COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied mathematics and mathematical methods [S2Trans1>MSiMM]

Course

Field of study
Transport

Year/Semester
1/1

Area of study (specialization)
Low-emission Transport

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 (e.g. online)
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:
Student has advanced and in-depth knowledge of transport engineering, theoretical foundations, tools and means used to solve simple engineering problems

Skills:
Student is able - when formulating and solving engineering tasks - to integrate knowledge from various

areas of transport (and, if necessary, also knowledge from other scientific disciplines) and apply a system approach, also taking into account non-technical aspects
Student is able to correctly use the selected method of estimating the labor consumption of manufacturing technical objects
Student is able - in accordance with the given specification, taking into account non-technical aspects - to design a complex device, system in the field of transport engineering or a process and to implement this project - at least in part - using appropriate methods, techniques and tools, including adapting the existing or developing new tools

Social competences:
Student understands the importance of using the latest knowledge in the field of transport engineering in solving research and practical problems
Student understands the importance of popularizing activities regarding the latest achievements in the field of transport engineering

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 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	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