4MEMS5 Micro and Precision Manufacturing

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Semester: 1

Course Organisation
The course runs for 12 weeks of the academic year and comprises three lectures and one tutorial per week (except the study week). Total contact time is 44 hours.

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<th>Start Week</th>
<th>End Week</th>
<th>Lectures per week</th>
<th>Lectures total</th>
<th>Tutorials per week</th>
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<td>1</td>
<td>12</td>
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<td>33</td>
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Course Description
In high value added manufacturing industry, engineers are required to understand how mechanical systems and materials behave at length scales of microns and nanometers. The objective of this course is to develop the student’s skills and knowledge in precision engineering, micro and nano-engineering. The course will consider selected topics in precision, micro and nanomanufacturing, ranging from enabling technologies and processes to applications. Examples including precision machine design, metrology, coatings, and nano materials will be considered.

Learning Outcomes
On successful completion of this course, students will be able to:

a) Calculate power requirements and process performance in laser micromachining

b) Calculate selectivities and etch rates in IC/MEMS device manufacture

c) Be aware of the hazards involved in dealing with toxic/dangerous materials such as HF in IC manufacture or Class 4 lasers in manufacturing

d) Develop and present a conceptual design solution to a precision machine operating in the micro and nano range

e) Be aware of techniques for advanced nano polymer materials processing, nano materials, and coatings

f) Examine materials under SEM and draw conclusions on issues associated with inspection of micro components
g) Consider fundamental aspects of micro and nano engineering including physics of surface tension, bonding and attraction forces

Course Content

- Laser technology in micro and nano manufacturing
- IC and MEMS Manufacture
- Precision machine design
- Measuring at the micro and nano scale
- Polymer nanocomposites, nano materials, and coating materials
- Bio-nanotechnology and Biomimetics

Course Notes

Web pages-blackboard-webCT
Selected research papers
Handouts from guest lecturers including material from the TCD centre for Microscopy and Analysis

Teaching Strategies

This course is typically a small group environment with approx 20 or less people participating. Hence the class forms the basis for discussion on topics, as well as more formal podium style lectures. Examples related in the class are often based on topical issues. Visiting lectures range from industry to visiting researchers. Dedicated sessions will take place with support of the TCD centre for Microscopy and Analysis

Assessment Modes

Written Exam (60%), assignment (40%)

Recommended Texts


Additional reading

Journal papers on micromanufacturing

Laboratory

Technology demonstrations, with emphasis on Microscopy using the Trinity Centre for Microscopy and Analysis.