



5 credits

30.0 h + 30.0 h

Q1

Teacher(s)	Delannay Laurent ;Simar Aude ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	<ul style="list-style-type: none"> <li>• Molding of metals</li> <li>• Machining processes</li> <li>• Extrusion and molding of polymers</li> <li>• Polymer-based composite materials</li> <li>• Powder metallurgy</li> <li>• Metal forming                             <ul style="list-style-type: none"> <li>- extrusion and drawing (incl. wire drawing)</li> <li>- rolling, bending, stamping and deep drawing</li> <li>- forging</li> </ul> </li> <li>• Hardening and surface treatments</li> <li>• Assembly processes (incl. welding and pasting)</li> </ul>
Aims	<p>Regarding the common AA references of the program "Masters degree in Mechanical Engineering", this course contributes to the development, the acquisition and the evaluation of the following learning outcomes:</p> <ul style="list-style-type: none"> <li>• AA1.1, AA1.2, AA1.3</li> <li>• AA2.1, AA2.2, AA2.3, AA2.4</li> <li>• AA3.1</li> <li>• AA5.4</li> <li>• AA6.1, AA6.2, AA6.3</li> </ul> <p>More precisely, at the end of the course, students will be able to:</p> <p>1</p> <ul style="list-style-type: none"> <li>• identify and justify the choice of a manufacturing process that is best suited to produce a commonly used object.</li> <li>• explain, based on the knowledge of the underlying physical phenomena, the influence of a manufacturing process on the mechanical properties of the final product.</li> <li>• explain the main challenges of each manufacturing process as well as the existing technological solutions.</li> </ul> <p>At the end of the course, students will have a first experience of</p> <ul style="list-style-type: none"> <li>• machining of metal parts in a mechanical manufacturing workshop,</li> <li>• experimental techniques used to characterize stiffness, hardening, hardness and toughness in a mechanical testing laboratory.</li> </ul> <p>----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Evaluation methods	Evaluation of the student personal involvement during the lab sessions (15%) and written exam assessing the learning outcomes (85%).
Teaching methods	<ul style="list-style-type: none"> <li>• lectures (introduced with practical problems),</li> <li>• lecture notes written in French by the teachers (English reference book available),</li> <li>• solution of exercises in smaller groups,</li> <li>• laboratories in groups of 3 or 6 students,</li> <li>• videos showing processes that are not presented in the lab sessions.</li> </ul>
Content	<p><b>Basics of solid mechanics</b></p> <ul style="list-style-type: none"> <li>- Physics underlying deformation</li> <li>- Mathematical description of stresses and strains</li> <li>- Mechanical constitutive laws</li> <li>- Failure processes</li> </ul> <p><b>Physical basis of the mechanical strength of materials</b></p> <ul style="list-style-type: none"> <li>- Crystalline structure of metals</li> <li>- Defects of the cristal lattice</li> </ul>

	<ul style="list-style-type: none"> <li>- Grain size, texture, recovery and recrystallization</li> <li>- Strengthening of alloys</li> <li><b>Molding of metals</b></li> <li>- Underlying physics</li> <li>- Practical questions raised</li> <li>- Technological solutions</li> <li><b>Machining processes</b></li> <li>- Mechanics of the cut</li> <li>- Cutting conditions</li> <li>- classification of the processes and machining machines</li> <li><b>Metallic joining</b></li> <li>- Welding</li> <li>- Adhesion</li> <li><b>Metal forming</b></li> <li>- Forging</li> <li>- Extrusion and drawing of long products</li> <li>- Rolling of flat products</li> <li>- Secondary sheet metal forming</li> <li><b>Surface treatments and coatings</b></li> <li>- Mechanical surface treatments</li> <li>- Hot dipping</li> <li>- Surface coating</li> <li>- Electrodeposition</li> <li>- Conversion treatment</li> <li>- Vapor deposition</li> <li>- Diffusion treatment</li> <li><b>Manufacturing of polymers</b></li> <li>- Physics of polymers</li> <li>- Extrusion of thermoplastics and elastomers</li> <li>- Molding of thermosets</li> <li>- Polymer-based composites</li> <li><b>Sintering and additive manufacturing</b></li> <li>- Powder metallurgy</li> <li>- Production of ceramic pieces by powder metallurgy</li> <li>- Additive manufacturing</li> </ul>
<p>Inline resources</p>	<p><a href="http://moodleucl.uclouvain.be/enrol/index.php?id=8095">http://moodleucl.uclouvain.be/enrol/index.php?id=8095</a></p>
<p>Bibliography</p>	<p>Syllabus écrit en français par les enseignants.                  Deux références utiles (<b>pas obligatoires</b>):</p> <ul style="list-style-type: none"> <li>• M.P. Groover. Fundamentals of Modern Manufacturing, Materials, Processes, and Systems, 3rd edition. Wiley, 2007, USA.</li> <li>• S. Kalpakjian, S.R. Schmid. Manufacturing Engineering and Technology, 6th edition. Pearson, 2010, Singapour.</li> </ul>
<p>Faculty or entity in charge</p>	<p>MECA</p>

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	<a href="#">ELME2M</a>	5		
Master [120] in Mechanical Engineering	<a href="#">MECA2M</a>	5		
Minor in Engineering Sciences: Mechanics	<a href="#">LMECA100I</a>	5		