

## 2026 年度シラバス

科目分類/Subject Categories			
学部等/Faculty	/大学院工芸科学研究科（博士前期課程）： /Graduate School of Science and Technology (Master's Programs)	今年度開講/Availability	/有 : /Available
学域等/Field	/物質・材料科学域 : /Academic Field of Materials Science	年次/Year	/1～2年次 : /1st through 2nd Year
課程等/Program	/材料制御化学専攻 : /Master's Program of Material's Properties Control	学期/Semester	/秋学期 : /Fall term
分類/Category	/授業科目 : /Courses	曜日時限/Day & Period	/ : /

科目情報/Course Information				
時間割番号 /Timetable Number				
科目番号 /Course Number	61760023			
単位数/Credits	2			
授業形態 /Course Type	講義・演習・実験 : Lecture/Practicum/Lab			
クラス/Class				
授業科目名 /Course Title	Materials for mechanical industries : Materials for mechanical industries			
担当教員名 / Instructor(s)	/トリノ工科大学教員（材料創製化学専攻および材料制御化学専攻ダブル・ディグリープログラムコース） : Related teacher of Polytechnic University of Turin (Double Degree Program course in the Master's Program of Innovative Materials and Material's Properties Control)			
その他/Other	インターンシップ実施科目 Internship	国際科学技術コース提供科目 IGP	PBL 実施科目 Project Based Learning	DX 活用科目 ICT Usage in Learning
	実務経験のある教員による科目 Practical Teacher			
科目ナンバリング /Numbering Code				

授業の目的・概要 Objectives and Outline of the Course	
日	
英	<p>The subject aims to provide more advanced and complementary knowledge related to metallic materials and their application in the mechanical industry than those provided in the first level courses of Italian universities. In particular, in the teaching of Science and technology of materials / Technology of metallic materials of this University. These are fundamental knowledge in the profession of a mechanical engineer.</p> <p>The teaching places particular emphasis on the understanding of the interdependence between the choice of a metallic material and the design of its working cycle: choice and design are conditioned by the desired and requested properties in working conditions; therefore, the following inherent aspects are dealt with, in particular concerning the metallic materials, together with the reciprocal correlations:</p> <ol style="list-style-type: none"> <li>1) Principles of physical metallurgy and thermodynamics;</li> <li>2) Manufacturing, heat treatment and mechanical processes;</li> <li>3) Structures, microstructures and their properties;</li> <li>4) Performance on site (mainly mechanical but also electromagnetic, thermal and in the presence of corrosion).</li> </ol>

学習の到達目標 Learning Objectives	
日	to provide more advanced and complementary knowledge related to metallic materials and their application in the mechanical
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industry than those provided in the first level courses of Italian universities
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学習目標の達成度の評価基準 / Fulfillment of Course Goals (JABEE 関連科目のみ)	
日	
英	

授業計画項目 Course Plan			
No.		項目 Topics	内容 Content
1	日		
	英	Powder metallurgy technology	Powders (types and properties), compacting pressing (materials classes, types of dies, methods), sintering (furnaces, atmospheres, operating conditions, mechanism) post-treatments, products.
2	日		
	英	Corrosion	Anodic and cathodic behavior. Oxygen, temperature and solution concentration influences.
3	日		
	英	The different types of corrosion	Galvanic corrosion coupling different materials or in case of different phases. Active and passive behavior of stainless steels. Protection methods of metallic materials.
4	日		
	英	Stainless steels	Schaeffler and De Long diagram. Stainless steels classes and designation. Heat treatment, welding, deformability and tool work-ability. Surface finishing. Sanification. Metallic ions release. Tool steels.
5	日		
	英	Cold and hot working classes	Cold and hot working classes
6	日		
	英	Surface coating technologies and materials	Titanium alloys. Grades, alloying elements, phase diagrams, properties, heat treatments, influence of microstructure
7	日		
	英	Applications and products	Metallic materials microstructure and failure analysis: fracture modes and morphologies.
8	日		
	英	Overview of cellular materials, applications(1)	Metal foams with open and closed cells. Elastic and plastic compression behavior, density effect. Absorption of energy during the impact.
9	日		
	英	Overview of cellular materials, applications(2)	Metal foams with open and closed cells. Elastic and plastic compression behavior, density effect. Absorption of energy during the impact.
10	日		
	英	Overview of cellular materials, applications(3)	Metal foams with open and closed cells. Elastic and plastic compression behavior, density effect. Absorption of energy during the impact.
11	日		
	英	Presentation(1)	Presentations of group exercised and laboratories in this course.
12	日		
	英	Presentation(2)	Presentations of group exercised and laboratories in this course.
13	日		
	英		
14	日		
	英		
15	日		
	英		

履修条件 Prerequisite(s)	
日	

英	
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授業時間外学習（予習・復習等）

Required study time, Preparation and review

日	
英	Basic knowledge of Physics, Chemistry, structural Mechanics, science and technology of metallic materials.

教科書／参考書 Textbooks/Reference Books

日	
英	<p>Following texts and lecture notes, uploaded on the "Portale della Didattica".</p> <p>G. Krauss, "Steels, Processing, Structure, and Performance", 2nd ed., ASM International</p> <p>F.C. Campbell, "Elements of Metallurgy and Engineering Alloys", ASM International</p> <p>H. Bhadesh a ed H. Honeycombe, "Steels: Microstructure and Properties", Butterworth-Heinemann</p> <p>ASM Metals Handbook X Ed.</p>

成績評価の方法及び基準 Grading Policy

日	
英	<p>Exam: Computer-based written test with open-ended questions or multiple-choice questions using the Exam platform and proctoring tools (Respondus).</p> <p>Exam: Written test; Computer-based written test with open-ended questions or multiple-choice questions using the Exam platform and proctoring tools (Respondus).</p>

留意事項等 Point to consider

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