B.E Semester: 8 Mechanical Engineering
Subject Name: Nano and Micromachining (ME804-N-E) [Dept. Elect.-6]

A. Course Objective:

- To give awareness of different techniques used in micro and nano machining/manufacturing.
- To give in-depth idea of the conventional techniques used in micro machining/manufacturing.
- To introduce Non-conventional micro-nano manufacturing and finishing approaches
- To introduce Micro and Nanofabrication Techniques and other processing routes in Micro and nano machining/manufacturing.

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	0	3	3	3	70	30	20	0	120

C. Detailed Syllabus:

Unit No.	Details
1	**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.
2	**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
3	**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
4	**Micro and Nano Finishing Processes** Need for Nano finishing, Magnetic abrasive Finishing, Magnetorheological Finish, Elastic Emission Finishing, Magnetic Float Polishing, Ion Beam finishing.
5	**Micro Joining** Challenges, Micro Resistance welding, Ultrasonic welding, Micro TIG, Applications.

6	**Applications of Nano and Micromachining in Industry** Typical machining methods, Applications in optical manufacturing, Semiconductor and electronics related applications.
Total hours (Theory):48	
Total hours (Practical):00	
Total hours:48	

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd} ,$3^{rd}4^{th}$	Unit 1	40%	1
2	5^{th} ,$6^{th}7^{th}$	Unit 2	20%	2
3	8^{th} ,$9^{th}10^{th}$	Unit 3	10%	3
4	11^{th} . $12^{th}13^{th}$	Unit 4	10%	4
5	14^{th} ,$15^{th,}$,16^{th}	Unit 5	20%	5,6

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the over all internal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

F. Students Learning Outcomes:

1	The student can identify different areas of Micro and Nano Machining
2	Can find the applications of all the areas in Industries.

G. Text Books & Reference Books:

1	J. Paulo Davim, Mark J. JacksonNano 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	NitaigourPremchandMahalik, 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
7	Kapil Gupta, Micro and Precision Manufacturing, Springer, 2017