



Subject card

Subject name and code	Manufacturing of semiconductor components, PG_00069762						
Field of study	Informatics, Hydrogen Technologies and Electromobility						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Optoelectronics -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Robert Bogdanowicz				
	Teachers		prof. dr hab. inż. Robert Bogdanowicz dr inż. Mateusz Ficek dr hab. inż. Michał Sobaszek				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=1938 Moodle ID: 8395 Wytwarzanie elementów półprzewodnikowych - 2026/2027 https://enauczanie.pg.edu.pl/2025/course/view.php?id=8395						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		2.0		18.0	50
Subject objectives	The course aims to provide students with comprehensive knowledge of semiconductor device fabrication. Students will learn the properties of fundamental semiconductor materials and technologies for crystal growth and wafer preparation. They will master the principles and applications of thin film deposition processes using PVD, CVD, and MBE methods, as well as doping and oxidation techniques. Students will acquire skills in designing technological process sequences for selected microelectronic and optoelectronic devices and analyzing the impact of process parameters on manufactured structure quality. Upon completion, they will be prepared for cleanroom work and collaboration in technological teams.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U07] can apply advanced methods of process and function support, specific to the field of study	The student can use in-situ process monitoring methods (reflectometry, ellipsometry) and computer simulations to optimize fabrication parameters and control semiconductor structure quality.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
	[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	The student understands physical phenomena in semiconductor fabrication processes (diffusion, implantation, epitaxy, oxidation) and relationships between process parameters and electrical/structural properties of devices.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	The student can design technological process sequences, solve problems related to fabrication parameter selection, and optimize deposition and doping processes using knowledge from solid-state physics and materials engineering.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
	[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	The student understands the structure and operating principles of semiconductor fabrication systems (CVD reactors, PVD vacuum chambers, MBE systems) and relationships between equipment parameters and manufactured structure properties.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
Subject contents	Course content – lecture • Fundamentals - Semiconductor materials (Si, GaAs, GaN, SiC) / Vacuum generation and measurement methods / Overview of technological equipment • Semiconductor wafers - Czochralski and flow-zone methods / Si wafer preparation (cutting, polishing) / Wafer cleaning (RCA) / Types of substrates and their preparation • Etching - Wet and dry etching (RIE, ICP) / Selectivity / Etching profiles • Thin film growth - Condensation, nucleation, growth / Growth monitoring (reflectometry, ellipsometry, RHEED) / Layer parameters: thickness, adhesion, defects, structure • Oxidation and doping - Thermal oxidation, Si/SiO interface / Thermal diffusion and ion implantation • PVD processes - Evaporation (conventional, e-beam) / Ion sputtering / Reactive evaporation / Contacts and metallization • CVD processes and epitaxy - Thermal CVD (pyrolysis, synthesis) / PECVD (plasma processes) / MOCVD / Molecular Beam Epitaxy (MBE) • Applications - Microelectronics (CMOS) / Optoelectronics (LEDs, lasers) / Sensors / Solar cells		
	Course content – laboratory • Si wafer preparation and cleaning - RCA cleaning process / Contact angle measurement / Surface cleanliness control • PVD metal layer deposition - Vacuum evaporation of Al/Au / Thickness and sheet resistance measurement / Adhesion analysis • CVD dielectric layer deposition - PECVD deposition of SiO/SiN / Refractive index measurement / Stress analysis in layers • Electrical measurements of structures - Four-point probe resistivity measurement / I-V characteristics of junctions / Carrier concentration measurement (Hall effect) • Profilometry and surface characterization - Layer thickness measurement by profilometer / Surface roughness analysis / Structure topography mapping		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Report	50.0%	50.0%
	Test	50.0%	50.0%

Recommended reading	Basic literature	Campbell, Stephen. <i>The Science and Engineering of Microelectronic Fabrication</i>. 2nd ed. New York, NY: Oxford University Press, 2001. ISBN: 0195136055. Vossen, John, and Werner Kern, eds. <i>Thin Film Processes</i>. Burlington, MA: Academic Press, 1978. ISBN: 0127282505. Vossen, John, and Werner Kern. <i>Thin Film Processes</i>. Burlington, MA: Academic Press, 1991. ISBN: 0127282513. Mayer, James W., and Sylvanus S. Lau. <i>Electronic Materials Science: For Integrated Circuits in Si and GaAs</i>. New York, NY: Macmillan, 1990. ISBN: 0023781408. Pierret, Robert, and George W. Neudeck. <i>Modular Series on Solid State Devices</i>. Vol. 1-5. Upper Saddle River, NJ: Prentice Hall, 1987, 89, and 90. ISBN: 0201122979. Pierret, Robert. <i>Advanced Semiconductor Fundamentals</i>. Upper Saddle River, NJ: Prentice Hall, 2003. ISBN: 013061792X.
	Supplementary literature	n/a
	eResources addresses	
Example issues/ example questions/ tasks being completed	n/a	
Practical activities within the subject	Not applicable	

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