COURSE DESCRIPTION CARD - SYLLABUS

Course name
Analytical Methods in Physics [S1FT2>MAwF]

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
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr inż. Justyna Barańska
justyna.baranska@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of mathematics including vector and matrix algebra, complex numbers, differential and integral calculus, ordinary differential equations achieved after the first year of studies in Technical Physics. Basic physics knowledge at the level achieved after the first year of studies in Technical Physics. Ability to solve elementary vector and matrix algebra problems and complex numbers, calculate analytical derivatives, partial derivatives, indefinite and definite integrals, and analytically solve simple ordinary differential equations. Ability to work in a group and an active approach to problem-solving.

Course objective

Knowledge: To acquaint students with analytical mathematical methods used in various physics and engineering issues. Skills: To develop practical skills in solving problems in physics and engineering using analytical mathematical methods. Social Competences: To develop teamwork skills.

Course-related learning outcomes

Knowledge:
The student who completes the course:
1. Knows the mathematical apparatus necessary to describe fundamental laws of physics and solve tasks

related to technical physics issues, including differential operators, variational calculus, analytic functions, operator methods.
2. Has knowledge about the applications of appropriate computational techniques supporting the work of engineers while understanding certain limitations.

Skills:
The student who completes the course:
1. Can use acquired mathematical knowledge to describe processes occurring in a simple physical system and create models, and solve tasks in the area of technical physics.
2. Can independently develop a model and mathematical equations describing a process in technical physics based on literature and other available sources.

Social competences:
The student will gain the following social competences:
2. Develops the ability to cooperate in a team.
3. Understands the need for critical evaluation of owned knowledge and continuous education. Can independently deepen their knowledge in the subject.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:
Exercises:
1. Oral responses during exercises - students receive additional points for independently presenting solutions to problems at the board
2. Activity during classes
3. Presentation of additional projects related to the applications of mathematics in technology
Lecture:
1. Responses to questions concerning the material covered in previous lectures
Summative assessment:
Exercises: based on a written quiz,
Lecture: based on a written quiz (8-10 questions),
assessment criteria:
<0–50)% unsatisfactory
<50–60)% - satisfactory;
<60–70)% - satisfactory plus;
<70–80)% - good;
<80–90)% - good plus;
<90–100> - very good.

Programme content

Lecture topics include differential operators in curvilinear systems, Binet's theorem and description of motion in central fields, variational calculus and its application in classical mechanics, analytic functions, special functions and orthogonal polynomials, transforms, operator methods in solving differential equations. Exercises involve solving tasks related to the lecture topics.

Course topics

none

Teaching methods

Lecture: Multimedia presentations, discussions, solving example problems on the board.
Exercises: Solving example problems on the board, initiating discussions on solutions, additional home tasks, teamwork.

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
5. W. Żakowski, W. Leksiński, Matematyka t. 4, WNT W-wa 1995
6. R. Grzymkowski, J. Pochciał, Elementy rachunku wariacyjnego, Wykłady z modelowania matematycznego 7, Gliwice 2009

Additional:
1. A. Zagórski, Metody matematyczne fizyki, OW PW, 2007
2. I.M. Gelfand, S.W. Fomin, Rachunek wariacyjny, PWN 1979;
3. A. Hennel, Zadania i problemy z Fizyki, t. 1-3, PWN

Breakdown of average student's workload

	Hours	ECTS
Total workload	70	4,00
Classes requiring direct contact with the teacher	40	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	2,00