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	61760022			
単位数/Credits	2			
授業形態 /Course Type	講義・実験：Lecture/Lab			
クラス/Class				
授業科目名 /Course Title	Materials and Characterization for Micro and Nanotechnologies : Materials and Characterization for Micro and Nanotechnologies			
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	The course is taught in English. Aim of the course is to provide the theoretical and the experimental tools concerning materials and characterization techniques involved in micro and nanotechnological processes. The role of this course is central for the development of the professional profile concerning Physics of Complex Systems, as it develops several skills required for learning the other courses in Master's Degree. The course is divided into two parts: in the first, the fundamental aspects of the physical and chemical properties of functional materials involved in micro and nanotechnological processes. In the second part, the student learns basic notions about the main characterization techniques dealing with materials (homogeneous and nanostructured) and synthesis processes

学習の到達目標 Learning Objectives	
日	to provide the theoretical and the experimental tools concerning materials and characterization techniques involved in m
英	to provide the theoretical and the experimental tools concerning materials and characterization techniques involved in micro and nanotechnological processes

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	Materials(1)	Fundamentals of materials bonding and structure; materials properties inferred from chemical bonding; crystal defects.
2	日		
	英	Materials(2)	Metals and Ceramics: Thermo-/Ferro-/Pyro-electrical properties, Piezoelectricity, Piezoresistivity.
3	日		
	英	Materials(3)	Materials for harsh environments. Shape memory materials.
4	日		
	英	Materials(4)	Nanostructured materials. Polymers.
5	日		
	英	Materials(5)	Materials(5)
6	日		
	英	Materials(6)	Nanostructured materials. Polymers.
7	日		
	英	Characterizations (1)	Introduction to Materials Characterization: Composition, Structure and Morphology through fundamental interactions (photons-matter, electrons-matter, ions/particles-matter).
8	日		
	英	Characterizations (2)	Optical microscopy (conventional [wide field], confocal/laser scanning). Electron microscopies (SEM and TEM with Electron Probe Microanalysis) and e-beam lithography - Ionic microscopy (Focus Ion Beam) and related lithography.
9	日		
	英	Characterizations (3)	Optical Spectroscopy: Photodetectors/Optical Spectrometers, Reflectance/Transmittance spectroscopy, Photoluminescence spectroscopy, Raman spectroscopy.
10	日		
	英	Characterizations (4)	Experimental demonstration of electron microscopies.
11	日		
	英	Characterizations (5)	Experimental demonstration of electron microscopies.
12	日		
	英	Characterizations (6)	Experimental demonstration of electron microscopies.
13	日		
	英	Presentation(1)	Presentations of group exercised and laboratories in this course.
14	日		
	英	Presentation(2)	Presentations of group exercised and laboratories in this course.
15	日		
	英	Presentation(3)	Presentations of group exercised and laboratories in this course.

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	The course concerns theoretical lectures with the discussion of several application case studies and experimental demonstrations performed in research laboratories. The theoretical lectures will be performed in class or online or blended, depending on sanitary emergency conditions. The exp. demonstrations will be filmed and made available to students.

教科書／参考書 Textbooks/Reference Books	
日	
英	Selected chapters from the following texts: - Materials Science and Engineering: An Introduction, by William D. Callister, Ed. Wiley - Foundations of Materials Science and Engineering, by William F. Smith and Javad Hashem, Ed. McGraw-Hill - Solid State Chemistry and its Applications, by Anthony R. West, Ed. Wiley - Structural and chemical analysis of materials, by J. P. Eberhart, Ed. Wiley - Surfaces and interfaces of solid materials, by H. Luth, Ed. Springer - A guide to scanning microscope observation, by JEOL Inc. - Optical processes in semiconductors, by J. I. Pankove, Ed. Dover Publ. Inc. - Optical diagnostics for thin film processing, by I. P. Herman, Ed. Academic Press - Fundamentals of photonics, by B.E.A. Saleh and M. C. Teich, Ed. Wiley Learning material provided by teachers

成績評価の方法及び基準 Grading Policy	
日	
英	The exam concerns a written test dealing with open questions on the developed theory and the experiments performed within the laboratory demonstrations, with a scheduled time of 1,5 hours. Such exam will be organized by PC (4 open questions) with PoliTo Exam platform and integrated proctoring (Respondus). Smarphones, book, pocket calculator, slides, notes are not allowed. Each question will be corrected and a mark will be assigned by the teacher. The final mark is the average of the marks concerning the 4 questions.

留意事項等 Point to consider	
日	
英	