



Subject card

Subject name and code	Computer modeling and design of nanomaterials, PG_00071215						
Field of study	Nanotechnology, Nanotechnology						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2027/2028		
Education level	second-cycle studies	Subject group			Specialty subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Division of Magnetic Properties of Materials -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marek Augustyniak					
	Teachers	dr inż. Marek Augustyniak					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	45.0	0.0	0.0	60
	E-learning hours included: 0.0						
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	60	2.0	63.0	125		
Subject objectives	<p>The course aims to equip students with practical skills related to computer-aided design software. The selection of tools is intended to ensure the universality of acquired competencies in computer-aided design, including elements of nanomaterial modeling. Course objectives include:</p> <ul style="list-style-type: none"> <li>- understanding and creating standard paper product documentation (CAD 2D)</li> <li>- understanding the specifics of 3D design, based on at least one of the currently popular programs (Fusion)</li> <li>- application of engineering simulation methods, primarily based on the FEA (free Salome pre-processor, ANSYS computing system)</li> </ul>						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W05] has in-depth knowledge of mathematical, numerical, and simulation methods - both classical and quantum - used in the modeling of nanostructures	The student gets to know multi-scale modeling, both on the macro and micro/nano scale (an example are nanotubes).			[SW1] Assessment of factual knowledge		
	[K7_U03] has enhanced abilities of using advanced specialist software packages	The student has in-depth skills in using advanced specialist software packages - such as ANSYS.			[SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture</p> <p>For the lecture section, I plan to:</p> <ul style="list-style-type: none"> <li>@ Test the starting knowledge of participants: "What do you already know about CAX? Which programs have you already used?"</li> <li>@ First Steps in New Engineering Software - pieces of advice</li> <li>@ My CAE Projects - Trials, Errors, and Successes in Various Industries</li> <li>@ CAX - Division into CAD/CAM/CAE, Major Programs and Manufacturers, Technical and Economic Issues</li> <li>@ The Issue of Realism in Computer Design - "The Lost Welder Method" and Other Misconceptions</li> <li>@ A Review of the Basics of Continuum Mechanics, Essential for Typical FEM Analyses</li> <li>@ FEM: Geometry and Mesh (Discretization)</li> <li>@ Introduction to Optimization and DOE</li> <li>@ The Specifics of Electromagnetic Simulation</li> <li>@ Supplementary Lectures / Upon Request</li> </ul>		
	<p>Course content – laboratory</p> <p>For the laboratory/project section, I plan to:</p> <ul style="list-style-type: none"> <li>@ LibreCad (introductory exercises, designing a room e.g., a research lab)</li> <li>@ ANSYS APDL (introductory exercises, meshing, more advanced tasks)</li> <li>@ OnShape and one of the additional programs (e.g., Salome/Calculix)</li> </ul>		
Prerequisites and co-requisites	Basics of fluid dynamics, physics of materials, acquaintance with any scripting programming language.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Student participation intensity	70.0%	50.0%
	Completing design tasks	70.0%	50.0%
Recommended reading	Basic literature	Software manuals (PDF, online training courses)  The Finite Element Method: Its Basis and Fundamentals, O.C. Zienkiewicz (freely available on the Internet, 2009 e.g. <a href="https://www.meil.pw.edu.pl/content/download/58297/306302/file/FEM_Zienkiewicz%20Vol1.pdf">https://www.meil.pw.edu.pl/content/download/58297/306302/file/FEM_Zienkiewicz%20Vol1.pdf</a> )	
	Supplementary literature	An Introduction to Computational Fluid Dynamics, The finite volume method, H K Versteeg and W Malalasekera, 2007 (available on the Internet)	
	eResources addresses		
Example issues/example questions/tasks being completed	<ul style="list-style-type: none"> <li>@ Exercises on sketching and dimensioning objects (e.g., a rotor, a computer mouse)</li> <li>@ Designing the layout of equipment in a science lab</li> <li>@ Bending a panel (with an experimental element)</li> <li>@ Modeling a pipeline section or simple modules of a Mars base</li> <li>@ Determining the mechanical characteristics of a nanotube using the Finite Element Method</li> <li>@ Modeling the welding process</li> <li>@ 3D geometries: created from a paper drawing or by reverse engineering from provided material objects</li> <li>@ Option: Tuning fork vibration modeling and calculation</li> </ul>		
Practical activities within the subject	The acquired skills are directly applicable in industry and scientific activities.		

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