

## 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）/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)/Graduate School of Science and Technology (Master's Programs)	今年度開講/Availability	/有/有 : /Available/Available
学域等/Field	/物質・材料科学域/物質・材料科学域： /Academic Field of Materials Science/Academic Field of Materials Science	年次/Year	/1～2年次/1～2年次 : /1st through 2nd Year/1st through 2nd Year
課程等/Program	/材料創製化学専攻/材料制御化学専攻： /Master's Program of Innovative Materials/Master's Program of Material's Properties Control	学期/Semester	/春学期/春学期 : /Spring term/Spring 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	61660057			
単位数/Credits	2			
授業形態 /Course Type	講義 : Lecture			
クラス/Class				
授業科目名 /Course Title	Materials Forming : Materials Forming			
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 course is aimed at deepening the knowledge related to the metal forming processes and technologies. After an introduction of the fundamental principles related to the different techniques, processes and equipments used in metal forming will be examined in details. The manufacturing of finished parts, made of metal alloys and metal based composites, is studied and analyzed, particularly in terms of the applications of technology in different industrial sectors.</p> <p>A fundamental aspect of the course deals with the evaluation of characteristics and properties of finished products, also as function of the adopted forming technology. A particular analysis will be devoted to the evaluation of the technical/economic aspects, also in terms of the results deriving from quality control.</p> <p>The close contact with the more relevant industrial scenarios, combined to the evaluation of case studies, provides a practical content for the course, and promotes a continuous updating on evolution and technological innovation.</p>

学習の到達目標 Learning Objectives	
日	金属成形のプロセスと技術に関する知識を習得する
英	To acquire knowledge related to the metal forming processes and technologies

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	FOUNDRY I	Principles of solidification of the alloys. Flow diagram and processing cycle typical of a foundry. Models, shapes and dies, traditional and special forming methods.
2	日		
	英	FOUNDRY II	Gravity casting, centrifugal casting and die casting. Investment Casting, Squeezecasting, Rheocasting, Thixomolding.
3	日		
	英	FOUNDRY III	Finishing operations and quality control; typical alloys and their fields of application, quality assurance.
4	日		
	英	PLASTIC DEFORMATION I	Mold Casting and continuous casting. Recall of the theory of plasticity and of the theoretical fundamentals of the plastic deformation. Hot, semi-hot and cold deformation. Primary and secondary rolling.
5	日		
	英	PLASTIC DEFORMATION II	PLASTIC DEFORMATION II
6	日		
	英	PLASTIC DEFORMATION III	Alloys for plastic deformation, properties and characteristics of the pieces obtained, quality control.
7	日		
	英	POWDER METALLURGY I	Production techniques and characterization of the product will be explained. Pressing in molds: obtainable shapes and limits. Special compaction processes, cold and hot isostatic pressing.
8	日		
	英	POWDER METALLURGY II	Sintering in furnaces: thermodynamic aspects of the process, furnaces and sintering atmospheres. Metal Injection Molding: characteristics and applications, raw materials and production cycle.
9	日		
	英	POWDER METALLURGY III	FAST Techniques: SPS, EDS, CDS Free-form processes and 3D printing. Additive Manufacturing: main techniques and typical products.
10	日		
	英	MACHINING I	Machining in the manufacturing sequence. Cutting tool classification. Cutting conditions. Chip formation and its morphology.
11	日		
	英	MACHINING II	Surface finishing. Different types of machining, typical systems and respective economics will be lectured.
12	日		
	英	SPRAYING I	Spraying techniques. General rules for spraying processes.
13	日		
	英	SPRAYING II	Characteristics of different processes and typical microstructures will be lectured.
14	日		
	英	DESIGN CRITERIA AND COST	Technical/economic comparison among the different alternative technologies and

		ANALYSIS I	selection criteria for process optimization. Cost indexes. Design of a forming process, tools and form factors.
15	日 英	DESIGN CRITERIA AND COST ANALYSIS II	The characteristics of formability, properties and microstructural characteristics of the materials will be examined by means of practical/virtual labs, as function of the different technologies adopted, with the observation and analysis of finished piece

履修条件 Prerequisite(s)	
日	
英	

授業時間外学習（予習・復習等） Required study time, Preparation and review	
日	
英	Knowledge related to the properties of metals and their alloys and on their plastic deformation, acquired during the BSc.

教科書／参考書 Textbooks/Reference Books	
日	
英	Kalpakjian, Mechanical Technology, Pearson, 2014 J. Beddoes, Principles of Metals Manufacturing Processes, Elsevier, 2006 A. Salak, Ferrous Powder Metallurgy, Cambridge International Science Pub., 1995 G. Dieter, Mechanical Metallurgy, McGraw.Hill, Tokio, 1988. M.P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley, 2012

成績評価の方法及び基準 Grading Policy	
日	
英	Compulsory oral exam; Group project;  Expected learning results: Comprehension of the topics illustrated and ability to couple the parts' shape, size and material characteristics to the most proper metal forming process Ability to summarize the most relevant characteristics of each production process and analyze its pros and cons, also in terms of the process economics

留意事項等 Point to consider	
日	
英	