






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>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <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>
Evaluation methods	<p>The evaluation will be based on a written exam and on work carried out during the semester, i.e. participation in laboratories and completion of assignments on moodle. The final grade will be weighted as follows: 80% for the exam, 20% for the semester's work.</p> <p>If the exam is organized in distance mode, teachers may supplement the written assessment of certain students with an oral exam.</p> <p>The use for assignments of generative AI such as ChatGPT, Consensus, Perplexity,... is forbidden.</p>
Teaching methods	<p>The whole course is taught in French.</p> <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>• compulsory laboratories in groups of 3 or 6 students,</li> <li>• videos showing processes that are not presented in the lab session</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> </ul>

	<ul style="list-style-type: none"> <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 crystal lattice</li> <li>- Grain size, texture, recovery and recrystallization</li> <li>- Strengthening of alloys</li> </ul> <p><b>Molding of metals</b></p> <ul style="list-style-type: none"> <li>- Underlying physics</li> <li>- Practical questions raised</li> <li>- Technological solutions</li> </ul> <p><b>Machining processes</b></p> <ul style="list-style-type: none"> <li>- Mechanics of the cut</li> <li>- Cutting conditions</li> <li>- classification of the processes and machining machines</li> </ul> <p><b>Metallic joining</b></p> <ul style="list-style-type: none"> <li>- Welding (technology et physics behind welding processes)</li> <li>- Adhesion</li> </ul> <p><b>Metal forming</b></p> <ul style="list-style-type: none"> <li>- Forging</li> <li>- Extrusion and drawing of long products</li> <li>- Rolling of flat products</li> <li>- Secondary sheet metal forming</li> </ul> <p><b>Surface treatments and coatings</b></p> <ul style="list-style-type: none"> <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> </ul> <p><b>Manufacturing of polymers</b></p> <ul style="list-style-type: none"> <li>- Physics of polymers</li> <li>- Extrusion of thermoplastics and elastomers</li> <li>- Molding of thermosets</li> <li>- Polymer-based composites</li> </ul> <p><b>Sintering and additive manufacturing</b></p> <ul style="list-style-type: none"> <li>- Powder metallurgy</li> <li>- Production of ceramic pieces by powder metallurgy</li> <li>- Additive manufacturing</li> </ul>
Inline resources	<a href="https://moodle.uclouvain.be/course/view.php?id=1349">https://moodle.uclouvain.be/course/view.php?id=1349</a>
Bibliography	<p>Syllabus écrit en français par les enseignants.</p> <p>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>
Faculty or entity in charge	MECA

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Specialization track in Mechanics	<a href="#">FILMECA</a>	5		
Master [120] in Mechanical Engineering	<a href="#">MECA2M</a>	5		
Master [120] in Electro-mechanical Engineering	<a href="#">ELME2M</a>	5		
Minor in Mechanics	<a href="#">LMINOMECA</a>	5		
Master [120] in Energy Engineering	<a href="#">NRGY2M</a>	5		
Mineure Polytechnique	<a href="#">MINPOLY</a>	5		