servo and Fast Tool Servo Mechanism	<b>04</b>	<b>CO4</b>
VII	<b>Sensors and Metrology for Micro Machining</b> Introduction to Sensors, Dynamometer and Acoustic Emission Sensor, Use of Microscope, 3D Profilo meter, and SEM	<b>05</b>	<b>CO5</b>
Total Hours		<b>36</b>	

**Essential Readings**

1. V.K. Jain, "Introduction to Micromachining", Narosa Publication, 2018.
2. J.A. McGeough, "Micromachining of Engineering Materials", CRC Press, 2001.

**Supplementary Readings**

1. K. Cheng and D. Huo, "Micro-Cutting: Fundamentals and Applications", Wiley, 2013.
2. D. Dornfeld and D. Lee, "Precision Manufacturing", Springer, 2008.