COURSE DESCRIPTION CARD - SYLLABUS

Course name
Partial differential equations [S2AiR2-SIiB>RRC]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/1

Area of study (specialization)
Intelligent and Unmanned Systems

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
30

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge of material from the first degree in mathematics on differential and integral calculus of functions of one and many variables and material on ordinary differential equations.

Course objective

1. To teach students the basic mathematical content of partial differential equations. 2. To develop in students the ability to solve mathematical tasks and problems in the field of partial differential equations and their applications in other fields of science.

Course-related learning outcomes

Knowledge:
Student:
1. has an in-depth understanding of selected areas of mathematics; possesses an expanded and profound knowledge necessary for formulating and solving complex problems in the fields of control

theory, optimization, modeling, identification and signal processing [K2_W1 (P7S_WG)];
2. has specialized knowledge in the field of remote systems, distributed systems, real-time systems, and networking techniques [K2_W3 (P7S_WG)];
3. has organized and in-depth knowledge in the field of modeling and system identification [K2_W5 (P7S_WG)].

Skills:
Student:
1. can critically utilize information from literature, databases, and other sources in both Polish and foreign languages [K2_U1 (P7S_UW)];
2. can create models of simple systems and processes and use them for the purpose of analysis and design of automation and robotics systems [K2_U10 (P7S_UW)].

Social competences:
Student:
1. has an awareness of the importance and understands non-technical aspects and consequences of engineering activities, including their impact on the environment and the associated responsibility for the decisions made; is ready to develop his professional achievements [K2_K2 (P7S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: written or oral test for theory and assignments during the last lecture.
Exercises: evaluation of written tests during the semester and direct activity during classes.
Gaining additional points related to activity during classes (presentations of examples of applications of mathematics, use of literature, discussion of problems, presentation of reports on applications of theory and diligence of elaboration).

Programme content

1. Linear partial differential equations of first order.
2. Quasi-linear partial differential equations of first order.
3. Linear partial differential equations of second order.
4. The most common partial differential equations.

Course topics

1. Linear partial differential equations of first order:
a) Prime integrals of systems of ordinary differential equations.
b) Linear differential equations of first order.
c) Method of characteristics, general solutions.
d) Transport equations.
e) Equations with variable coefficients.
2. Quasi-linear partial differential equations of first order:
a) General solutions of an equation in entangled form by the method of characteristics.
b) Euler's theorem for homogeneous functions and its inverse.
c) Boundary conditions, initial conditions, special solution of the equation.
3. Linear partial differential equations of second order:
a) String equation.
b) Classification of partial differential equations of second order.
c) Canonical form of the equation.
d) Selected methods for solving partial differential equations for two independent variables.
4. The most common partial differential equations:
a) Laplace's equation. Harmonic polynomials, spherical functions.
b) Poisson's equation.
c) Diffusion equation. Thermal polynomials.
d) Wave equation.

Teaching methods

Lecture and exercises conducted in a blackboard format using a multimedia presentation.

Course materials are posted on the eKursy platform, with the possibility of downloading them by the student.

Bibliography

Basic:
1. W. W. Stiepanow, Równania różniczkowe, PWN, Warszawa 1964.
2. N. M. Matwiejew, Metody całkowania równań różniczkowych zwyczajnych, PWN, Warszawa 1982.
3. I. Foltyńska, Z. Ratajczak, Z. Szafrański, Matematyka dla studentów uczelni technicznych (część III), Wydawnictwo Politechniki Poznańskiej.

Additional:
1. L. C. Evans, Równania różniczkowe cząstkowe, PWN, Warszawa 2022.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00