5MEMS1 Precision and Micro Manufacturing – [5 credits]

Lecturers: Assist. Prof. Rocco Lupoi (lupoir@tcd.ie)

Semester: 2

Module Organisation

The module 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>Max. Tutorials per week</th>
<th>Max. Tutorials total</th>
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<td>1</td>
<td>12</td>
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<td>33</td>
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Module 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 module is to develop the student’s skills and knowledge in precision engineering, micro and nano-engineering. The module will consider selected topics in precision, micro and nanomanufacturing, ranging from enabling technologies and processes to applications. The module is research-lead, hence the content can vary on a year to year basis. Currently, most of the module is around LASER based manufacturing.

The module will require an active participation of the students.

Learning Outcomes

On successful completion of this module, students will be able to:

1. Calculate power requirements and process performance in laser manufacturing.
2. Understand the basic working mechanisms of lasers, components, and be aware of the laser types currently available.
3. Be aware of the hazards involved in dealing with lasers and safety classification.
4. Develop and present a conceptual design solution to a precision machine operating. The specifics of this outcome will vary on a year to year basis.
5. Understanding the role of optics in laser based systems.
Module Content
- Lasers and basic principles. Cavity design for CO₂ lasers.
- Laser cutting.
- Laser drilling.
- Laser welding.
- Laser surface treatments.
- Laser micro-manufacturing.

Module Notes
Web pages-blackboard.
Selected research papers
Handouts from guest lecturers including material from the TCD centre for Microscopy and Analysis – if applicable.

Teaching Strategies
This module 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.

Assessment Modes
Written Exam (60%), Continuous Assessment (40%). The CA topic will vary from year to year and will be group-based.

Recommended Texts

Additional reading
Journal papers on micromanufacturing
Laboratory

Technology demonstrations, may include laboratory and/or company visits.