GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Calculations in Physics and Technology, PG_00047926		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional 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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Atomic, Molecular and Optical Physics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Sebastian Bielski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

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	30	2.0	18.0	50

Subject objectives

The aim of the course is to recall and to systematize some mathematical objects, definitions or methods as tools that can be used to describe physical quantities and relations they obey.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student knows the following concepts: scalar product, vector product, derivative, partial derivative, gradient, divergence, curl, integral, differential equations and others. Student can use the concepts to describe some physical problems.	[SW1] Assessment of factual knowledge
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student solves analytically simple problems concerning selected branches of physics.	[SU1] Assessment of task fulfilment
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	Student lists and explains the basic physical phenomena, concepts and laws of mechanics, electromagnetism and heat transfer.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>1. Vectors
1.1. Definition of a vector.
1.2. Vector operations

2. Derivative of a function
2.1. The first derivative of a function
2.2. Derivative of a vector function
2.3. Higher-order derivative
2.4. Extremes of a function

3. Derivative of a function of many variables
3.1. Partial derivative
3.2. Directional derivative, the gradient
3.3. Divergence
3.4. Curl

4. Integral
4.1. Indefinite integral and definite integral
4.2. Improper integral
4.3. Multiple integral
4.4. A short addendum

5. Differential equations
5.1. Ordinary differential equations
5.2. Boundary value problem
5.3. Inhomogeneous differential equation
5.4. The Bessel functions
5.5. Some examples of partial differential equations

6. Integral transform method
6.1. The Fourier transform
6.2. The discrete Fourier transform</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>written test</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Donald A. McQuarrie, Mathematical Methods for Scientists and Engineers, University Science Books, 2003</td></tr>
<tr><td>Supplementary literature</td><td>T. Pang, An Introduction to Computational Physics, Cambridge University Press, Cambridge, 1997</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Starting from the Maxwell's equations find the wave equations obeyed by the electric field E and the magnetic field B.
2. Use the double integral to find the center of mass of the planar region with some density.
3. Solve the differential equation descibing the damped harmonic oscillator. The initial displacement and the initial velocity are given.
4. The Coriolis force.
5. The divergence of the heat flux density.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>