

## 2026 年度シラバス

科目分類/Subject Categories			
学部等/Faculty	/大学院工学科学研究科（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	/春学期 : /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	0			
科目番号 /Course Number	61760019			
単位数/Credits	2			
授業形態 /Course Type	講義・演習 : Lecture/Practicum			
クラス/Class				
授業科目名 /Course Title	Science and Technology of Functional Materials : Science and Technology of Functional Materials			
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 aim of the course of Science and Technology of Functional Materials is to help students to know the semiconductor materials class and the problems connected to the concept of functional material. The course is about: the theory necessary to understand the behavior of a semiconductor, the mode of operation of some basic devices, the technological processes used for the preparation of the semiconductor materials and for the building of the devices, some characterization techniques, some innovative materials, processes and applications in the field of functional materials. Another objective of the course is also for the students to familiarize with the calculations typical of the semiconductors field, through well-aimed exercises, and to develop the ability of explaining and presenting subjects close to those treated in the course, through group exercises and laboratory experiences.

学習の到達目標 /Learning Objectives	
日	to know the semiconductor materials class and the problems connected to the concept of functional material
英	to know the semiconductor materials class and the problems connected to the concept of functional material

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	Classification of materials	Semiconducting materials.
2	日		
	英	Properties of materials, with a particular attention to semiconducting materials	crystallography and defects, electrical, thermal, magnetic and optic properties, elements on nanoscale materials properties.
3	日		
	英	Transport in semiconductors	Doping. PN junction. Transistors.
4	日		
	英	Precursors of silicon and of III-V materials	Growth of monocrystals of Si, III-V materials and other semiconductors.
5	日		
	英	Wafering of substrates and process control(1)	Wafering of substrates and process control(1)
6	日		
	英	Wafering of substrates and process control(2)	Integrated circuits technology. Optoelectronic devices technology.
7	日		
	英	Characterization techniques	Optical and electronic microscopy, SPM microscopies, elements of RBS, SIMS.
8	日		
	英	Nucleation and crystal growth	Epitaxial growth techniques. Heterojunctions. Quantum wells. Optoelectronic devices.
9	日		
	英	Optical fibers	Materials for photonic devices. Materials for photovoltaics.
10	日		
	英	Safety of materials	Recycle of functional materials, responsible engineering.
11	日		
	英	Exercises of calculations	Waves and particles, transport in semiconductors, PN junction, diffusion.
12	日		
	英	Group exercised and laboratories(1)	Dismounting of electronic equipment, cutting and preparation of sample for observation at optical and electronic microscope.
13	日		
	英	Group exercised and laboratories(2)	Discussion workshop on hot topics close to the subject of the course.
14	日		
	英	Presentation(1)	Presentations of group exercised and laboratories in this course.
15	日		
	英	Presentation(2)	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 will be organized with: - lectures; - exercises in the classroom (with particular attention to the ability of carry out complex calculations without errors); - group exercise and laboratories, based on the analysis of real electronic devices; - discussion workshops; - seminars on themes in line with the course topic.

## 教科書／参考書 /Textbooks/Reference Books

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英	No single textbook exists, the references will be given during the course. However, as a general reference, the following books are suggested: - Sze. Semiconductor devices, Wiley - a book on microfabrication, for instance: Franssila. Introduction to microfabrication. Wiley The teachers will provide the student with the course slides, before or after the classes.
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成績評価の方法及び基準 /Grading Policy	
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英	Compulsory oral exam; Individual essay; Paper-based written test with video surveillance of the teaching staff; Computer-based written test with open-ended questions or multiple-choice questions using the Exam platform and proctoring tools. Written test; Compulsory oral exam; Individual essay; Paper-based written test with video surveillance of the teaching staff; Computer-based written test with open-ended questions or multiple-choice questions using the Exam platform and proctoring tools.

留意事項等 /Point to consider	
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英	