COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied mathematics and mathematical methods [S2MiBP1>MSiMM]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/1

Area of study (specialization)
Railway Vehicles

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student starting this subject should have knowledge and skills from the first-cycle studies in mathematics and computer science. He should also have the ability to obtain information from the indicated sources and be ready to cooperate as part of the team. He should know the limitations of his own knowledge and understand the need for further education.

Course objective

Presentation of selected numerical methods and analytical methods for solving selected differential equations.

Course-related learning outcomes

Knowledge:
Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation.
Has extended knowledge in the field of computer science, concerning computer programming and engineering calculation programs in the field of computer simulation of physical systems.
Is aware of the civilization effects of technology.

Skills:
Can formulate and test hypotheses related to simple research problems.
Can interact with other people as part of teamwork and take a leading role in teams.He is able to independently plan and implement his own learning throughout life and direct others in this regard.

Social competences:
He is ready to critically assess his knowledge and received content.
Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.
Is willing to think and act in an entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The knowledge acquired during the course is verified by the assessment of activity, assigned tasks and an exam.
The skills acquired during the tutorials are verified on the basis of the developed projects and the final test.

Programme content

Linear differential equations of the order of n.
Selected nonlinear differential equations.
Selected numerical methods of solving initial problems, interpolation, approximation.

Course topics

Homogeneous and non-homogeneous linear differential equations of the first order.
Nonlinear differential equations:
- Bernoulli,
- Riccati,
- Clairaut,
- Lagrange-d'Alembert,
- Complete differential equation,
- Integrating factor.

Linear differential equations of order higher than the first:
- with constant coefficients, homogeneous and heterogeneous,
- Eulerian homogeneous and inhomogeneous.

Systems of differential equations.
Fourier series.
Polynomial interpolation with applications.
Numerical methods of the Runge-Kutta type for solving initial problems. Ode45 method.

Teaching methods

1) lectures:
- presenting a new topic preceded by a reminder of related content, known to students from other subjects,
- an interactive lecture with the formulation of questions to a group of students or to identified specific students,
- a lecture supplemented with examples given on the blackboard and calculations made with the use of MatLab or open source software,
- lecture supplemented with tasks for independent solution, the solution of which has an impact on the final grade,
- student activity during classes is taken into account when assigning the final grade.

2) tutorials:
- an example of solving the task on the board along with analyzing the next stages,
- students" way of solving the task on the blackboard is reviewed by the tutor.

Bibliography

Basic
1. Fortuna Z., Macukow B., Wąsowski J., Metody numeryczne, WNT, Warszawa, 2020.
2. Kincaid D., Cheney W., Analiza numeryczna [Numerical Analysis: Mathematics of Scientific Computing (The Sally Series; Pure and Applied Undergraduate Texts, Vol. 2)], WNT, Warszawa 2006.
3. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, t. II, PWN, Warszawa 2020.
Additional
1. Horla D., Metody obliczeniowe optymalizacji w zadaniach, WPP, Poznań, 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	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)	20	1,00