GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer modeling and design of nanomaterials, PG_00063959		
Field of study	Nanotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
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	2	Language of instruction	English
Semester of study	3	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment
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	5.0	60.0	125

Subject objectives

The course aims to provide students with practical skills related to computer-aided design software. The selection of tools is driven by the desire to maintain their broadest possible versatility, within the limited course time, enabling:
- creating standard 2D product documentation (CAD2D: standard, lightweight and free LibreCAD, optionally AutoCAD)
- applying engineering simulation methods, primarily FEM-based, with the creation of 3D models or using pre-built geometries (base program: ANSYS APDL, due to its educational value and wide industrial application)

For extension work or projects, it is recommended to choose one of the programs such as Fusion 360, Blender, FreeCAD, Salome/Calculix, etc., and master its basics. Special support during classes can be provided in the programs: OnShape or Salome.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] can plan and conduct theoretical and numerical calculations, simulations of phenomena and processes, critically analyze their results, draw conclusions and formulate reasoned conclusions – within their specialization.	The student is able to plan and carry out theoretical and numerical calculations and simulations of phenomena and processes, critically analyze their results, draw conclusions and formulate reasoned opinions – within the scope of the specialization.	[SU2] Assessment of ability to analyse information
[K7_U03] has enhanced abilities of using advanced specialist software packages	The student has in-depth skills in using advanced specialist software packages.	[SU1] Assessment of task fulfilment
[K7_K04] can work systematically on long-term projects.	The student is able to work systematically on long-term projects.	[SK4] Assessment of communication skills, including language correctness
[K7_W05] has enhanced knowledge of mathematical, numerical, simulation, classical and quantum methods, applied in modeling nanostructures.	The student has in-depth knowledge of mathematical, numerical and simulation methods, classical and quantum, used in modeling nanostructures.	[SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>Course content – lecture

For the laboratory/project section, I plan to:
@ LibreCad (introductory exercises, designing a roome.g., a research lab)
@ ANSYS APDL (introductory exercises, meshing, more advanced tasks)
@ In the version with 45 hours of lab/project time: also OnShape and one of the additional programs (e.g., Salome/Calculix)
For the lecture section, I plan to:
@ Test the starting knowledge of participants: "What do you already know about CAX? Which programs have you already used?"
@ First Steps in New Engineering Software - pieces of advice
@ My CAE Projects - Trials, Errors, and Successes in Various Industries
@ CAX - Division into CAD/CAM/CAE, Major Programs and Manufacturers, Technical and Economic Issues
@ The Issue of Realism in Computer Design - "The Lost Welder Method" and Other Misconceptions
@ A Review of the Basics of Continuum Mechanics, Essential for Typical FEM Analyses
@ FEM: Geometry and Mesh (Discretization)
@ Introduction to Optimization and DOE
@ The Specifics of Electromagnetic Simulation
@ Supplementary Lectures / Upon Request</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Student participation intensity</td><td>80.0%</td><td>50.0%</td></tr>
<tr><td>Completing design tasks</td><td>70.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Technical Machine Drawing with CAD Elements, Paweł Romanowicz
Finite Element Method in Materials and Structural Mechanics. Solving Selected Problems Using ANSYS
Grzegorz Krzesiński, Paweł Borkowski, Piotr Marek, Tomasz Zagrajek
Onshape for Beginners: Black & White: Tutorial Books (collective author, 2021)
Tutorials on the Internet, including:
https://learn.onshape.com
https://www.youtube.com/@AnsysLearning
https://www.youtube.com/@MufasuCAD</td></tr>
<tr><td>Supplementary literature</td><td>----</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Introduction to CAX (Computer-Aided Design, Manufacturing, Engineering).
Common problems associated with mastering engineering software.
An overview of tools on the market. How to choose the right program from approximately 1,000 options available?
Agreement or discrepancy between computer designs and production reality.
Selected projects from the instructor's own experience - good vs bad practices.
Common operations on 3D geometries. Sources for obtaining ready-made geometries online.
Introduction to FEM (basics): nodes, element types, mesh, boundary conditions, linear material models.
Selected advanced concepts, to choose from: nonlinearities, explicit vs. implicit algorithms, optimization, specifics of electromagnetic calculations.</td></tr>
<tr><td>Practical activites within the subject</td><td>The acquired skills are directly applicable in industry.</td></tr>
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