






Teacher(s)	Delannay Laurent ;Simar Aude ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	<ul style="list-style-type: none"> • Molding of metals • Machining processes • Extrusion and molding of polymers • Polymer-based composite materials • Powder metallurgy • Metal forming <ul style="list-style-type: none"> - extrusion and drawing (incl. wire drawing) - rolling, bending, stamping and deep drawing - forging • Hardening and surface treatments • Assembly processes (incl. welding and pasting)
Learning outcomes	<p>At the end of this learning unit, the student is able to :</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"> • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3, AA2.4 • AA3.1 • AA5.4 • AA6.1, AA6.2, AA6.3 <p>More precisely, at the end of the course, students will be able to:</p> <p>1</p> <ul style="list-style-type: none"> • identify and justify the choice of a manufacturing process that is best suited to produce a commonly used object. • explain, based on the knowledge of the underlying physical phenomena, the influence of a manufacturing process on the mechanical properties of the final product. • explain the main challenges of each manufacturing process as well as the existing technological solutions. <p>At the end of the course, students will have a first experience of</p> <ul style="list-style-type: none"> • machining of metal parts in a mechanical manufacturing workshop, • experimental techniques used to characterize stiffness, hardening, hardness and toughness in a mechanical testing laboratory.
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"> • lectures (introduced with practical problems), • lecture notes written in French by the teachers (English reference book available), • solution of exercises in smaller groups, • compulsory laboratories in groups of 3 or 6 students, • videos showing processes that are not presented in the lab session
Content	<p>Basics of solid mechanics</p> <ul style="list-style-type: none"> - Physics underlying deformation - Mathematical description of stresses and strains - Mechanical constitutive laws

	<ul style="list-style-type: none"> - Failure processes Physical basis of the mechanical strength of materials - Cristalline structure of metals - Defects of the cristal lattice - Grain size, texture, recovery and recrystallization - Strengthening of alloys Molding of metals - Underlying physics - Practical questions raised - Technological solutions Machining processes - Mechanics of the cut - Cutting conditions - classification of the processes and machining machines Metallic joining - Welding (technology et physics behind welding processes) - Adhesion Metal forming - Forging - Extrusion and drawing of long products - Rolling of flat products - Secondary sheet metal forming Surface treatments and coatings - Mechanical surface treatments - Hot dipping - Surface coating - Electrodeposition - Conversion treatment - Vapor deposition - Diffusion treatment Manufacturing of polymers - Physics of polymers - Extrusion of thermoplastics and elastomers - Molding of thermosets - Polymer-based composites Sintering and additive manufacturing - Powder metallurgy - Production of ceramic pieces by powder metallurgy - Additive manufacturing
<p>Inline resources</p>	<p>https://moodle.uclouvain.be/course/view.php?id=1349</p>
<p>Bibliography</p>	<p>Syllabus écrit en français par les enseignants. Deux références utiles (pas obligatoires):</p> <ul style="list-style-type: none"> • M.P. Groover. Fundamentals of Modern Manufacturing, Materials, Processes, and Systems, 3rd edition. Wiley, 2007, USA. • S. Kalpakjian, S.R. Schmid. Manufacturing Engineering and Technology, 6th edition. Pearson, 2010, Singapour.
<p>Faculty or entity in charge</p>	<p>MECA</p>

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