1MEMS1 Introduction to Manufacturing [5 credits]

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Module organisation

<table>
<thead>
<tr>
<th>SEMESTER: 1</th>
<th>LECTURE/WEEK: 3</th>
<th>TUTORIALS/WEEK: 1</th>
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<td>DURATION (WEEKS): 12</td>
<td>TOTAL: 33</td>
<td>TOTAL: 11</td>
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Module description, aims and contribution to programme

- To introduce students to the basic concepts of manufacturing via shaping, forming, machining, CNC machining and assembly.
- To develop a knowledge of appropriate parameters to be used for various machining operations.
- To develop a knowledge of workshop practice and basic use of machine tools and workshop equipment.
- To introduce students to the role of manufacturing in an economy and to show the relationship between design and manufacturing.
- To make students aware of the necessity to manage manufacturing processes and systems for the best use of material and human resources with particular emphasis on product safety and environmental considerations.
- To introduce students non-conventional manufacturing processes.
- To introduce students to the scientific principles underlying material behaviour during manufacturing processes so as to enable them to undertake calculations of forces, tool stresses and material removal rates.

Learning outcomes

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

1. Analyse various machining processes and calculate relevant quantities such as velocities, forces and powers.

2. Identify and explain the function of the basic components of a machine tool.

3. Have a basic knowledge of safe workshop practice and the environmental implications of machining process decisions.

4. Understand the limitations of various machining processes with regard to shape formation and surface quality and the impact this has on design.
5. Explain the relationship between manufacturing technology and systems, the impact of manufacturing on the economy and the relationship between materials selection, design and manufacture.

6. Understand the procedures and techniques involved for the manufacturing of components, and keep up to date with innovation through literature search.

7. Describe and explain applications of the most common bulk and sheet forming. Understand the potential of more advanced manufacturing processes such as Rapid Prototyping, EDM, Cold Spray and LASER based methods.

8. Give short presentations in front of the class about manufacturing topics, write summaries and reports.

**Module content**

- Introduction to manufacturing processes and systems. The relationship between material selection, product design, manufacturing decisions, product uses and safety and environmental considerations.
- Introduction to engineering materials: ferrous and non-ferrous metals and polymers, basic manufacturing processes and material properties – elasticity, plasticity, ductility, toughness.
- Introduction to stress, strain, yielding and plastic flow.
- Crystal structure of metals, dendrite formation, recrystallisation, hot and cold working.
- Introduction to Turning, Milling and Drilling.
- Introduction to the technology associated with forging, rolling, extrusion, wiredrawing, piercing and blanking, bending, casting, joining processes and polymer forming. Advanced technologies, such as for the production of coatings and LASER material processing are also introduced.
- Calculations of forming forces and tool/workpiece stresses for the most conventional processes.
- Basic machine tool structure and terminology.

**ASSOCIATED LABORATORY/PROJECT PROGRAMME**

- Visits to Laboratories and Workshop.
- Group and single research summaries/reports.
- Presentation in front of the class.

**Teaching Strategies**

The module is taught using a combination of lectures, group projects, and tutorials. Regular visits are made to the workshop to demonstrate the actual machines and
processes being discussed. External speakers (from other departments or companies) are typically invited to give lectures about their specific manufacturing experience and research.

**Assessment**

Written Exam (60%) and Continuous Assessment (40%).

**Required textbook**