COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematical methods in technology [S1ETI2>MMwT]

Course

Field of study
Education in Technology and Informatics

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

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.

2. describe a sample CAS Computer Algebra System, supporting the work of an engineer, while understanding certain limitations

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
2. use analytical methods to formulate and solve basic tasks in the field of physical quantity measurements
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
4. formulate conclusions based on the obtained results of calculations
5. obtain information from literature, databases and other available sources of knowledge

Social competences:
The student will acquire the following social competences:
1. develop the ability to cooperate in a team
2. understands the need for critical assessment of knowledge and continuous education

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

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)% unsatisfactory
<50–60)% - satisfactory;
<60–70)% - satisfactory plus;
<70–80)% - good;
<80–90)% - good plus;
<90–100> - very good.

Programme content

Participants will learn mathematical methods used in various problems in physics and technology. Demonstrating the usefulness of CAS Computer Algebra System.

Course topics

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	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50