COURSE DESCRIPTION CARD - SYLLABUS

Course name
Laboratory of Symbolic Methods [S1FT2>LMSwF]

Course

Field of study
Technical Physics

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of mathematics - algebra of vectors and matrices, complex numbers, differential and integral calculus, ordinary differential equations, obtained after the first year of studies in Technical Physics. Basic knowledge of physics at the level achieved after the first year of studies in Technical Physics. Ability to work in a group and an active attitude towards problem-solving.

Course objective

Knowledge: To acquaint students with example CAS (Computer Algebra System) packages for symbolic and numerical computations and demonstrate their usefulness as tools supporting the work of engineers in the field of technical physics. Skills: To develop practical skills in using CAS packages for modeling and analyzing processes occurring in simple physical systems. Social Competences: To develop teamwork skills.

Course-related learning outcomes

Knowledge:
Students will have knowledge about the applications of appropriate computational techniques supporting the work of engineers, understand the limitations, and know selected CAS software packages

supporting engineering calculations. Students have knowledge of the state of the art and trends in the field of computer simulations of physical processes.

Skills:
Students will be able to use mathematical knowledge to create models and algorithms in the field of technical physics, develop a model and mathematical equations describing a process in technical physics based on literature and other available sources, and correctly use a CAS package to solve a given physical problem analytically or numerically, and critically analyze the results.

Social competences:
Students will be able to work independently and in a team on a given task, showing responsibility for the accuracy of their work and its interpretation.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative Assessment: Based on oral answers in the laboratory (students gain additional points for independently solving more difficult problems), activity during classes, and individual presentation of additional projects using computer software.
Summative Assessment: Based on a 90-minute practical exam - working on a computer to solve short tasks using the learned CAS package. Grading criteria:
<0–50)% unsatisfactory
<50–60)% - satisfactory;
<60–70)% - satisfactory plus;
<70–80)% - good;
<80–90)% - good plus;
<90–100> - very good.

Programme content

The laboratory includes presentations on the applications of selected CAS packages. Introduction to programming using instructions from a chosen CAS package, including analytical solving of equations and systems of algebraic equations, symbolic methods for determining derivatives and integrals, finding zeros and extremums of functions, symbolic methods for finding solutions to differential equations, creating graphs and animations, conditional instructions, loops, and custom functions. Analysis of the properties of simple physical systems using learned CAS package instructions, e.g., determining the range and trajectory analysis of a projectile considering the resistance of the medium, steady and unsteady vibrations, and resonance curves of a forced harmonic oscillator with varying damping coefficient.

Course topics

none

Teaching methods

Laboratory: Multimedia presentation, conducting numerical experiments, initiating discussions on obtained solutions, teamwork, home assignments, and project preparation.

Bibliography

Basic:
1. Pang Tao, Metody obliczeniowe w fizyce, PWN 2001

Additional:
1. Dieter W. Hermann, Podstawy symulacji komputerowych w fizyce, WNT 1997

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00