



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematical methods in technology

### Course

Field of study

Education in Technology and Informatics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

part-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

20

Laboratory classes

0

Other (e.g. online)

0

Tutorials

30

Projects/seminars

0

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

dr inż. Justyna Barańska

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Responsible for the course/lecturer:

Faculty of Materials Engineering and Technical  
Physics

ul. Piotrowo 3, 60-965 Poznań

### Prerequisites

Basic knowledge on physics. Basic knowledge on mathematics : vector and matrix calculus, complex numbers, differential and integral calculus, ordinary differential equations. Ability to work in a group, active attitude to solve problems.

### Course objective

1. In terms of knowledge: presentation to students the mathematical methods used in various problems in physics and technology.

2. In terms of skills:

- development of practical skills in solving problem in physics and mathematics with the use of known mathematical methods.



- demonstrating the usefulness of CAS Computer Algebra System as a tool supporting the work of an engineer.

3. In terms of social competences: developing teamwork skills

### Course-related learning outcomes

#### Knowledge

The student, who has completed the course will be able to:

1. explain the mathematical apparatus necessary to describe and solve simple problems associated with technical physics [K1\_W01].
2. use of appropriate computational techniques, supporting the work of an engineer, while understanding certain limitations - [K1\_W01]
3. describe a sample CAS Computer Algebra System, supporting the work of an engineer, while understanding certain limitations [K1\_W08,K1\_W20].

#### Skills

Student, who has completed the course, is able to:

1. use the acquired mathematical knowledge to describe the processes running in a simple physical system and create models based on literature, the internet, databases and other sources, and know how to use analytical methods to solve tasks in the field of technical physics - [K1\_U01,K1\_U04]
2. use analytical methods to formulate and solve basic tasks in the field of physical quantity measurements - [K1\_U04]
3. correctly use a CAS Computer Algebra System for an analytical or numerical solution of a given physical or technical problem, presenting the results of calculations or simulations using properly formatted graphs and animations, and then make a critical analysis of the obtained results - [K1\_U04,K1\_U08,K1\_U11,K1\_U22]
4. formulate conclusions based on the obtained results of calculations [K1\_U01]
5. obtain information from literature, databases and other available sources of knowledge - [K1\_U01, K1\_U02]

#### Social competences

The student will acquire the following social competences:

1. develop the ability to cooperate in a team. - [K\_K01, K\_K05]
2. understands the need for critical assessment of knowledge and continuous education [K1\_K03]

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:



a) In the scope of the tutorials, on the basis of:

(1) assessment of classroom activity

(2) getting extra points related with activity ( additional projects in the field of applications of mathematics in technology, use of literature, discussion of problems, presenting reports concerning applications of the theory and diligence of the study)

b) In the scope of the lectures, on the basis of:

(1) answers to questions about the material discussed in previous lectures

Summative assessment:

a) In the scope of the tutorials, on the basis of:

written tests during the semester

The rating is based on the number of points scored

(0-50% - rating 2,0; 50,1-60% - rating 3,0; 60,1-70% - rating 3,5; 70,1-80% - rating 4,0; 80,1-90% - rating 4,5; 90,1-100% - rating 5,0)

b) In the scope of the lectures, on the basis of:

the written exam under written test with open questions consists of 10 questions.

The rating is based on the number of points scored

(0-50% - rating 2,0; 50,1-60% - rating 3,0; 60,1-70% - rating 3,5; 70,1-80% - rating 4,0; 80,1-90% - rating 4,5; 90,1-100% - rating 5,0)

### Programme content

Lecture: differential operators in curvilinear systems, a description of the movement in the central fields and Binet's theorem, calculus of variations and Lagrange equations in mechanical systems, analytical functions, Laplace transform and operator methods in differential equations, demonstrating the usefulness of sample CAS Computer Algebra System.

Tutorials: solving problems, discussion, introduction to programming using CAS, analysis of the properties of simple systems using the learned instructions of the CAS package

### Teaching methods

1. Lecture: multimedia presentation, discussion.

2. Tutorials: solving sample tasks on the blackboard, initiate discussion on solutions, homework / additional tasks, team work, carrying out numerical experiments.

### Bibliography

Basic

1. Fizyka matematyczna, J. Stefaniak, H. Kamiński, G. Kamińska, WPP 2008
2. Wybrane rozdziały Matematycznych Metod Fizyki, Andrzej Lenda, Wydawnictwo AGH, 2004
3. F.W. Byron, R.W. Fuller, Matematyka w fizyce klasycznej i kwantowej t. 1-2, PWN W-wa 1973
4. Pang Tao, Metody obliczeniowe w fizyce, PWN 2001



Additional

1. A. Zagórski, Metody matematyczne fizyki, OW PW, 2007
2. R. Grzymkowski, J. Pochciał, Elementy rachunku wariacyjnego, Wykłady z modelowania matematycznego 7, Gliwice 2009
3. A. Hennel, Zadania i problemy z Fizyki, t. 1-3, PWN

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	70	5,0
Classes requiring direct contact with the teacher	50	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	20	2,0

<sup>1</sup> delete or add other activities as appropriate